



Designation: D243/D243M – 22

# Standard Test Method for Residue of Specified Penetration<sup>1</sup>

This standard is issued under the fixed designation D243/D243M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 This test method is used to thermally reduce cutback asphalt, a road oil or a semisolid asphalt, having a penetration greater than 100, to a residue of specified penetration. It is primarily used with slow-curing cutback asphalt as specified in Specification [D2026/D2026M](#).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 **Warning**—Mercury has been designated by the United States Environmental Protection Agency (EPA) and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website—<http://www.epa.gov/mercury/>—for additional information. Users should be aware that selling mercury, mercury-containing products, or both, into your state may be prohibited by state law.

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

*Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D5/D5M Test Method for Penetration of Bituminous Materials](#)

[D8 Terminology Relating to Materials for Roads and Pavements](#)

[D2026/D2026M Specification for Cutback Asphalt \(Slow-Curing Type\)](#)

[D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials](#)

[D8055 Guide for Selecting an Appropriate Electronic Thermometer for Replacing Mercury Thermometers in D04 Road and Paving Standards](#)

[E1 Specification for ASTM Liquid-in-Glass Thermometers](#)  
[E230/E230M Specification for Temperature-Electromotive Force \(emf\) Tables for Standardized Thermocouples](#)

2.2 *IEC Standards:*<sup>3</sup>

[IEC 60584 Thermocouples—Part 3: Extension and Compensating Cables—Tolerances and Identification System](#)

## 3. Terminology

3.1 Definitions of terms used in this practice may be found in Terminology [D8](#), determined from common English usage, or combinations of both.

## 4. Summary of Test Method

4.1 The material to be tested is rapidly heated to 249 °C [480 °F] and maintained at 249 to 260 °C [480 to 500 °F] during evaporation of the volatiles. Penetration of the residue is determined and if not within the specified limits, the evaporation procedure is repeated. Change in sample mass is used to calculate the percentage of residue having the specified penetration.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D04](#) on Road and Paving Materials and is the direct responsibility of Subcommittee [D04.46](#) on Durability and Distillation Tests.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, <https://www.iec.ch>.



## 5. Significance and Use

5.1 This test method is used to determine the percentage of residue having a specified penetration at 100 g/5 s at 25 °C [77 °F]. This test method provides a residue for quality control or for use in other tests as desired.

NOTE 1—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 Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

## 6. Apparatus

6.1 The apparatus shall consist of a container, heating bath, hot plate, and thermometric device, with necessary accessory apparatus as follows:

6.1.1 *Container*—The container in which the sample is to be tested shall be a flat-bottom, cylindrical seamless tin box, approximately 70 mm in diameter and 45 mm in depth.

NOTE 2—Containers known in the pharmaceutical industry as seamless “ointment boxes” may be obtained in dimensions conforming to the above requirements.

6.1.2 *Heating Bath*—The heating bath shall be a cast iron air bath, or equivalent, permitting the immersion of the container to a depth of  $32 \pm 5$  mm through an opening  $3 \pm 2$  mm larger in diameter than the container. It shall support the container  $6 \pm 2$  mm above the hot plate, and with at least 6.4 mm free air space between the sides of the container and of the air bath below the opening. A suitable air bath is shown in Fig. 1.

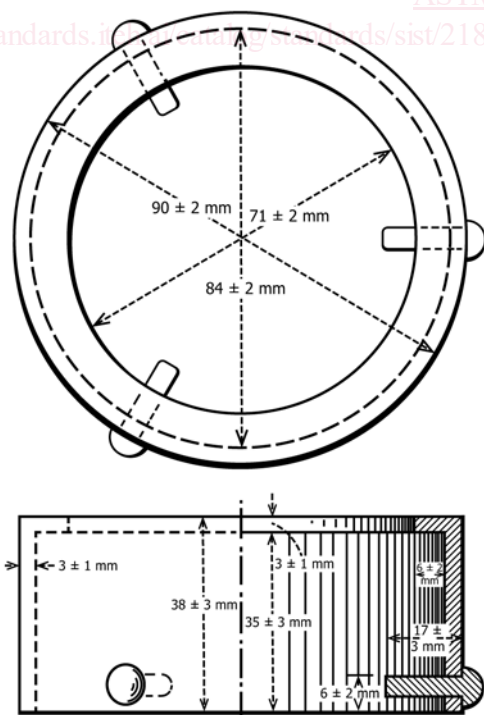


FIG. 1 Cast Iron Air Bath

6.1.3 *Hot Plate*—The air bath shall be heated upon a suitably mounted hot plate, heated either electrically or by means of a gas flame. The plate shall be capable of maintaining the sample continuously at the required temperature, and apparatus necessary to fulfill this requirement, such as a rheostat or gas pressure regulator, shall be provided.

6.1.4 *Thermometer*—A thermometer for measuring the temperature of the sample during evaporation. The thermometer shall have a measurement temperature range of 200 to 300 °C [392 to 572 °F] and an accuracy of at least 2.8 °C [5 °F] and shall be one of the following (see Note 3):

6.1.4.1 Specification E1 thermometers that meet the temperature and tolerance range requirements.

6.1.4.2 Type T or Type J (Specification E230/E230M, IEC 60584) thermocouple with a sufficient length of wire that allows the meter to be placed away from the heat source and with covering that can withstand exposure to the upper temperature limit, and a sensor-compatible meter that can display the temperature to at least one decimal place.

NOTE 3—Guide D8055 provides additional guidance on selecting appropriate electronic thermometer alternatives to a mercury-in-glass thermometer.

6.1.5 A balance, readable to 0.01 g, for determining the mass of the asphalt sample and the mass of the residue.

## 7. Preparation of Sample

7.1 Thoroughly stir and agitate the sample as received to ensure a uniform mixture before the portion for testing is removed.

## 8. Procedure

8.1 Weigh a  $100.00 \pm 0.1$  g sample of the material to be tested into a tared container, then place the container in the air bath in position to be heated. Support the probe of the thermometric device in the sample equidistant from the sides of the container and with the bottom of the probe neither more than 6 mm [ $\frac{1}{4}$  in.] above nor touching the bottom of the container. The tip of the probe shall be completely immersed in the sample throughout the heating. An assembly of the apparatus is shown in Fig. 2.

8.2 Heat the sample as rapidly as possible without foaming to a temperature of 249 °C [480 °F] and, during the evaporation, maintain the temperature between 249 and 260 °C [480 and 500 °F]. Stir the sample with the probe of the thermometer from time to time to prevent local overheating and to maintain a homogeneous sample. Stir into the sample all cakes of hardened asphalt that form at the sides of the container.

NOTE 4—Certain types of road oil will readily form rings of hard asphalt at the side of the container. Take great care that this material is completely stirred into the sample before the penetration of the residue is determined.

8.3 An experienced operator can judge approximately what percentage of residue should be obtained to secure the desired penetration. When it is supposed that the residue will show the required penetration, return to the container the asphalt on the probe of the thermometric device that may be readily scraped off; then remove the container from the air bath and cool and