Standard Method of Test for

Specific Gravity and Density of Semi-Solid Asphalt Materials

AASHTO Designation: T 228-22

Technically Revised: 2022

Technical Subcommittee: 2b, Liquid Asphalt

ASTM Designation: D70-21

AASHTO

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AASHTO T 228-22 is identical to ASTM D70-21 except for the following provisions:

1. Replace all references to the ASTM standards listed in the following table with the corresponding AASHTO standards:

Referenced Standards	
ASTM	AASHTO
D140	R 66
D3142	T 295

2. Add references in Section 2 for AASHTO standards:
- M 231, Weighing Devices Used in the Testing of Materials
- M 339M/M 339, Thermometers Used in the Testing of Construction Materials

3. Add references in Section 2 for ASTM standards:
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers

4. Delete references in Section 2 for ASTM standards that no longer apply:
- E77, Test Method for Inspection and Verification of Thermometers
- E563, Practice for Preparation and Use of an Ice-Point Bath as a Reference Temperature
- E644, Test Methods for Testing Industrial Resistance Thermometers

5. Add the following to Section 2:

   2.4 *International Electrotechnical Commission Standards*:
- IEC 60584-1: 2013 Thermocouples - Part 1: EMF Specifications and Tolerances
- IEC 60751: 2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

6. Replace all of Section 6.3 (including subsections 6.3.1 through 6.3.3 and existing Notes 4 and 5) with the following:

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Thermometer—A thermometer for measuring water bath temperature, described in Section 6.2 while completing the test procedure as described in Section 11, shall meet the requirements of M 339M/M 339 with a temperature range of at least 8 to 32°C (46 to 90°F), and an accuracy of ±0.05°C (±0.09°F) (see Note 4).

Note 4—Thermometer types suitable for use include ASTM E1 mercury thermometers 63C (63F); ASTM E879 thermistor thermometer, Special order; ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, Special order; or IEC 60751: 2008 Pt-100 RTD platinum resistance thermometer, Special order.

7. Replace Section 6.4 with the following:

   6.4 *Balance*—conforming to the requirements of M 231, Class B.

8. Add new Section 6.7 for heating requirements as follows:

   Oven or heating apparatus—The oven or heating apparatus shall be used for heating samples, as described in Section 11.1, with operating temperatures of up to 175°C (347°F). Ovens, when used, shall be capable of operation at the temperatures required, as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the temperature of samples, regardless of heating apparatus used, shall meet the requirements of M 339M/M 339 with a temperature range of at least 25 to 175°C (77 to 347°F), and an accuracy of ±1.25°C (±2.25°F) (see Note 5).

   Note 5—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E230/E230M thermocouple thermometer, Type T, Standard Class; or IEC 60584 thermocouple thermometer, Type T, Class 2.

9. Replace Section 15 with the following:

   15. **Precision and Bias**

   15.1 *Precision*—Criteria for judging the acceptability of the relative density results obtained by this method are given in Table 1.

   15.1.1 *Single-Operator Precision (Repeatability)*—The figures in Column 2 of Table 1 are the standard deviations that have been found to be appropriate for the conditions of test described in Column 1. Two results obtained in the same laboratory, by the same operator using the same equipment, in the shortest practical period of time, should not be considered suspect unless the difference in the two results exceeds the values given in Table 1, Column 3.

   15.1.2 *Multilaboratory Precision (Reproducibility)*—The figures in Column 4 of Table 1 are the standard deviations that have been found to be appropriate for the conditions of test described in Column 1. Two results submitted by two different operators testing the same material in different laboratories shall not be considered suspect unless the difference in the two results exceeds the values given in Table 1, Column 5.

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Table 1—Precision Estimates[a]

Condition	Single-Operator		Multilaboratory	
	Standard Deviation (1s)[b]	Acceptable Range of Two Results (d2s)[b]	Standard Deviation (1s)[b]	Acceptable Range of Two Results (d2s)[b]
Asphalt:				
Specific Gravity (15.6°C)	0.0011	0.0032	0.0018	0.0051
Specific Gravity (25°C)	0.0008[c]	0.0021[c]	0.0013[c]	0.0035[c]
Soft Tar Pitch:				
Specific Gravity (15.6°C)	0.0013	0.0038	0.0029	0.0083
Specific Gravity (25°C)	0.00083	0.0023	0.0017	0.0048

[a] Values in Table 1 not marked with a superscript "c" are precision estimates retained from ASTM D70-03, Section 14, Table 1. These values were not part of the scope of the AMRL research activities described with the superscript "c."

[b] These values represent the 1s and d2s limits described in ASTM C670.

[c] The precision estimates denoted by the superscript "c" are based on the analysis of test results from eight pairs of AMRL proficiency samples. The data analyzed consisted of results from 104 to 121 laboratories for each of the eight pairs of samples. The analysis included four binder grades: PG 52-34, PG 64-16, PG 64-22, and PG 70-22. Average specific gravities in the analysis ranged from 1.0058 to 1.0428. The details of this analysis are in the final report for NCHRP Project No. 9-26, Phase 3.

15.2 *Bias*—No information can be presented on the bias of the procedure because no material having an accepted reference value is available.

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