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6 ]li a Yb`]b`V]h a Ybg\_Uj Ynj] U!`8 c`c Yj Ub`YcXdcfbcgh]`dfch]`g]f`Yj Ub`1 `dcX  
j d`]j ca `l`cd`ch`Y]b`nfU\_U!`%`XY`A YlcXUFH: CH

Bitumen and bituminous binders - Determination of the resistance to hardening under the 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

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**Ta slovenski standard je istoveten z: EN 12607-1:1999**

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**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

**SIST EN 12607-1:2000**

**en**

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ICS 75.140

English version

Bitumen and bituminous binders - Determination of the  
resistance to hardening under the 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 European Standard was approved by CEN on 5 September 1999.

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

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

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 19 "Petroleum products, lubricants and related products", the secretariat of which is held by NNI.

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 April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard is based on ASTM D 2872-88.

This draft European standard EN 12607 consists of the following parts under the general title "Bitumen and bituminous binders – Determination of the resistance to hardening under the influence of heat and air"

Part 1: RTFOT method

Part 2: TFOT method

Part 3: RFT method

In this standard, annex A is normative.

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## 1 Scope

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

The method described is not applicable to some modified binders or to those whose viscosity is too high to provide a moving film.

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

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

## 2 Normative References

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 58, *Sampling bituminous binders*.

EN 1425, *Bitumen and bituminous binders - Characterization of perceptible properties*.

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

EN 1427, *Bitumen and bituminous binders - Determination of 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*.

prEN 12735-1:1997 *Copper and copper alloys - Seamless, round copper tubes for air conditioning and refrigeration - Part 1: Tubes for piping systems*.

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## 3 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 on the basis of the change in mass (expressed as a percentage) or as the change in the bituminous binder's characteristics such as penetration (EN 1426), softening point (EN 1427) or dynamic viscosity (EN 12596) before and after the period in the oven.

## 4 Apparatus

Usual laboratory apparatus and glassware, together with the following :

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

- height : 340 mm  $\pm$  15 mm ;
- width : 405 mm  $\pm$  15 mm ;
- depth : 445 mm  $\pm$  15 mm.

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

- width : 320 mm  $\pm$  15 mm ;
- height : 215 mm  $\pm$  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 mm  $\pm$  9 mm below the oven floor.

The oven shall be ventilated by convection currents of air. To this end, the oven shall have air inlets and outlets for the evacuation of hot gases. The air inlets towards 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 15 cm<sup>2</sup>  $\pm$  1 cm<sup>2</sup>. The outlets for evacuation of hot gases shall be located in the upper part of the oven and their total open area shall be 10 cm<sup>2</sup>  $\pm$  1 cm<sup>2</sup>.

The oven shall incorporate an air flow around the side walls and ceiling. The air plenum shall be of uniform thickness 38 mm  $\pm$  3 mm (figure 1a). The inside of the oven shall be equipped with a vertical circular aluminium carriage of diameter 300 mm  $\pm$  10 mm (figure 2a). The horizontal axis of the circular carriage is located 160 mm  $\pm$  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 2b). The carriage shall be mechanically driven by a 20 mm diameter shaft at a speed of 15,0 min<sup>-1</sup>  $\pm$  0,2 min<sup>-1</sup>. The front surface of the carriage shall be 110 mm  $\pm$  5 mm from the rear inside wall of the oven.

On the upper surface and at a midpoint in the width of the oven and 150 mm  $\pm$  5 mm from the front face of the carriage, a squirrel cage-type fan shall be mounted of outside diameter 135 mm  $\pm$  5 mm and thickness 75 mm  $\pm$  5 mm and turned at 1725 min<sup>-1</sup>  $\pm$  100 min<sup>-1</sup> by an externally mounted motor. (standards.iteh.ai)

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 1b).  
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The oven shall be equipped with a thermostat capable of maintaining a constant temperature to  $\pm$  0,5 °C. The corresponding regulation probe shall be situated in the right side of the oven as described in figure 1 or symmetrically in the left side.

The temperature shall be recorded inside the oven with the reading point at a maximum of 25 mm  $\pm$  9 mm below a horizontal line through the axle of the carriage, 50 mm  $\pm$  5 mm from the right hand inside wall and 115 mm  $\pm$  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 of diameter  $1,0 \text{ mm} \pm 0,1 \text{ mm}$  connected to a copper tubing (see prEN 12735-1:1997) of external diameter  $8,0 \text{ mm} \pm 0,1 \text{ mm}$  and length  $7,60 \text{ m} \pm 0,05 \text{ m}$ . This tubing 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 1 Activated silica gel treated with an indicator is a satisfactory desiccant for the air.

NOTE 2 The performance of the equipment (particularly the motor rotation speed and the fan rotation speed) should be verified and action should be taken if it does not comply with the requirements stated in this method.

**4.2 Flow meter**, capable of measuring the airflow at a rate of  $4\ 000 \text{ ml/min} \pm 200 \text{ ml/min}$  at ambient temperature and pressure.

**4.3 Thermometer**, solid stem, as specified in Annex A.

Other temperature measuring devices may be used instead of mercury stem thermometers. However, the mercury stem thermometer is the reference device. Therefore any alternative device employed shall be calibrated so as to provide the same readings as would be provided by the mercury stem thermometer, recognising and allowing for the fact of changed thermal response times compared with the mercury thermometer.

NOTE When measuring and controlling nominally constant temperatures, as in this test method, alternative devices can indicate greater cyclic variations than mercury thermometers, to an extent depending on the cycle time of heating and the power of the controlled heat input.

**4.4 Glass container**, (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.

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

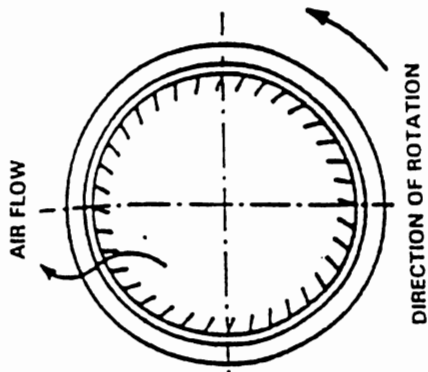
**4.5 Balance**, accurate to  $\pm 10 \text{ mg}$ , readable to 1 mg.

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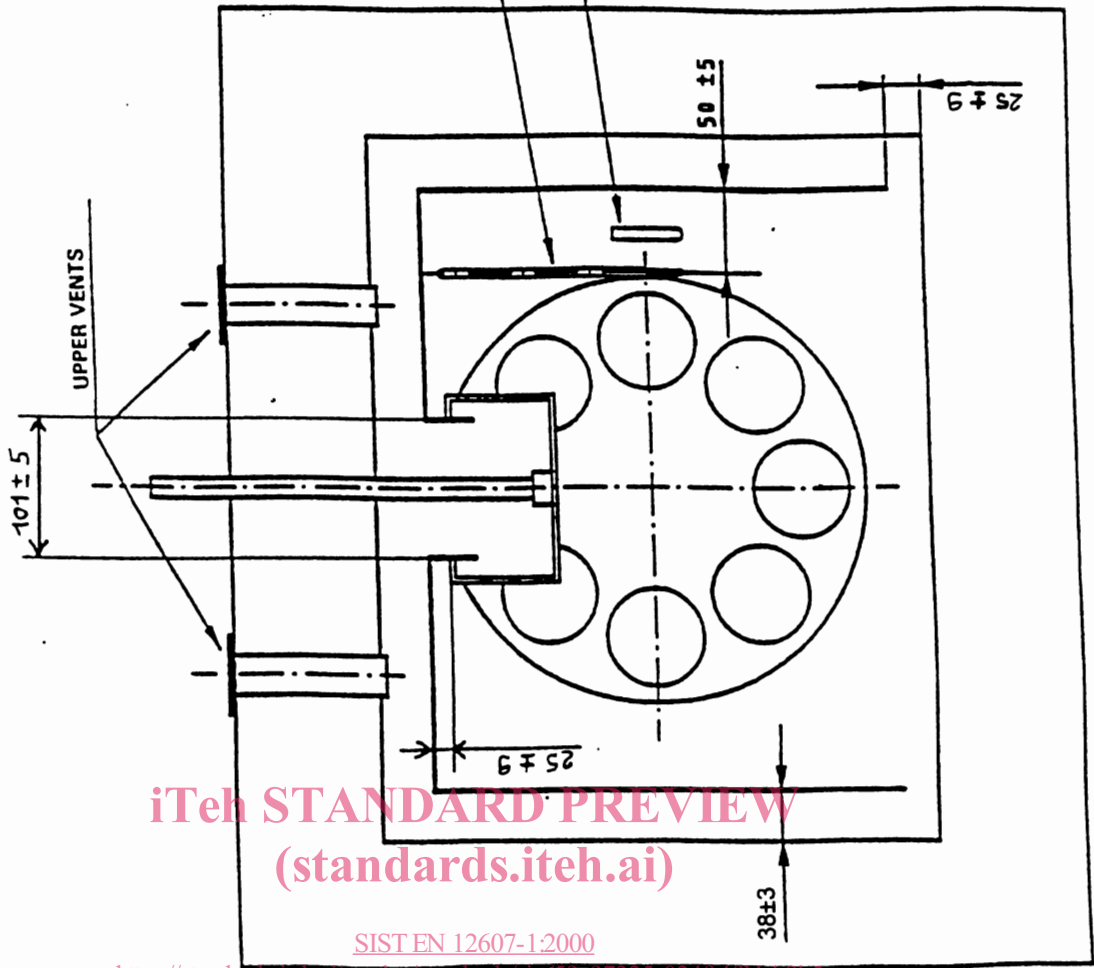
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1b) Squirrel cage-type fan (bottom view)



Dimensions in millimetres



1a) Oven (front view)

Figure 1 - Oven and squirrel cage-type fan

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Dimensions in millimetres

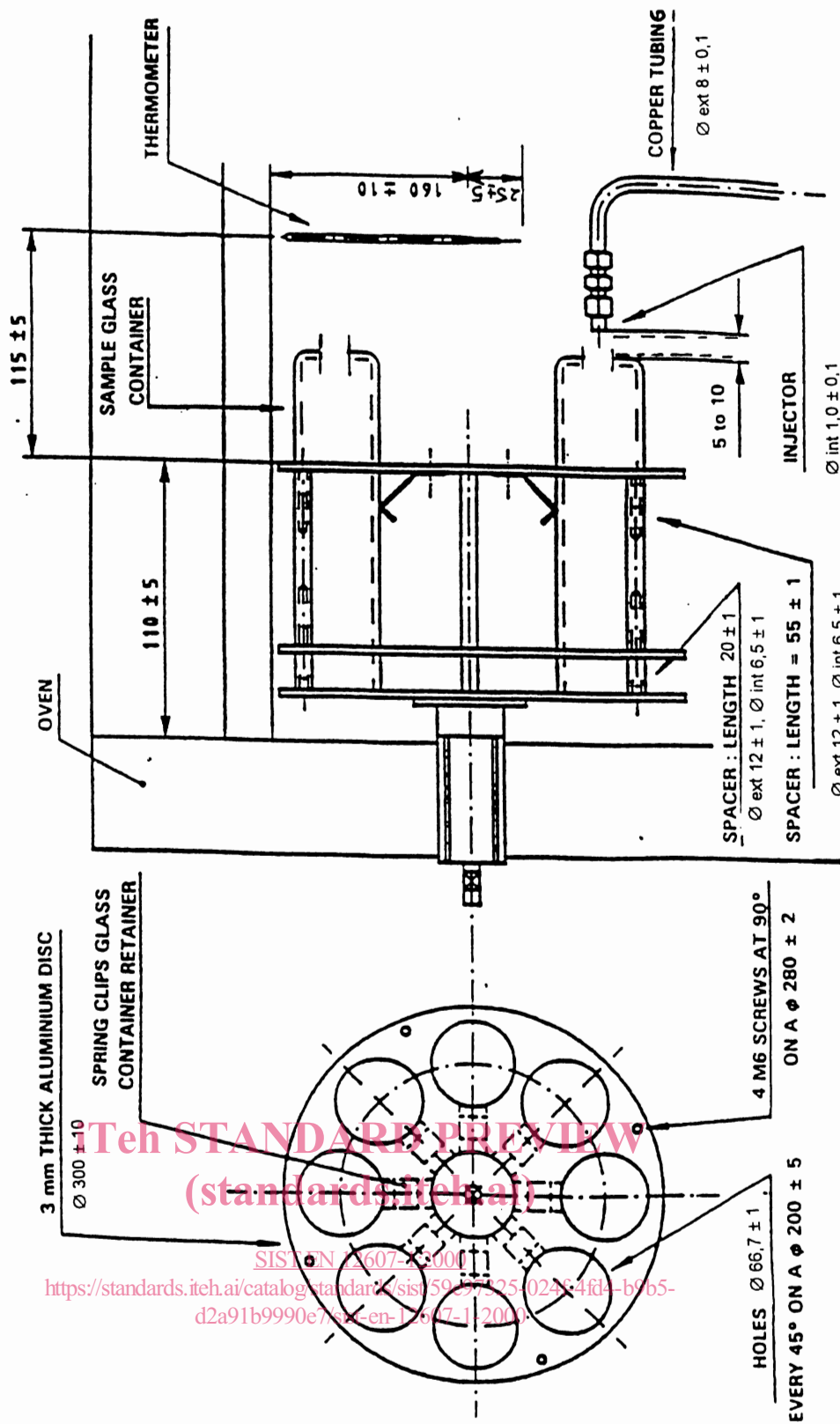


FIGURE 2 - CIRCULAR METAL CARRIAGE