



SLOVENSKI STANDARD
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Bitumen in bitumenska veziva - Določanje odpornosti proti otrjevanju pod vplivom toplote in zraka - 1. del: Metoda RTFOT

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

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Beständigkeit gegen Verhärtung unter Einfluss von Wärme und Luft - Teil 1: RTFOT-Verfahren

Bitumes et liants bitumineux - Détermination de la résistance au durcissement sous l'effet de la chaleur et de l'air - Partie 1 : Méthode RTFOT

Ta slovenski standard je istoveten z: prEN 12607-1

ICS:

75.140	Voski, bitumni in drugi naftni proizvodi	Waxes, bituminous materials and other petroleum products
91.100.50	Veziva. Tesnilni materiali	Binders. Sealing materials

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

Bitumes et liants bitumineux - Détermination de la résistance au durcissement sous l'effet de la chaleur et de l'air - Partie 1 : Méthode RTFOT

Bitumen und bitumenhaltige Bindemittel - Bestimmung der Beständigkeit gegen Verhärtung unter Einfluss von Wärme und Luft - Teil 1: RTFOT-Verfahren

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

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

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European foreword

This document (prEN 12607-1:2023) has been prepared by Technical Committee CEN/TC 336 “Bituminous binders”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12607-1:2014.

Compared to the previous edition the main technical changes are:

- a) reference duration of procedure was added in Clause 4;
- b) Clause 4 was updated by removing limitation to test following the RTFOT procedure to those listed;
- c) reference to new informative Annex B was made in 5.1;
- d) amendments were made on temperature control and verification in 5.1 and in the new informative Annex B;
- e) a complementary drawing to Figure 3 in Clause 5 was added to show concave glass containers and renamed into Figure 3 a) and Figure 3 b) and a second note was added to 5.4;
- f) Clause 6 was aligned with draft revised EN 12594;
- g) 6.3 was removed;
- h) Clause 8 was editorially updated;
- i) a new informative Annex B on temperature verification was added.

EN 12607, *Bitumen and bituminous binders — Determination of the resistance to hardening under the influence of heat and air*, is currently composed with the following parts:

- *Part 1: RTFOT method*
- *Part 2: TFOT method*
- *Part 3: RFT method*

prEN 12607-1:2023 (E)**1 Scope**

This document specifies a method for measuring the combined effects of heat and air on a thin moving film of bitumen or bituminous binder simulating the hardening which most bituminous binders undergo during mixing in an asphalt mixing plant.

The method described is not applicable to some modified binders or to those where the viscosity does not allow to provide a moving film. In some cases, the sample may creep out of the glass container and flow on the heating elements of the oven during testing. The method is suitable for other bituminous binders than paving grade bitumen, but the reference temperature might give excessive hardening that do not resemble real conditions during mixing at the plant. The method may not represent the hardening that occurs during mixing of warm mix binders.

The method is referred to as RTFOT, i.e. Rolling Thin Film Oven Test.

WARNING — 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 identify the hazards and assess the risks involved in performing this test method and to implement sufficient control measures to protect individual operators (and the environment). This includes appropriate safety and health practices and determination of the applicability of regulatory limitations prior to use.

If there is a likelihood of volatile components being present in a binder, this procedure should not be used. It should not be used for cutback bitumen or bituminous emulsions before these products have been stabilized, e.g. in accordance with EN 13074-2.

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* 2023

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 12594, *Bitumen and bituminous binders - Preparation of test samples*

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

EN 13302, *Bitumen and bituminous binders - Determination of dynamic viscosity of bituminous binder using a rotating spindle apparatus*

3 Terms and definitions

No terms and definitions are listed in this document.

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/>

4 Principle

A moving film of bituminous binder is heated in an oven to a specified temperature for a given period of time with a constant supply of air.

The effects of heat and air are determined based on the change in mass (expressed as a percentage) or on the change in the bituminous binder's characteristics such as penetration according to EN 1426, softening point according to EN 1427 or dynamic viscosity according to EN 12596 or EN 13302, and other tests before and after the period in the oven.

The reference temperature of this conditioning is 163 °C and the reference duration is 75 min.

5 Apparatus

Usual laboratory apparatus and glassware, together with the following:

5.1 Oven, rectangular, double-walled and electrically heated. The inside dimensions excluding the air plenum shall be as follows:

- height: (340 ± 15) mm;
- width: (405 ± 15) mm;
- depth: (445 ± 15) mm.

The front door shall contain a symmetrically located window of the following dimensions:

- width: (320 ± 15) mm;
- height: (215 ± 15) mm.

This window shall contain two sheets of heat resistant glass separated by an air space. The window shall permit an unobstructed view of the interior of the oven.

The top of the upper heating element shall be (25 ± 9) mm below the oven floor.

The oven shall be ventilated by convection currents of air; the oven shall have air inlets and outlets for the evacuation of hot gases. The air inlets toward the bottom of the oven shall be located so that the air is able to flow around the heating elements and their total open area shall be $(1\,500 \pm 100)$ mm². The outlets for the hot gases evacuation shall be located in the upper part of the oven and their total open area shall be $(1\,000 \pm 100)$ mm².

The oven shall incorporate an air flow around the side walls and ceiling. The air plenum (between the wall and the sheaths) shall be of uniform thickness (38 ± 3) mm [Figure 1 a)]. The inside of the oven shall be equipped with a vertical circular aluminium carriage with a diameter of (300 ± 10) mm [Figure 2 a)]. The horizontal axis of the circular carriage is located (160 ± 10) mm from the upper inside wall of the oven, excluding the air plenum. The carriage shall be provided with suitable openings and spring clips for firmly holding eight glass containers in a horizontal position [Figure 2 b)]. The carriage shall be mechanically driven by a 20 mm diameter shaft and shall make 15 turns within (60 ± 1) s. The front surface of the carriage shall be (110 ± 5) mm from the rear inside wall of the oven.

On the upper surface and at the midpoint of the width of the oven and (150 ± 5) mm from the front face of the carriage, a squirrel cage-type fan shall be mounted with an outside diameter of (135 ± 5) mm and a thickness of (75 ± 5) mm and turned at $(1\,725 \pm 100)$ r/min by an externally mounted motor.

The fan shall be set so that it turns in an opposite direction to its vanes. The air flow characteristics shall be suction from the floor of the oven then flow along the walls in the sheaths fitted for this purpose and exhaust at the upper surface through the fan [Figure 1 a) and Figure 1 b)].

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The oven shall be equipped with a thermostat capable of maintaining a constant temperature to $\pm 0,5$ °C throughout the entire periphery of the vertical circular carriage. The corresponding regulation probe shall be situated on the right side of the oven as described in Figure 1 or symmetrically on the left side.

The temperature shall be recorded inside the oven with the reading point (25 ± 5) mm below a horizontal line through the axle of the carriage, (50 ± 5) mm from the inside wall and (115 ± 5) mm from the front face of the carriage. The heating capacity shall be sufficient to bring the oven back to the test temperature within a 10 min period after insertion of the containers.

The oven shall be equipped with an air jet positioned to blow heated air into each container at its lowest point of travel. The air jet shall have an outlet orifice with a diameter of $(1,0 \pm 0,1)$ mm connected to a copper tubing (see EN 12735-1) with an external diameter of $(8,0 \pm 0,1)$ mm and a length of $(7,60 \pm 0,05)$ m. This tube shall be coiled to lie flat on the bottom of the oven and lead to a source of oil-free, dried and dust-free air. The orifice of the tubing shall be between 5 mm and 10 mm from the opening in the glass container. The air jet shall blow along the main axis of the glass container.

NOTE Activated silica gel treated with an indicator is a satisfactory desiccant for the air.

The equipment (particularly the circular carriage rotation/fan rotation speed, the homogeneity of temperature in the oven as well as the accuracy of the temperature control system) should be calibrated at regular intervals in accordance with the quality assurance procedure of the laboratory, at least once per year, and verified as described in the equipment manufacturers handbook. Action should be taken if it does not comply with the requirements stated in this method. Annex B gives information and describes a method to check the temperature uniformity in the working space of the circular carriage.

5.2 Flow meter, capable of measuring the airflow at a rate of $(4,0 \pm 0,2)$ l/min at ambient temperature and pressure.

5.3 Temperature measuring device

A temperature measuring device (combining sensor and reading unit) that shall:

- have a range from at least 150 °C to 200 °C;
- be readable to 0,1 °C or less;
- have a maximum permissible error of $\pm 0,5$ °C or better.

Sensors based on platinum resistance thermometers have been found suitable but other principles are also allowed. The thermal response time of the sensor shall be comparable with the former used reference (see informative Annex A). The temperature measuring device shall be calibrated regularly.

When measuring and controlling nominally constant temperatures, as in this test method, the thermal response time can be rather high (e.g. slow response to a change in temperature). Care shall be taken to consider this aspect since low thermal response times of the sensor can indicate greater cyclic variations than the bituminous material in practice experiences.

5.4 Glass containers, (in which the sample of bituminous binder is subjected to the test), made of heat-resistant glass conforming to the dimensions shown in Figure 3 a) and Figure 3 b) respectively.

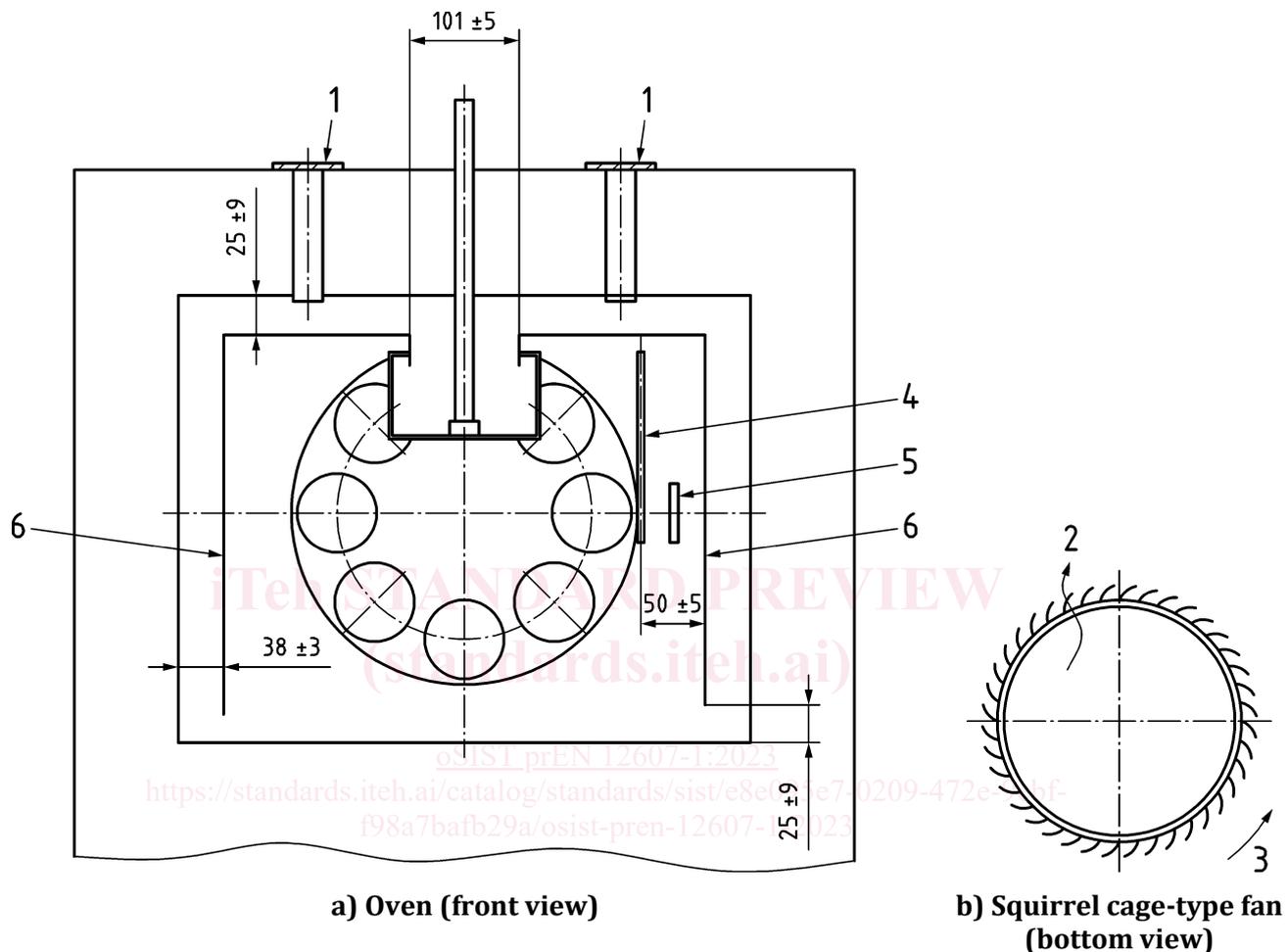
NOTE 1 An outside opening (convex) is more suitable than the standard inside (concave) opening to facilitate the pouring of the hardened bituminous binder.

NOTE 2 As for concave containers the length cannot be measured on the outside, a Vernier calliper can be used to measure the length from the inside bottom of the container.

A special container with a removable ground-glass stopper (which allows easier cleaning) can be used for non-referee purposes provided all the standardized dimensions are satisfied.

5.5 Balance, having a maximum permissible error of ± 1 mg.

Dimensions in millimetres

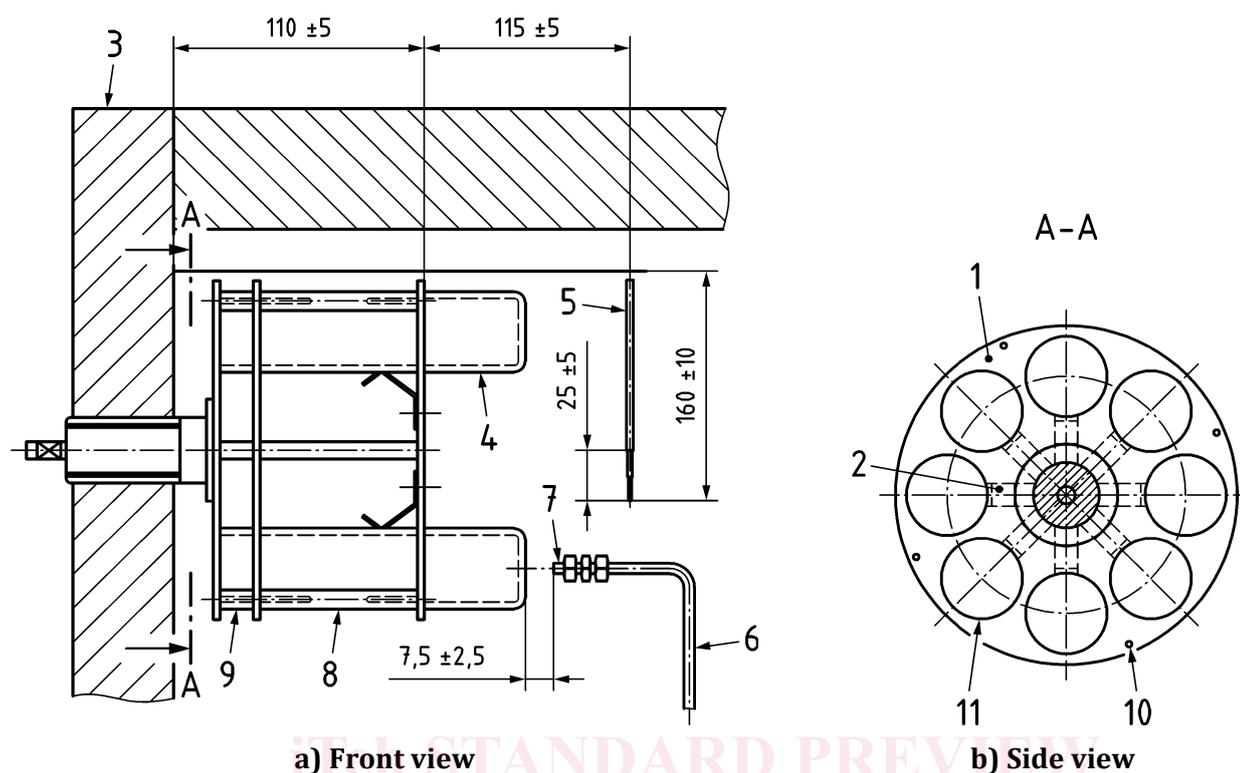


Key

- 1 upper vents
- 2 air flow
- 3 direction of rotation
- 4 thermometer
- 5 regulation probe
- 6 sheaths

Figure 1 — Oven and squirrel cage-type fan

Dimensions in millimetres



Key

- 1 (3,0 ± 0,1) mm thick aluminium disc; diameter: (300 ± 10) mm
- 2 spring clips glass container retainer
- 3 oven
- 4 sample glass container
- 5 thermometer
- 6 copper tubing; diameter: (8,0 ± 0,1) mm
- 7 orifice; diameter: (1,0 ± 0,1) mm
- 8 spacer length: (55 ± 1) mm; external diameter: (12 ± 1) mm, internal diameter: (6,5 ± 1,0) mm
- 9 spacer length: (20 ± 1) mm; external diameter: (12 ± 1) mm, internal diameter: (6,5 ± 1,0) mm
- 10 4 M6 screws at 90°; on a diameter of (280 ± 2) mm
- 11 8 holes, diameter: (66,7 ± 1,0) mm; every 45° on a diameter of (200 ± 5) mm

Figure 2 — Circular metal carriage

Dimensions in millimetres

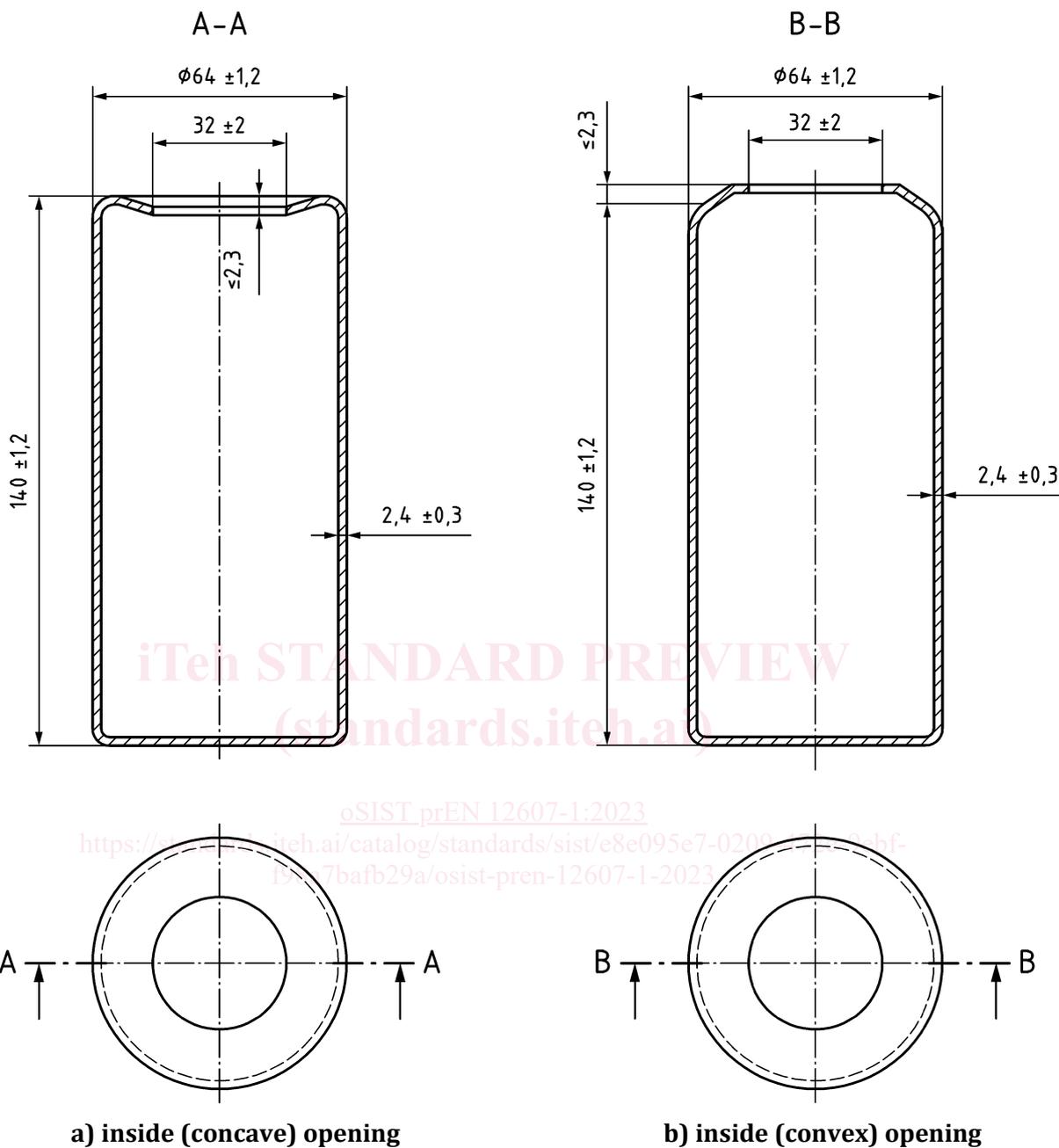


Figure 3 — Glass container