Standard Method of Test for

Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)

AASHTO Designation: T 240-21[1]

Technically Revised: 2021 **Editorially Revised: 2021**

Technical Subcommittee: 2b, Liquid Asphalt

ASTM Designation: D2872-04

AASHTO

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1. SCOPE

1.1. This test is used to measure the effect of heat and air on a moving film of asphalt binder and to provide residue for additional testing. The effects of this treatment are determined from measurements of the properties of the asphalt binder before and after the test.

1.2. The values stated in SI units are to be regarded as the standard.

1.3. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns 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.*

1.4. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 231, Weighing Devices Used in the Testing of Materials
- M 320, Performance-Graded Asphalt Binder
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories

2.2. *ASTM Standards*:

- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E220, Standard Test Method for Calibration of Thermocouples by Comparison Techniques
- E644, Standard Test Methods for Testing Industrial Resistance Thermometers

2.3. *NCHRP Document*:

- NCHRP Web-Only Document 71 (Project 09-26), Precision Estimates for AASHTO Test Method T 308 and the Test Methods for Performance-Graded Asphalt Binder in AASHTO Specification M 320
- NCHRP Project 20-07 / Task 400, Effect of Elevation on Rolling Thin Film Oven Aging of Asphalt Binder

2.4. *Federal Standard:*

- Fed. Std. No. 29, CFR 1910.1200 OSHA Hazard Communication Standard; see also Permissible Exposure Limits—Annotated Tables, available at https://www.osha.gov/dsg/annotated-pels/

3. SUMMARY OF TEST METHOD

3.1. A moving film of asphaltic material is heated in an oven for 85 min at 163°C (325°F). The effects of heat and air are determined from changes in physical test values as measured before and after the oven treatment. The residue from this test is also used for additional testing as required in M 320. An optional procedure is provided for determining the change in sample mass.

3.2. Precision values for this test method have been developed for viscosity at 60°C (140°F), ductility at 15.6°C (60°F), and mass change.

4. SIGNIFICANCE AND USE

4.1. This method indicates the approximate change in properties of asphalt binder during conventional batch plant and drum mix plant mixing at about 150°C (302°F) as indicated by viscosity and other rheological measurements. The residue from this test is also used to determine the conformance of an asphalt binder to M 320. It yields a residue that approximates the condition of the asphalt binder immediately after the pavement is constructed. If the mixing temperature differs appreciably from 150°C (302°F), more or less effect on the properties will occur. This method can also be used to determine mass change, which is a measure of asphalt binder volatility and mass changes resulting from oxidation.

5. APPARATUS

5.1. *Oven*—A double-walled electrically heated convection type with inside dimensions as follows: a height of 381 mm (15 in.), a width of 483 mm (19 in.), and a depth (with door closed) of 445 ± 13 mm ($17\frac{1}{2} \pm \frac{1}{2}$ in.). The door shall contain a symmetrically located window with dimensions of 305- to 330-mm (12- to 13-in.) wide by 203- to 229-mm (8- to 9-in.) high. The window shall contain two sheets of heat-resistant glass separated by an air space. The window should permit an unobstructed view of the interior of the oven. The heating element shall be located below the oven floor and shall be adequate to maintain the required temperature. The oven shall be vented at the top and bottom. The bottom vents shall be located symmetrically to supply incoming air around the heating elements. They shall have an open area of 15.0 ± 0.7 cm^2 (2.31 ± 0.11 $in.^2$). The top vents shall be symmetrically arranged in the upper part of the oven and have an open area of 9.3 ± 0.45 cm^2 (1.45 ± 0.07 $in.^2$).

5.1.1. The oven shall have an air plenum covering the side walls and ceiling, the air space being 38.1 ± 4.8 mm ($1\frac{1}{2} \pm \frac{3}{16}$ in.) deep from the walls and ceiling. At a midpoint in the width of the oven and 152 mm (6 in.) from the face of the circular metal carriage to its axis, a squirrel cage-type fan 133.4 mm ($5\frac{1}{4}$ in.) outside diameter by 73 mm ($2\frac{7}{8}$ in.) wide shall be turned at 1725 r/min by an externally mounted motor. The squirrel cage fan shall be set so that the fan turns in an opposite