



DPC: 24/30480040 DC

**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 07 March 2024

Origin: European

**Latest date for receipt of comments: 30 April 2024**

Project No. 2023/02145

Responsible committee: PTI/13 Petroleum Testing and Terminology

Interested committees:

Title: Draft BS EN 1427 Bitumens and bituminous binders - Determination of the softening point - Ring and Ball method.

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 30 April 2024**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email [cservices@bsigroup.com](mailto:cservices@bsigroup.com). British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

Responsible Committee Secretary: Mr Rattanjit Gill (BSI)

Direct tel: 0207 467 7130

E-mail: [rgill@energyinst.org](mailto:rgill@energyinst.org)

Full document details: 24/30480040 DC

## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

## UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

## Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

## Template for comments and secretariat observations

|                  |                        |
|------------------|------------------------|
| Date: xx/xx/20xx | Document: ISO/DIS xxxx |
|------------------|------------------------|

| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/ Figure/Table/Note | Type of comment | Comment (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |

English Version

## Bitumens and bituminous binders - Determination of the softening point - Ring and Ball method

Bitumes et liants bitumineux - Détermination du point de ramollissement - Méthode Bille et Anneau

Bitumen und bitumenhaltige Bindemittel - Bestimmung des Erweichungspunktes - Ring- und Kugel-Verfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 336.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

**Warning :** This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

| <b>Contents</b>                                                                                                           | <b>Page</b> |
|---------------------------------------------------------------------------------------------------------------------------|-------------|
| European foreword .....                                                                                                   | 3           |
| 1 Scope.....                                                                                                              | 4           |
| 2 Normative references.....                                                                                               | 4           |
| 3 Terms and definitions .....                                                                                             | 4           |
| 4 Principle .....                                                                                                         | 4           |
| 5 Reagents and materials .....                                                                                            | 5           |
| 6 Apparatus .....                                                                                                         | 5           |
| 6.1 Ring and Ball apparatus .....                                                                                         | 5           |
| 6.2 Calibration/Verification.....                                                                                         | 7           |
| 7 Test sample preparation .....                                                                                           | 7           |
| 8 Procedure and reporting .....                                                                                           | 8           |
| 8.1 Selection of bath liquid and thermometer.....                                                                         | 8           |
| 8.1.1 Initial selection .....                                                                                             | 8           |
| 8.1.2 Assessment of correct selection of bath liquid.....                                                                 | 8           |
| 8.1.3 Procedure and reporting for softening points < 80 °C .....                                                          | 8           |
| 8.2 Procedure and reporting for softening points above 80 °C and up to 150 °C .....                                       | 10          |
| 9 Expression of results .....                                                                                             | 11          |
| 10 Precision .....                                                                                                        | 11          |
| 10.1 General.....                                                                                                         | 11          |
| 10.2 Repeatability .....                                                                                                  | 11          |
| 10.3 Reproducibility.....                                                                                                 | 11          |
| 11 Test report.....                                                                                                       | 12          |
| Annex A (normative) Characteristics of thermometers.....                                                                  | 18          |
| Annex B (informative) Examples of valid and invalid temperature gradients.....                                            | 19          |
| B.1 General.....                                                                                                          | 19          |
| B.2 Example 1 Bath liquid: Water.....                                                                                     | 20          |
| B.3 Example 2 Bath liquid: Glycerol .....                                                                                 | 21          |
| Annex C (informative) Examples of even temperature distribution and experiences on<br>beaker - stirrer combinations ..... | 23          |
| C.1 Uneven temperature distribution due to layering of glycerol .....                                                     | 23          |
| C.2 Examples of beaker - stirrer combinations .....                                                                       | 23          |
| Annex D (informative) Silicone oil as alternative to glycerol as bath liquid .....                                        | 25          |
| D.1 Verification of influence of silicone oil on the test sample .....                                                    | 25          |
| D.2 Verification of speed of stirring on test results .....                                                               | 25          |
| Bibliography .....                                                                                                        | 27          |

## European foreword

This document (prEN 1427:2024) has been prepared by Technical Committee CEN/TC 336 “Bitumens and bituminous binders”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1427:2015.

prEN 1427:2024 includes the following significant technical changes with respect to EN 1427:2015:

- in Clause 3, a Note to entry has been added in 3.1;
- in 5.2.2, a Note has been added;
- in the description of the ring holder and assembly (6.1.5), it has been clarified that dimensions shown in Figures 4 and 6 are mandatory while the shape is exemplary;
- the descriptions of the beaker (6.1.6) and the stirrer (6.1.8) have been updated;
- the description of the temperature measurement device (6.1.7) has been aligned with Annex A;
- in 6.1.7.2 the position of thermometer or temperature sensor has been clarified;
- 6.2 has been updated;
- Clause 7 is now called “Test sample preparation” and the specifications have been updated;
- Clause 8 has been reorganized in order to increase readability;
- in Clause 10, Table 1 now refers to polymer modified or oxidized bitumen instead of only oxidized bitumen and information on background and references on Round-Robin Tests have been updated;
- in Figure 5, the diameter dimensions of the beaker have been adapted;
- Annex A has been converted from an informative into a normative Annex;
- Annex C and Annex D have been added;
- the document has been editorially revised.

## 1 Scope

This document specifies a method for the determination of the softening point of bitumen and bituminous binders in the range of 28 °C to 150 °C.

The method described also applies to bituminous binders that have been recovered from bituminous mixes, e.g. by extraction according to EN 12697-3 [1].

The change from mercury thermometers to electronic temperature devices has revealed that the temperature definition in the mercury thermometer has not been precise enough to make a correct, unbiased transfer to electronic devices. Care should be taken for softening points ring and ball above 100 °C as the condition may have changed from previous practice to present days testing equipment. Below approximately 100 °C the difference in temperature readings between electronic and mercury stem thermometer is acceptable compared to the repeatability of this test method.

**WARNING** — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 12594, *Bitumen and bituminous binders - Preparation of test samples*

EN 12597, *Bitumen and bituminous binders - Terminology*

EN ISO 3696:1995, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987)*

## 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org>

### 3.1

#### **softening point**

temperature at which material under standardized test conditions attains a specific consistency

Note 1 to entry: Softening Point Ring and Ball can be used to assess the essential characteristic of “Consistency at elevated service temperature” for paving grade bitumen.

## 4 Principle

Two horizontal discs of bituminous binder, cast in shouldered brass rings shall be heated at a controlled rate in a liquid bath while each supports a steel ball. The softening point shall be reported as the mean of

the temperatures at which the two discs soften enough to allow each ball, enveloped in bituminous binder, to fall a distance of  $(25,0 \pm 0,4)$  mm.

## 5 Reagents and materials

### 5.1 Reagents

Use only reagents of specified analytical grade and water conforming to grade 3 of EN ISO 3696:1995 unless otherwise specified.

### 5.2 Bath liquid

#### 5.2.1 Distilled or deionized water.

The use of freshly boiled, cooled, distilled or deionized water is essential to avoid trapping air bubbles on the surface of the test sample, which can affect the results.

#### 5.2.2 Glycerol, with a density $(1\,250 \pm 10)$ kg/m<sup>3</sup> at 20 °C, with a 99 % mass fraction purity.

**WARNING** — Glycerol has a flash point of 160 °C, measured according to EN ISO 2592 [2]. In temperatures above 100 °C, as glycerol may contain water due to hygroscopic properties, glycerol may splash on the heating elements and ignite.

NOTE Silicone oil is tested as an alternative for glycerol. Available data are summarized in Annex D and can be used to verify for further development of this document.

### 5.3 Release agent, mixture of glycerol and dextrin or mineral talc, or another commercially available release agent.

To prevent the bituminous binder from adhering to the pouring plate when casting discs, the surface of the metal pouring plate shall be thinly coated just before use with the release agent.

NOTE 1 Applying the release agent coating is easier when the plate is warmed to approximately 40 °C.

NOTE 2 Instead of a release agent, other materials, e.g. baking paper, can be used.

## 6 Apparatus

### 6.1 Ring and Ball apparatus

The ring and ball apparatus can be either manual, semi-automatic or automatic and shall comprise the elements given in 6.1.1 to 6.1.9.

**6.1.1 Two rings**, made from brass, square-shouldered, and having dimensions in accordance with Figure 1.

**6.1.2 Pouring plate**, made from metal, having a flat and smooth surface, with dimensions of  $(50 \pm 5)$  mm  $\times$   $(75 \pm 5)$  mm and a thickness between 1,5 mm and 2,0 mm with the edges turned down (see Figure 2).

**6.1.3 Two balls**, made from stainless steel, each having a diameter of  $(9,50 \pm 0,05)$  mm and a mass of  $(3,50 \pm 0,05)$  g.

**6.1.4 Two ball centring guides**, made from brass, for centring the balls (6.1.3), one for each ring (6.1.1). Figure 3 shows an example of a ball centring guide.

**6.1.5 Ring holder and assembly**, stainless steel or brass, with a holder (A) to support the two rings (6.1.1) in a horizontal position, conforming to the dimensions and exemplary shape shown in Figure 4, supported in the assembly shown in Figure 5. The bottom of the shouldered rings in the ring holder shall be  $(25,0 \pm 0,4)$  mm above the upper surface of the bottom plate (B), the dimensions and exemplary shape of which are shown in Figure 6; the upper edge of the rings shall be  $(50 \pm 3)$  mm below the surface of the bath liquid (5.2).

NOTE For automatic apparatus, see 6.1.9.

**6.1.6 Beaker**, made from glass, capable of being heated, with an outside diameter between 85 mm and 110 mm, with a height of at least 120 mm as shown in Figure 5, and capable of holding a volume of at least 600 ml of the bath liquid (5.2). The beaker shall allow the correct placement of ring holder assembly as well as an evenly temperature distribution within the bath liquid, no matter which one is used, in combination with the stirrer used.

### 6.1.7 Temperature measuring device

#### 6.1.7.1 Thermometer specifications

A thermometer or a temperature measuring device (combining sensor and reading unit) for determination in water shall:

- have a range from at least 0 °C to 90 °C;
- be readable at least to the nearest 0,2 °C;
- have a maximum permissible error of 0,2 °C;
- have a response time ( $\tau$ ) at 63 % to a temperature step not exceeding 3,3 s.

A thermometer or a temperature measuring device (combining sensor and reading unit) for determination in glycerol shall

- have a range from at least 40 °C to 155 °C;
- be readable at least to the nearest 0,5 °C;
- have a maximum permissible error of 0,5 °C;
- have a response time ( $\tau$ ) at 63 % to a temperature step not exceeding 5 s.

Sensors based on platinum resistance thermometers cast in glass of the approximate dimension mentioned in Table A.1 have been found suitable but other principles are also allowed. The thermal response time of the sensor shall be comparable with the formerly used reference (see Table A.1). The liquid in glass thermometer ASTM S15C does not fulfil the response time requirement. The temperature-measuring device shall be calibrated regularly.

**6.1.7.2** The appropriate thermometer or temperature sensor shall be suspended in the assembly as shown in Figure 5 so that the bottom of the temperature registering part is level with the bottom of the rings and the temperature sensor is centred between the rings, but not touching the rings or the ring holder.

For the method described in which increasing temperatures are read during the test procedure, documented corrections should be determined in advance and applied to the observed readings.

**6.1.8 Stirrer**, magnetic stirrer/hot plate with suitably coated stirring bar of length approximately 40 mm and diameter 8 mm to ensure uniform heat distribution throughout the bath and to avoid

turbulent flow throughout the bath. The stirrer shall be placed so that it does not disturb the samples when the test is in operation.

Under the same conditions, depending on the beaker dimensions, magnetic stirrers with other dimensions may be used. The rotation speed of the stirring bar shall be approximately 100 r/min.

A propeller stirrer which operates smoothly may also be used provided the temperature distribution in the beaker is evenly and similar to the one achieved with a magnetic stirrer and does not disturb the sample when test is in operation by turbulence.

**NOTE** Information on temperature distribution and experiences with beaker-stirrer combinations is given in Annex C.

The blade of the propeller stirrer should preferably be placed at a level between the bottom plate of the assembly and the bottom of the beaker (see Figure 5).

The definite combination of stirrer, beaker, bath liquid, and assembly shall be given in the equipment manufacturer's handbook. Only these combinations shall be used.

**WARNING** — If the propeller stirrer is electrically driven, ensure that it is safely earthed.

#### 6.1.9 Semi-automatic or automatic equipment

Instead of the apparatus described in 6.1.1 to 6.1.8, a semi-automatic or automatic apparatus may be used (after it has been calibrated). The results obtained shall be the same as with the manual method and shall be within the precision of the manual method. In case of doubt, the referee method shall be the manual one with the apparatus as shown in Figure 5.

**NOTE** When using an automatic apparatus, the ball can possibly trigger the interruption of a ray of light at a distance of  $(25,0 \pm 0,4)$  mm below the underside of the ring, rather than the ball touching the bottom plate.

### 6.2 Calibration/Verification

All equipment and parts described above shall be checked for accuracy and/or calibrated/verified at least once per year.

## 7 Test sample preparation

Take the test sample in accordance with EN 58 taking all necessary safety precautions and ensuring that the test sample is representative of the laboratory sample from which it is taken. Prepare the test sample in accordance with EN 12594.

For modified bitumen, the quantity of the test sample shall be adjusted to fill four rings in case the test has to be repeated (see 8.3.7).

Heat the two rings (6.1.1) to a temperature of not more than 100 °C above the expected softening point and place them on the pouring plate treated with the release agent (5.3). The pouring plate (6.1.2) shall not be heated.

Do not use too much of the release agent to avoid the transfer of particles to the bath liquid (5.2) as these can interfere with the test end detections of an automatic device, e.g. ray of light.

Pour a slight excess of the heated bituminous binder into each of the rings (6.1.1), then allow the specimens to cool in ambient air for at least 30 min. For materials that are soft at room temperature, cool the test sample for at least 30 min at an air temperature at least 10 °C below the expected softening point. No more than 4 h shall elapse until completion of the test from the time the test samples are poured.

When the test samples have cooled, cleanly cut away the excess bituminous binder with a warmed knife or blade, so that each test sample is flush and level with the top of its ring (6.1.1). Cut the excess of