



Designation: D 3791 – 96

Standard Practice for Evaluating the Effects of Heat on Asphalts¹

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1. Scope

1.1 This practice covers a procedure for evaluating some of the effects on asphalts of heating in the presence of little or no air.

1.2 *This standard does not purport to address all of the safety concerns, if any, 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. Referenced Documents

2.1 ASTM Standards:

D 5 Test Method for Penetration of Bituminous Materials²

D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)³

D 140 Practice for Sampling Bituminous Materials²

D 1079 Terminology Relating to Roofing, Waterproofing, and Bituminous Materials³

D 2170 Test Method for Kinematic Viscosity of Asphalts (Bitumens)²

D 2171 Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer²

D 4402 Test Method for Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus³

E 1 Specification for ASTM Thermometers⁴

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens⁵

3. Terminology

3.1 *Definitions*—Definitions of terms used in this practice can be found in Terminology D 1079.

4. Summary of Practices

4.1 A sample of asphalt in a loosely covered container is heated to a temperature chosen by the investigator for a period

of $5 \text{ h} \pm 10 \text{ min}$. Certain characteristics of the asphalt after heat exposure at the test temperature chosen are then compared with those characteristics before exposure.

NOTE 1—A set temperature is required when this practice is used as part of a specification. Historically, a temperature of 400°F has been used.

5. Significance and Use

5.1 When asphalts are maintained at elevated temperatures in the presence of air, their characteristics may change. Certain blown asphalts also soften when maintained near, and particularly above, their final blowing temperatures under virtually air-free conditions. This may happen if the asphalt is overheated for application purposes. This practice provides a uniform heat-treatment procedure and methods for evaluating the effect of this treatment on some of the characteristics of asphalts. Changes observed when asphalts are overheated are not indicative of changes to be expected when asphalts are heated to normal application temperatures.

6. Apparatus

6.1 *Oven*—A forced-ventilation oven conforming to the requirements for Type IIA as prescribed in Specification E 145, capable of maintaining temperatures up to 572°F (300°C), and with a chamber at least 12 by 12 by 12 in. (300 by 300 by 300 mm).

6.2 *Thermometer*—ASTM Low-Distillation Thermometer, having a range from 30 to 580°F or from -2 to $+300^\circ\text{C}$ and conforming to the requirements for Thermometers 7C or 7F as prescribed in Specification E 1.

6.3 *Containers*, triple-seal, friction-top, 1-qt (1-litre) and 1-pt (0.5-litre) cans with lids, free of any interior resinous or lacquer coatings.⁶

6.4 *Laboratory Timer*.

6.5 *Hot Plate*.

7. Sampling

7.1 Sample the asphalt in accordance with Practice D 140.

8. Test Specimen and Sample

8.1 Heat a minimum of 1 qt (1 litre) of the asphalt on the hot plate. Stir occasionally to prevent local overheating. Keep

¹ This practice is under the jurisdiction of ASTM Committee D-8 on Roofing, Waterproofing, and Bituminous Materials and is the direct responsibility of Subcommittee D08.03 on Surfacing and Bituminous Materials for Membrane Waterproofing and Built-Up Roofing.

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² *Annual Book of ASTM Standards*, Vol 04.03.

³ *Annual Book of ASTM Standards*, Vol 04.04.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ “Triple-Tite” cans, available from Continental Can Co., 633 3rd Ave., New York, NY, or equivalent, have been found suitable.



covered whenever possible to minimize volatiles loss. Heat the material until sufficiently fluid to pour, but in no case more than 200°F (110°C) above the softening point of the asphalt.

8.2 When molten, pour the asphalt into a 1-pt (0.5-litre) container to within 1.0 ± 0.1 in. (25 ± 2 mm) of the top, and also pour test specimens for determination of the characteristics of the original material in accordance with the methods listed in Section 10. Test these specimens within the time limits specified by the respective test procedures.

NOTE 2—Pour a small amount of the asphalt in the groove around the top of the can, sufficient to act as a seal when the lid is placed loosely in position.

8.3 Cover the container loosely with a lid and set aside to cool. Subject the sample to heat treatment within 18 to 24 h after pouring.

9. Procedure

9.1 Preheat the test oven to the selected temperature. Place the container on a shelf in the oven so as to permit air circulation around it.

9.2 Start the laboratory timer when the container has been placed in the oven and the door closed. Continue the heating for 5 h.

9.3 Remove the container from the oven after 5 h. Remove the lid; if a skin is present, remove it carefully before allowing the asphalt to cool. Stir the molten asphalt gently.

9.4 Cool the sample to approximately the original pouring temperature. Gently stir the sample to avoid air entrapment. Then, proceed to pour the test specimens.

10. Test Methods

10.1 Characteristics of asphalt before and after heat exposure may be evaluated in duplicate by any desired procedures, but the following methods are recommended:

10.1.1 *Softening Point*—Test Method D 36.

10.1.2 *Penetration*—Test Method D 5.

10.1.3 *Viscosity*—Test Method D 2170 or D 2171 or D 4402.

11. Report

11.1 Report the heat-exposure temperature used.

11.2 Report the presence or absence of a skin on the heat-exposed sample.

11.3 Report the tests used to evaluate the sample before and after heat exposure and the individual test result from each procedure.

12. Keywords

12.1 asphalts; heat exposure; overheated; physical property changes

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