BS EN 13924-1:2015

BSI Standards Publication

Bitumen and bituminous binders — Specification framework for special paving grade bitumen

Part 1: Hard paving grade bitumens

bsi.

National foreword

This British Standard is the UK implementation of EN 13924-1:2015. It supersedes BS EN 13924:2006 which is withdrawn.

Guidance for users on the implementation of BS EN 13924-1:2015 in the UK is included in National Annex NA (informative).

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 subcommittee can be obtained on request to its secretary.

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

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Bitumes et liants bitumineux - Cadre de spécifications pour les bitumes routiers spéciaux - Partie 1 : Bitumes routiers de grade dur

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This European Standard was approved by CEN on 3 October 2015.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 13924-1:2015) 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of an identical text or by endorsement, at the latest by June 2016 and conflicting national standards shall be withdrawn at the latest by September 2017.

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 13924:2006.

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 Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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

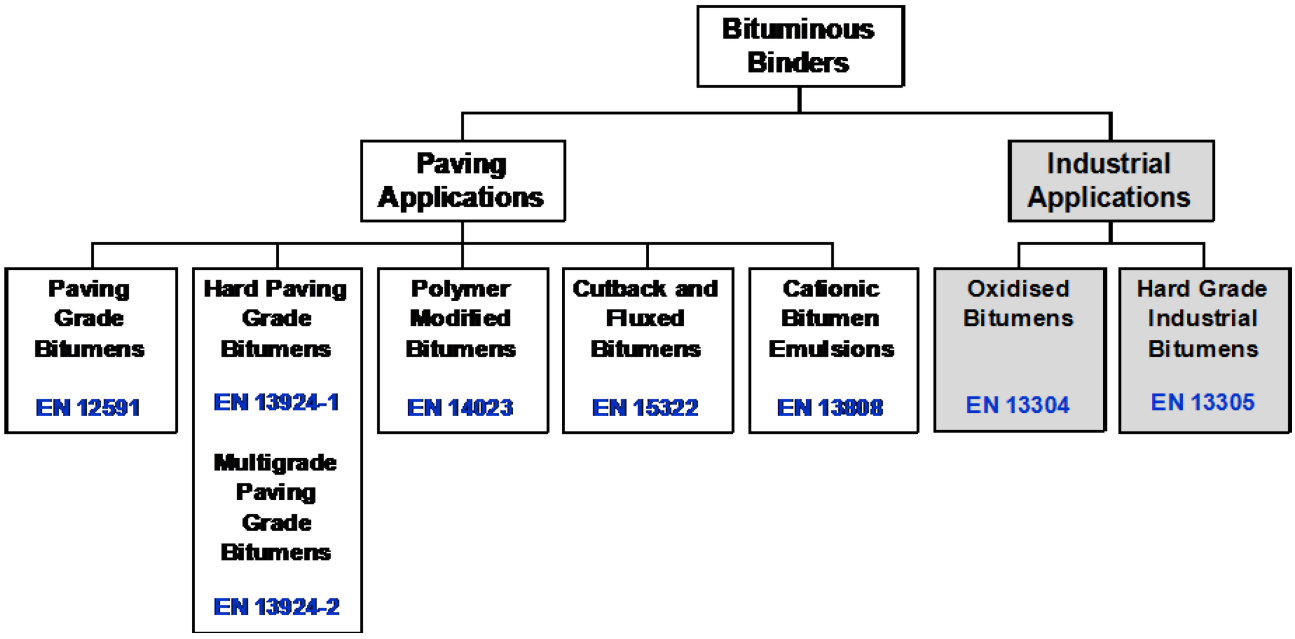

Figure 1 — European Standards for bitumens

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

This part of EN 13924 is closely related to EN 12591 [2]. This introduction gives information on the basis for selection of the grades defined in this part of EN 13924, the status of certain properties and test methods, and proposed development of this part of EN 13924.

The general principle adopted in the development of EN 12591 [2] was to provide a range of grades suitable for the manufacture of the materials for road construction and maintenance used, and the climatic and traffic conditions encountered, in all the Member States. This part of EN 13924 extends the range of grades specified in EN 12591 [2], following the wider use of materials for road construction and maintenance having very high modulus values.

This part of EN 13924 can be read in conjunction with National Guidance Documents, where they exist, which have the opportunity to identify the appropriate grade in the territory of use.

This part of EN 13924 has been based on the regional requirements identified when the process started. It is a step in harmonizing the so-called "empirical" specifications and it is intended to evaluate alternative properties and test methods to develop new specifications that are more directly performance-related. To this end, work programmes are being undertaken and the results will be considered for a future revision of this part of EN 13924. The progress of these work programmes are reported in CEN/TR 15352 [1], and the results will be considered for future revisions of this part of EN 13924.

For hard paving grade bitumens, the testing of the five essential characteristics, according to the mandate M/124, also gives an indication that its intrinsic cohesive properties are adequate for its normal use. The properties of "adhesion" and "setting ability" are indicated by tests used on the finished asphalt mixtures, EN 12697-1, EN 12697-11, EN 12697-12, EN 12697-26 (respectively [4] to [7]), rather than tests on the bitumen itself.

Hard paving grade bitumens are designated by the penetration range at 25 °C, e.g. 5/15, 10/20 or 15/25 (see Table 1).

1 Scope

This part of EN 13924 provides a framework for specifying the properties and relevant test methods for hard paving grade bitumens which are suitable for use in the construction and maintenance of roads, airfields and other paved areas.

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 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 12597:2014, *Bitumen and bituminous binders - Terminology*

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

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

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12597:2014 apply.

4 Sampling

Sampling shall be carried out in accordance with EN 58 and sample preparation shall be carried out in accordance with EN 12594.

5 Requirements and test methods

5.1 General

This European Standard is a framework of specifications and classes for properties of hard paving grade bitumens which are chosen from Table 1 and Table 2.

There is a subdivision of properties into two tables. The properties in Table 1 shall be specified for all hard paving grade bitumens. They are associated with regulatory or Health Safety and Environmental requirements. The properties in Table 2 are required to meet specific regional conditions. They are associated with regulatory or other regional requirements.

5.2 Properties and related test methods

5.2.1 General

The properties of, and related test methods, for hard paving grade bitumens shall be selected from the classes given in Table 1 and Table 2. When tested by the methods given in the tables, the various grades shall conform to the limits specified by classes in that table.

Each country will then have a particular selection of specifications, which are covered in Tables 1 and Table 2. It is useful for each country to publish in a national guidance document for their requirements for hard paving grade bitumens. The appropriate class for each technical requirement or application is selected in turn and the selection of classes should be made from past experience of successful use, on a regional basis, in order to avoid unworkable combinations, see also Table 1, footnote c, and Table 2, footnote d.

5.2.2 Consistency at intermediate service temperatures

Consistency at intermediate service temperature for these hard paving grade bitumens shall comply with the requirements for penetration at 25 °C in Table 1.

The grades are designated by the nominal penetration range at 25 °C.

5.2.3 Consistency at elevated service temperatures

Consistency at elevated service temperature for these hard paving bitumens shall comply with the requirements for softening point as indicated in Table 1.

Hard paving grade bitumens are supplied for a variety of end uses, and thus the specifications include a wide range of softening point values. A restricted softening point range, of ± 5 °C about a mid-point, shall be declared by the supplier; the overall range shall be within the range in the tables.

5.2.4 Brittleness at low service temperature

Brittleness at low service temperature may be required to meet specific regional conditions. Where required, hard paving grade bitumens shall conform to the requirements for Fraass breaking point in Table 2.

5.2.5 Temperature dependence of consistency

Temperature dependence of consistency may be required to meet specific regional conditions. Where required, hard paving grade bitumens shall conform to the requirement for dynamic viscosity in Table 2.

If the supplier wishes to declare the penetration index (for the purpose of regulatory marking), it shall be calculated in accordance with Annex A.

5.2.6 Durability – Resistance to hardening

Durability shall be demonstrated by compliance with testing of properties after hardening defined in Table 1 and Table 2.

Resistance to hardening shall be tested according to the Rolling Thin Film Oven Test (RTFOT) (EN 12607-1).

NOTE Appropriate tests and classes, for measurements on material after the hardening procedure, are given in Tables 1 and 2. The choice depends upon the intended use of the product.

5.2.7 Informative properties

The specifications include a table of informative properties (Table B.1). Suppliers of hard paving grade bitumens are encouraged to produce data from these measurements as "Supplier Declared Values". It is hoped that the data so provided will be of assistance in developing performance-related specifications in the future.

5.2.8 Temperature dependency of mixing

Where required, hard paving grade bitumens shall comply also with the requirement for kinematic viscosity in Table 2.

5.2.9 Flash point

Flash point shall be determined by the Cleveland open cup method in EN ISO 2592.

NOTE The Pensky-Martens closed cup method (see EN ISO 2719 [10]) can be used to investigate possible contamination but is likely to give lower values.

5.2.10 Density

If the supplier wishes to declare the density of hard paving grade bitumens, it shall be determined in accordance with EN 15326

5.2.11 Solubility

Solubility shall be determined on the hard paving grade bitumens in accordance with EN 12592.

Table 1 — Specifications for hard paving grade bitumens – Properties applying to all hard paving grade bitumens [a]

Properties		Test methods	Units	Classes		
				2	3	4
Penetration at 25 °C		EN 1426	0,1 mm	15 to 25 [c]	10 to 20	5 to 15
Softening point [b]		EN 1427	°C	55 to 71 [b-c]	58 to 78 [b]	60 to 76 [b]
Resistance to hardening	Change of mass [d]	EN 12607–1	%	≤ 0,5		
	Retained penetration		%	≥ 55		
	Increase in softening point		°C	≤ 8	≤ 10	
Flash point		EN ISO 2592	°C	≥ 235	≥ 245	
Solubility		EN 12592	% mass	≥ 99,0		

[a] The grades are designated by the nominal penetration range at 25 °C.

[b] IMPORTANT A restricted softening point range, of ± 5 °C about a mid-point, shall be declared by the supplier; the overall range shall be within the range in the table.

[c] In selecting combinations of classes it is intended that values marked "c", if selected, shall only be used with the softer grade, 15/25 penetration.

[d] Change of mass can be positive or negative.

Table 2 — Specifications for hard paving grade bitumens – Properties associated with regulatory or other regional requirements

Properties		Test methods	Units	Classes			
				0	1	2	3
Dynamic viscosity at 60 °C		EN 12596	Pa·s	NR [a]	TBR [b]	≥ 550 [d]	≥ 700
Softening point after hardening		EN 12607–1+ EN 1427	°C	NR [a]	TBR [b]	≥ orig. min. + 2 [c]	
Resistance to hardening	Increase in softening point and Penetration Index on unaged binder	EN 12607–1+ EN 1427 I_p calculation (see Annex A)	°C	NR [a]	TBR [b]	≤ 10 ≥ −1,5 and ≤ +0,7	≤ 10 ≥ −1,5
Kinematic viscosity at 135 °C		EN 12595	mm^2/s	NR [a]	TBR [b]	≥ 600 [d]	≥ 700
Fraass breaking point		EN 12593	°C	NR [a]	TBR [b]	≤ 0 [d]	≤ 3

[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.

[b] TBR. To Be Reported may be used when there are no regulations or other regional requirements for the property in the territory of intended use, but the property has been considered useful in specification of hard paving grade bitumens in some cases.

[c] The softening point after treatment shall be at least 2 °C above the selected minimum value for the original bitumen (see Table 1, Note [b]).

[d] In selecting combinations of classes it is intended that values marked "d", if selected, shall only be used with the softer grade, 15/25 penetration.

5.3 Release of 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 dangerous substances in accordance with provisions applicable in the intended place of use of the product.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction website on Europa accessed through http://ec.europa.eu/enterprise/construction/cpd-ds/.

5.4 Precision

The test methods referred to in this European Standard include a precision statement where 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.

6 Assessment and verification of constancy of performance – AVCP

6.1 General

The compliance of hard paving grade bitumens 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,

— Factory Production Control (FPC) by the manufacturer, including product assessment.

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).

NOTE The information from AVCP can be available for audit as detailed in the manufacturer's quality plan.

6.2 Type testing

6.2.1 General

All performances related to characteristics included in this European Standard shall be determined when the manufacturer intends to declare the respective performances.

Assessment previously performed in accordance with the provisions of this European Standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family.

Products may be grouped in different families for different characteristics.

With reference to the assessment method, standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

— at the beginning of the production of a new or modified hard paving grade bitumens (unless a member of the same product range), or

— at the beginning of a new or modified method of production (where this may affect the stated properties); or they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the hard paving grade bitumens design, in the raw material or in the supply of the components, or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the declaration of performance (DoP), although this does not replace the responsibility on the hard paving grade bitumen manufacturer to ensure that the hard paving grade bitumen as a whole is correctly manufactured and its component products have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

Sampling shall be carried out in accordance with Clause 4.

The results of all type tests shall be recorded, held by the manufacturer at least 10 years from the date of the test or until the type test is no longer valid (whichever is the longer) and be available for inspection.

6.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the hard paving grade bitumen to which they relate.

6.2.4 Shared other party results

A manufacturer may use the results of the product type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind, provided that:

— the results are known to be valid for products with the same essential characteristics relevant for the product performance;

— in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product type concerned or has had it carried out, has expressly accepted to transmit to the manufacturer the results and the test report to be used for the latter's product type determination, as well as information regarding production facilities and the production control process that can be taken into account for FPC;

— the manufacturer using other party results accepts to remain responsible for the declared performances and he also:

— ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product type, and

— keeps available a copy of the determination of the product type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

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 comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared product type results, the FPC shall also include the appropriate documentation as described in 6.2.4.

6.3.2 Requirements

6.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory, the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate constancy of performance of the product at appropriate stages,

— identify and record any instance of non-constancy,

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

— the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made,

— the effective implementation of these procedures and instructions,

— the recording of these operations and their results,

— the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass the above responsibilities on to a subcontractor.

Manufacturers having an FPC system that complies with EN ISO 9001:2015 and that addresses the provisions of the present European Standard are considered as satisfying the FPC requirements of Regulation (EU) No 305/2011.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

6.3.2.2.2 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 and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.2.3 Raw material and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance.

6.3.2.2.4 Traceability and marking

Individual product batches shall be identifiable and traceable with regard to their production origin. Compliance with EN ISO 9001:2015 shall be deemed to satisfy the requirements of this sub-clause. The manufacturer shall have written procedures ensuring that processes related to affixing traceability information and/or markings are inspected regularly.

6.3.2.2.5 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

6.3.2.2.6 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 testing 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

— consistency at intermediate 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,

— consistency at elevated service temperatures: monthly,

— durability and brittleness at low temperature: annually.

6.3.2.2.7 Non-complying products

The manufacturer shall have written procedures that specify how non-complying 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.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.2.8 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 9001:2015 shall be deemed to satisfy the requirements of this sub-clause.

6.3.2.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration. Compliance with EN ISO 9001:2015 shall be deemed to satisfy the requirements of this sub-clause.

6.3.3 Initial inspection of factory and of FPC

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 6.3.2 are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European Standard are in place and correctly implemented, and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and

c) that the product complies with the product type samples, for which compliance of the product performance to the DoP has been verified.

All locations where final production or at least final testing of the relevant product is performed shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

6.3.4 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken once per year. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

In the case of a manufacturer operating more than one production site under the same FPC, then sampling of the sites should be applied using the IAF rules [11].

The sample of the sites to be visited during each surveillance audit could be determined before and/or during the surveillance visit based on information gathered during the visit. Minor sites doing only mixing of CE marked products may be audited from the main site controlling the minor site. All the production sites shall be visited within a period of 3 years.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples

submitted to the determination of the product type and that the correct actions have been taken for non-compliant products.

6.3.5 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this European Standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in 6.2.1.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

6.3.6 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The hard paving grade bitumens produced as a one-off, prototypes assessed before full production is established, and products produced in quantities of less than 100 tonnes per year shall be assessed by the manufacturer as follows.

For type assessment, the provisions of 6.2.1, 3rd paragraph, apply, together with the following additional provisions:

— in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The FPC-documentation and the factory shall be assessed.

In the initial assessment of the factory and FPC, it shall be verified

— that all resources necessary for the achievement of the product characteristics included in this European Standard will be available, and

— that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

— that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European Standard and that the product will be the same as the samples used for the determination of the product type, for which compliance with this European Standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

Annex A
(normative)

Calculation of the penetration index

A.1 General

Annex A specifies the procedure that shall be used for calculating the penetration index of paving grade bitumens when required in relation to the specification for resistance to hardening given in Table 1.

A.2 Term and definition

For the purposes of Annex A, the following term and 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 Ring and Ball, determined in accordance with EN 1427.

NOTE 1 The calculation is based on the following hypothesis of Pfeiffer and Van Doormael.

a) At the temperature of the softening point Ring and Ball, the penetration of bitumen is (800 × 0,1) mm.

b) When the logarithm (base 10) of penetration is plotted against temperature, a straight line is obtained, the slope A of which is defined by:

$$A = \frac{\left(20 - I_p\right)}{\left(10 + I_p\right)} \times \frac{1}{50}$$

NOTE 2 A penetration index of zero is attributed to bitumen with a penetration at 25 °C of (200 × 0,1) mm and a softening point Ring and Ball of 40 °C.

A.4 Determination

Calculate the index of penetration, I_p, from the following formula:

$$I_p = \frac{\left(20 \times t_{RaB}\right) + \left(500 \times \log P\right) - 1952}{t_{RaB} - \left(50 \times \log P\right) + 120}$$

where

t_{RaB} is the softening point Ring and Ball in degrees Celsius (°C);

P is 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.

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 may exceed 0,3 in no more than one case in 20.

A.6.2 Reproducibility

The difference between two single and independent results obtained by different operators working in different laboratories on identical test material may exceed 0,5 in no more than one case in 20.

Annex B
(informative)

Informative properties

Table B.1 lists informative properties which suppliers of hard paving grade bitumens are encouraged to produce as "Supplier Declared Values". It is hoped that the data so provided will be of assistance in developing performance-related specifications in the future.

Table B.1 — Informative properties

Properties	Units	Test methods	Data
$T_{S\,=\,300\ MPa}$, by BBR [a]	°C	EN 14771 [9]	TBR
$T_{m\,=\,0,3}$, by BBR [a]	°C	EN 14771 [9]	TBR
G^* at 15 °C and 10 Hz, by DSR [b]	MPa	EN 14770 [8]	TBR
$T_{G^*/sin\,\delta\ =\ 1\ kPa\ at\ 1,6\ Hz,}$ by DSR [b]	°C	EN 14770 [8]	TBR
[a] BBR: Bending Beam Rheometer [b] DSR: Dynamic Shear Rheometer, or any other rheometer able to measure a complex modulus			

Annex ZA
(informative)

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

ZA.1 Scope and relevant characteristics

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

If this European Standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No 305/2011.

This annex deals with the CE marking of the hard paving grade bitumens intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard with regard to the products covered by the mandate and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses for hard paving grade bitumens and their intended use

Construction Product(s):	Hard paving grade bitumens		
Intended use(s):	For construction and maintenance of roads, airfields and other paved areas		
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Consistency at intermediate service temperature	5.2.2	None	Class
Consistency at elevated service temperature	5.2.3	None	Class (declared range)
Durability of the consistency at intermediate and elevated service temperatures	5.2.6	None	Class
Brittleness at low service temperature	5.2.4	None	Class (NPD may be used)
Regulated dangerous substances	5.3	None	

The declaration of the product performance related to certain essential characteristics is not required in those Member State (MS) where there is no regulatory requirement on these essential characteristics for the intended use of the product.

In this case, manufacturers placing their products on the market are not obliged to determine nor to declare the performance of their products with regard to these characteristics and the option "No Performance Determined" (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedure for AVCP of hard paving grade bitumens

ZA.2.1 System of AVCP

The AVCP systems of hard paving grade bitumens indicated in Table ZA.1, established by EC Decision 98/601/EC of 13 October 1998 under OJ L 287 and amended by EC decision 2001/596/EC of 8 January 2001 published 2 August 2001 under OJ L 209 are shown in Table ZA.2 for the indicated intended use and relevant levels or classes of performance.

Table ZA.2 — System of AVCP

Product	Intended use	Level(s) or class(es) of performance	AVCP system
Bitumen	For road construction and maintenance of roads	None	2+
System 2+: See Regulation (EU) No 305/2011, Annex V, 1.3 including certification of the factory production control by a notified production control certification body on the basis of initial inspection of the manufacturing plant and of factory production control as well as of continuous surveillance, assessment and evaluation of factory production control.			

NOTE The product and intended use defined in Table ZA.2 are as cited in the Commission Decision. The hard paving grade bitumens are considered as part of the general product family 'Bitumen'.

The AVCP of the hard paving grade bitumens in Table ZA.1 shall be according to the AVCP procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3 — Assignment of AVCP tasks for hard paving grade bitumens under system 2+

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory Production Control (FPC)	Parameters related to all relevant characteristics of Table ZA.1	6.3
	Determination of the product-type on the basis of type testing	All relevant characteristics of Table ZA.1	6.2
	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	6.2
Tasks for the notified body	Initial inspection of factory and of FPC	Parameters related to all relevant characteristics of Table ZA.1, i.e.: - *Consistency at intermediate service temperature,* - *Consistency at elevated service temperature,* - *Durability of the consistency at intermediate and elevated service temperatures,* - *Brittleness at low service temperature*	6.3

Tasks		Content of the task	AVCP clauses to apply
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to all relevant characteristics of Table ZA.1, i.e.: - *Consistency at intermediate service temperature,* - *Consistency at elevated service temperature,* - *Durability of the consistency at intermediate and elevated service temperatures,* - *Brittleness at low service temperature*	6.3

ZA.2.2 Declaration of performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of the different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

— the determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; the factory production control and the testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer, and

— the certificate of conformity of the factory production control, issued by the notified production control certification body on the basis of:

  — initial inspection of the manufacturing plant and of factory production control, and

  — continuous surveillance, assessment and evaluation of factory production control.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

— the reference of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and the date of issue of the harmonized standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall contain in addition:

— the intended use or uses for the construction product, in accordance with the applicable harmonized technical specification;

— the list of essential characteristics, as determined in the harmonized technical specification for the declared intended use or uses;

— the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

— where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared;

— the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

— for the listed essential characteristics for which no performance is declared, the letters “NPD” (No Performance Determined).

Regarding the supply of the DoP, Article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of EC Regulation 1907/2006, (REACH) shall be provided together with the DoP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for a hard paving grade bitumen

DECLARATION OF PERFORMANCE

No. 001CPR2013-07-14

1) Unique identification code of the product-type:

Hard paving grade bitumen 10/20

2) Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

Hard paving grade bitumen 10/20

3) Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:

Construction and maintenance of roads, airfields and other paved areas

4) Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):

AnyCo SA,
PO Box 21
B-1050 Brussels, Belgium
Tel. +32987654321
Fax: +32123456789
Email: anyco.sa@provider.be

5) Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2):

Anyone Ltd
Flower Str. 24
West Hamfordshire
UK-589645 United Kingdom
Tel. +44987654321
Fax: +44123456789
e-mail: anyone.ltd@provider.uk

6) System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 2+

7) In case of the declaration of performance concerning a construction product covered by a harmonized standard:

Notified factory production control certification body No. 5678 performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control.

8) Declared performance

Essential characteristics	**Performance**	**Harmonized technical specification**
Consistency at intermediate service temperature	10 0,1 mm to 20 0,1 mm (Class3)	EN 13924-1:2015
Consistency at elevated service temperature	62 °C to 72 °C (Class 3)	
Durability of the consistency at intermediate and elevated service temperatures	≥ 55 % (Class2)	
	≤ 8 °C (Class2)	
Brittleness at low service temperature	NPD	

9) The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by: .....(name and function) .....

…… (place and date of issue) (signature) ……

ZA.3 CE marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of EC Regulation 765/2008 and shall be affixed visibly, legibly and indelibly to the packaging or with the delivery note.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed,

— the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity,

— the unique identification code of the product-type,

— the reference number of the declaration of performance,

— the level or class of the performance declared,

— the dated reference to the harmonized technical specification applied,

— the identification number of the notified body,

— the intended use as laid down in the harmonized technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

The “No performance determined” (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.

Figures ZA.1, ZA.2 and ZA.3 give examples of the information related to products subject to AVCP under system 2+.

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

Other information on the characteristics listed in Table ZA.1 shall be made available with the accompanying document(s).

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

CE	*CE marking, consisting of the "CE" symbol*
01234	*Identification number of the notified of the production control certification body*
AnyCo Ltd, P.O. Box 21, B – 1050	*Name and registered address of the manufacturer, or identifying mark*
15	*Last two digits of year in which the CE marking was first affixed*
00001-CPR-2013/05/12	*Reference number of the DoP*
EN 13924–1:2015	*Dated reference of European Standard applied, as referenced in OJEU*
Hard paving grade bitumen 10/20 – 62/72 (2)	*Unique identification code of the product-type, intended use as laid down in the European Standard applied and level or class of the performance declared*

Figure ZA.1 — Example of CE marking information of products under AVCP system 2+ to be affixed to the packaging or to be given on a Delivery Note

NOTE It is essential that product designation allows an unambiguous tracing to the corresponding CE marking information given on commercial documents.

CE	*CE marking, consisting of the "CE" symbol*
01234	*Identification number of the notified of the production control certification body*
AnyCo Ltd, P.O. Box 21, B – 1050	*Name and registered address of the manufacturer, or identifying mark*
15	*Last two digits of year in which the CE marking was first affixed*
00001-CPR-2013/05/12	*Reference number of the DoP*
EN 13924–1:2015	*Dated reference of European Standard applied, as referenced in OJEU*
Hard bitumen for paving 10/20	*Unique identification code of the product-type, intended use as laid down in the European Standard applied and level or class of the performance declared*
Penetration at 25 °C — Class 3	*Level or class of the performance declared*
Softening point — Class 3 (62 °C - 72 °C)	
Resistance to hardening at 163 °C — (EN 12607-1)	
Retained penetration at 25 °C — Class 2	
Increase in softening point — Class 2	

Figure ZA.2 — Example of CE marking information and values of products under AVCP system 2+

CE	*CE marking, consisting of the "CE" symbol*
01234	*Identification number of the notified of the production control certification body*
AnyCo Ltd, P.O. Box 21, B – 1050	*Name and registered address of the manufacturer, or identifying mark*
15	*Last two digits of year in which the CE marking was first affixed*
00001-CPR-2013/05/12	*Reference number of the DoP*
EN 13924–1:2015	*Dated reference of European Standard applied, as referenced in OJEU*
Hard bitumen for paving 10/20	*Unique identification code of the product-type, intended use as laid down in the European Standard applied and level or class of the performance declared*
Penetration at 25 °C 10 – 20 × 0,1 mm	*Level or class of the performance declared*
Softening point 62 °C - 72 °C	
Resistance to hardening at 163 °C (EN 12607-1)	
Retained penetration at 25 °C ≥ 55 %	
Increase in softening point ≤ 8 °C	
Fraass breaking point ≤ 3 °C	

Figure ZA.3 — Example of CE marking information with associated regulatory regional requirements of products under AVCP system 2+

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[1] CEN/TR 15352, *Bitumen and bituminous binders - Development of performance-related specifications: status report 2005*

[2] EN 12591, *Bitumen and bituminous binders - Specifications for paving grade bitumens*

[3] EN 12607-3, *Bitumen and bituminous binders - Determination of the resistance to hardening under influence of heat and air - Part 3: RFT method*

[4] EN 12697-1, *Bituminous mixtures - Test methods for hot mix asphalt - Part 1: Soluble binder content*

[5] EN 12697-11, *Bituminous mixtures - Test methods for hot mix asphalt - Part 11: Determination of the affinity between aggregate and bitumen*

[6] EN 12697-12, *Bituminous mixtures - Test methods for hot mix asphalt - Part 12: Determination of the water sensitivity of bituminous specimens*

[7] EN 12697-26, *Bituminous mixtures - Test methods for hot mix asphalt - Part 26: Stiffness*

[8] EN 14770, *Bitumen and bituminous binders - Determination of complex shear modulus and phase angle - Dynamic Shear Rheometer (DSR)*

[9] EN 14771, *Bitumen and bituminous binders - Determination of the flexural creep stiffness - Bending Beam Rheometer (BBR)*

[10] EN ISO 2719, *Determination of flash point - Pensky-Martens closed cup method (ISO 2719)*

[11] IAF Guidance On The Application Of ISO/IEC Guide 62:1996, Annex 3 Multisite Certification/ Registration

[12] EN ISO 9001:2015, *Quality management systems - Requirements (ISO 9001:2015)*

National Annex NA
(informative)
Guidance for use of BS EN 13924-1:2015 in the UK

Introduction

This National Annex NA (informative) provides guidance to users on the implementation of BS EN 13924-1:2015 for hard paving grade bitumens, for use in high stiffness modulus asphalt for the construction and maintenance of roads and airfields in the UK.

BS EN 13924-1:2015 is not a performance-related specification but contains classes for various properties, allowing the selection of the most suitable specification for the bitumen, taking its use and the local climate into account.

Possible poor selection of properties/classes has been recognised by UK industry and guidance on the selection of properties suitable for use in high stiffness modulus asphalt in UK conditions is included in NA.3.

The recommended choice of properties is based on the use of the bitumens in high stiffness modulus asphalts, and includes the properties specified in France where high stiffness modulus asphalt (known in France as EME 2, *Enrobé à Module Élevé*) was originally developed and where there are many years' experience of successful use.

NA.1 Implementation

BS EN 13924-1:2015 is applicable to hard paving grade bitumens for use in high stiffness modulus asphalt.

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

> "Hard paving grade bitumens shall conform to the requirements of BS EN 13924-1:2015, National Annex NA (informative), Table NA.1, and the informative properties in Table NA.2 shall be reported".

NA.2 National guidance for the selection of properties

BS EN 13924-1:2015 specifies the characteristics that may be called up in hard paving grade bitumen specifications. In accordance with Subclause 5.2.1 in this standard, the UK committee provides the following national requirements for hard paving grade bitumens for use in products for the construction and maintenance of roads and airfields.

Subclause 5.2 requires that the hard paving grade bitumen supplier shall state for each hard paving grade bitumen the class for each of the properties shown in Tables 1 and 2. Class 0 (NR, i.e. No Requirement) or Class 1 (TBR, i.e. To Be Reported) may be selected for the properties in Table 2. The information should appear on the technical information documentation provided by the hard grade bitumen supplier. This information is needed for CE marking purposes.

The recommendations for each appropriate characteristic for hard paving grade bitumens for use in the UK are made in NA.3.

NA.3 Selection of properties and classes

It is recommended that hard paving grade bitumens for use in high stiffness modulus asphalt in the UK are specified as given in Tables NA.1 and NA.2. Class 0 (NR) or Class 1 (TBR) may be selected by the hard paving grade bitumen supplier for other properties in Table 2.

It is specified in BS EN 13924-1:2015, Subclause 5.2.3, that for softening point, a restricted range of ± 5 °C about a mid-point shall be declared by the supplier; the overall range must be within the following ranges, 58 °C to 76 °C for the 10/ 20 grade and 55 °C to 71 °C for the 15/25 grade. In the UK it has been agreed that a fixed range for each grade should be used, see Table NA.1.

Table NA.1 – Specification for hard paving grade bitumens – Properties applying to all hard paving grade bitumens

Properties		Test methods	Units	Hard paving grade bitumen nomenclature			
				10/20 penetration		15/25 penetration	
				Specified limit(s)	Class	Specified limit(s)	Class
Penetration at 25 °C		BS EN 1426	0,1 mm	10-20	3	15-25	2
Softening point		BS EN 1427	°C	63-73 (Target 71 max [a])	4	60-70 (Target 68 max [a])	2
Resistance to hardening	Change of mass	BS EN 12607-1	%	≤ 0,5	2	≤ 0,5	2
	Retained penetration	BS EN 1426	%	≥ 55	2	≥ 55	2
	Increase in softening point	BS EN 1427	°C	≤ 8	2	≤ 8	2
Flash point		BS EN ISO 2592	°C	≥ 245	3	≥ 245	3
Solubility		BS EN 12592	%	≥ 99,0	2	≥ 99,0	2

[a] Softening point target maximum value based on a rolling mean of the last six consecutive results in Factory Production Control (FPC)

Table NA.2 – Specification for hard paving grade bitumens – Properties associated with regulatory or other regional requirements

Properties	Test methods	Units	Hard paving grade bitumen nomenclature			
			10/20 penetration		15/25 penetration	
			Specified limit(s)	Class	Specified limit(s)	Class
Dynamic viscosity at 60 °C	BS EN 12596	Pa·s	NR	0	NR	0
Softening point after hardening	BS EN 12607-1 + BS EN 1427	°C	NR	0	NR	0
Increase in softening point [a]			see note [a]		see note [a]	
Penetration index on unaged bitumen	BS EN 1427	I_p calculation (see Annex A)	≥ –1,5 and ≤ +0,7	2	≥ –1,5 and ≤ +0,7	2
Kinematic viscosity at 135 °C	BS EN 12595	mm²/s	≥ 700 b	3	≥ 600 b	2
Fraass breaking point	BS EN 12593	°C	≤ 3	3	≤ 0	2

[a] Increase in softening point and penetration index on unaged bitumen are specified so that penetration index on unaged bitumen is controlled. Increase in softening point is specified in Table NA.1

[b] The values specified in this standard for Kinematic viscosity at 135°C are ≥ 700 mm²/s (Class 3) for 10/20 grade and ≥ 600 mm²/s (Class 2) for 15/25 grade. In TRL 636, ≥ 1100 mm²/s for 10/20 grade and ≥ 900 mm²/s for 15/25 grade were recommended

NR = No Requirement

NA.4 Annex B (informative): Informative properties

Annex B refers to the "Informative properties", which are additional properties, determined using test methods that are being used on a voluntary basis and these may be declared by the supplier. It is anticipated that experience gained with these "informative properties" could eventually lead to the development of performance-related hard grade bitumen specifications in the future.

The "informative properties" are not yet ready to be used in specifications.

Informative properties, using Dynamic Shear Rheology and Bending Beam Rheology are included (see Table NA.3). It is proposed that a periodic review of the informative data will be carried out by UK Committee B/510/19, Bitumen and related products.

The data for the bitumens supplied during this period confirms that the key issues are the selection of the target levels for penetration, softening point (within the allowed ranges in BS EN 13924-1:2015) and the increase in softening point after the Rolling Thin Film Oven Test (RTFOT). This is dealt with in NA.3 and Table NA.1. For a certain penetration level, restricting the softening point range (10 °C) and the allowed change after RTFOT (≤ 8 °C) influences the remaining properties and this should be recognised when preparing specifications.

Table NA.3 – Informative properties

Properties	Units	Test methods	Data
T200cP, T2000cP, T5000cP by Dynamic viscosity	°C	BS EN 13302	TBR [c]
$T_{S=300\ MPa}$, by BBR [a]	°C	BS EN 14771	TBR [d]
$T_{m\ =\ 0,3}$, by BBR [a]	°C	BS EN 14771	TBR [d]
G^* at 15 °C and 10 Hz, by DSR [b]	MPa	BS EN 14770	TBR [d]
$T_{G^*/sin\ \delta=\ 1\ kPa\ at\ 1,6\ Hz}$, by DSR [b]	°C	BS EN 14770	TBR [d]
G^* and phase angle 10 °C to 80 °C, 0,1 Hz to 10 Hz by DSR [b]	Pa, degrees (Graphical output)	BS EN 14770	TBR [d]
G' and G'' (ref. temp. 25 °C) master curves 80 °C to 0 °C by DSR [b]	Pa, degrees (Graphical output)	BS EN 14770	TBR [d]

[a] BBR: Bending Beam Rheometer

[b] DSR: Dynamic Shear Rheometer

The report may include parameters such as a plot of G* at 0,4 Hz and value reported at 25 °C, and also $T_{G^*/sin\ \delta=\ 2\ kPa\ at\ 0,4\ Hz}$. The test conditions and parameters reported should be agreed with the supplier

[c] T200cP should be measured on bitumen as supplied. T2000cP and T5000cP should be measured after short term ageing (after BS EN 12607-1 RTFOT)

[d] Data should be produced on bitumen as supplied, after short term ageing (after BS EN 12607-1 RTFOT) and after long term ageing (after PAV 85)

TBR = To Be Reported

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Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.