Designation: ~~D6307 – 10~~ D6307 – 16

Standard Test Method for Asphalt Content of ~~Hot-Mix~~ Asphalt Mixture by Ignition Method[1]

This standard is issued under the fixed designation D6307; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of asphalt content of ~~hot-mix asphalt (HMA) paving mixtures and~~ asphalt mixture and asphalt pavement samples by removing the asphalt cement in an ignition furnace. The means of sample heating may be the convection method or direct irradiation method.

NOTE 1—Aggregate obtained by this test method may be used for sieve analysis. Particle size degradation may occur with some aggregates.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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 limitation prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
C702 Practice for Reducing Samples of Aggregate to Testing Size
D75 Practice for Sampling Aggregates
D140 Practice for Sampling Bituminous Materials
D979 Practice for Sampling Bituminous Paving Mixtures
D1461 Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
D5444 Test Method for Mechanical Size Analysis of Extracted Aggregate

2.2 *AASHTO Standards:*[3]

R47 Standard Practice for Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size

3. Summary of Test Methods

3.1 The asphalt cement in the paving mixture is ignited using the furnace equipment applicable to the particular method. The asphalt content is calculated by difference from the mass of the residual aggregate and moisture content. The asphalt content is expressed as mass percent of moisture-free mixtures. Test Method A is intended for furnaces with an internal, automated weighing system. Test Method B is intended for furnaces without an internal weighing system.

4. Significance and Use

4.1 This test method can be used for quantitative determination of asphalt content in ~~HMA paving mixtures~~ asphalt mixture and pavement samples for quality control, specification acceptance, and mixture evaluation studies. This test method does not require the use of solvents. Aggregate obtained by this test method may be used for gradation analysis according to Test Method D5444.

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[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.25 on Analysis of ~~Bituminous~~Asphalt Mixtures.

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

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

5. Apparatus

5.1 *Balance,* readable to 0.1 g, and capable of measuring the mass of sample, sample trays, and catch pan. The balance shall be in accordance with Guide D4753, Class GP2.

5.2 *Sample Tray(s),* of appropriate size that allows the samples to be spread thinly and allows air to flow up through and around the sample particles. The sample shall be enclosed completely with screen mesh, perforated stainless steel plate, or other suitable material.

NOTE 2—Screen mesh or other suitable material with maximum and minimum openings of 3.35 mm and 600 µm, respectively, has been found to perform well.

5.3 *Catch Pan,* of appropriate size to hold the sample trays so that aggregate particles and melting asphalt binder falling through the screen mesh are caught.

5.4 *Catch Pan/Sample Tray(s) Handling Apparatus,* suitable for inserting catch pan and sample tray(s) into furnace and removing hot catch pan and sample tray(s) from furnace.

5.5 *Assorted Spatulas, Pans, Bowls, and Wire Brushes,* for preparing ~~HMA~~asphalt mixtures and removing aggregate from sample tray(s) and catch pan.

5.6 *Protective Gloves,* well insulated and capable of withstanding 580°C.

5.7 *Ovens*—Mechanical ovens, convection or forced draft, shall be provided for drying aggregates and ~~HMA~~asphalt mixtures, and for preheating ~~HMA~~asphalt mixtures prior to ignition testing.

5.8 *Ignition Furnace,* as described in 8.1.1 or 11.1.1.

6. Hazards

6.1 The temperature of the furnace, sample, sample tray(s), and catch pan after removal from the furnace is extremely high. Caution, therefore, must be exercised at all times when handling these items as failure to do so could result in serious injury, severe burns, or fire. The sample, sample tray(s), and catch pan should be placed inside a safety cage and should not be allowed to cool near any materials that are subject to ignition at the high temperatures used in this procedure. The furnace manufacturer's instruction manual must be followed to take all necessary precautions.

7. Sampling

7.1 Obtain samples of aggregate in accordance with Practice D75.

7.2 Obtain samples of ~~HMA~~ asphalt mixture in accordance with Practice D979~~.~~ and AASHTO R47.

7.3 *Preparation of Test Specimens:*

7.3.1 If the mixture is not soft enough to separate with a spatula or trowel, place it in a large, flat pan and warm in an oven set at 110 ± 5°C until it can be separated or mixed. Split or quarter the material in accordance with Practice C702 until the mass of material required for the test is obtained.

7.3.2 The size of the test sample shall be governed by the nominal maximum aggregate size of the mixture and shall conform to the mass requirement shown in Table 1 (see Note 3).

NOTE 3—When the mass of the test specimen exceeds the capacity of the equipment used (for a particular method), the test specimen may be divided into suitable increments, tested, and the results combined for calculation of asphalt content based on the weighted average of the masses used in the increments.

7.4 Obtain samples of asphalt cement in accordance with Practice D140.

TEST METHOD A

8. Apparatus

8.1 In addition to the apparatus listed in Section 5, the following apparatus is required for Test Method A.

TABLE 1 Size of Sample

Nominal Maximum Aggregate Size Standard, mm	Minimum Mass of Sample, kg
4.75	0.5
9.5	1
12.5	1.5
19.0	2
25.0	3
37.5	4

8.1.1 *Ignition Furnace*—A forced air ignition furnace that heats the sample by either convection method or direct-irradiation method. The convection-type furnace must have a minimum temperature capability of 580°C. The furnace shall have an internal weighing system capable of measuring the mass of sample sizes of at least 2500 g. The furnace chamber shall be of sufficient size to accommodate sample sizes of at least 2500 g. A data collection system also shall be included so that the sample mass loss can be determined automatically to an accuracy of 0.1 g and displayed during a test. The test is deemed complete when the difference between consecutive measured mass loss does not exceed 0.01 % of the sample mass for three consecutive 1-min intervals. The equipment shall provide a printout of the test results. A system capable of reducing furnace emissions to an acceptable level also shall be incorporated in the furnace. The furnace shall be vented into a hood or to the outside and when set up properly will have no noticeable odors escaping into the laboratory. The furnace will have a fan with the capability to pull air through the furnace to expedite the test and to reduce escape of smoke into the laboratory. The furnace shall be equipped so that the door cannot be opened during the ignition test.

8.1.2 *Filters,* if required, of the type specified by the furnace manufacturer.

9. Calibration

9.1 The type of aggregate in the mixture may affect the results of this test method because different aggregates lose mass on ignition to varying degrees. The results also may be affected by the presence of additives and modifiers in the ~~HMA~~ asphalt mixture sample. Accordingly, to optimize accuracy, a calibration factor shall be established by testing three calibration samples for each mix type. The calibration shall be performed on a prepared sample of asphalt mixture, which also shall include additives and modifiers, if any, to be used.

9.2 Obtain samples of blended aggregate to be used in ~~HMA~~ the asphalt mixture in accordance with 7.1. The sample should be approximately the same mass and gradation as that to be used for the ~~HMA~~ asphalt mixture test sample (10.1).

9.3 Obtain samples of asphalt cement to be used in ~~HMA~~ the asphalt mixture in accordance with 7.4.

9.4 Oven-dry the aggregate samples to a constant mass.

9.4.1 For the convection-type furnace, set the furnace temperature to 540 ± 5°C for calibration using mixtures.

9.4.2 For the direct-irradiation-type furnace, set the burn profile to the DEFAULT mode.

9.5 Heat the aggregates and asphalt cement to approximately 150°C. Heat all mixing bowls and tools to approximately 150°C.

9.6 Prior to the mixing of calibration samples, an initial or "butter" mix is required to condition the mixing equipment. Remove and discard the "butter" mix from the bowl by scraping, leaving a uniform coating of asphalt mix residue.

NOTE 4—The "butter" mix prevents calibration samples from being biased by residual asphalt mix retained in the mixing bowl.

9.7 Prepare three calibration samples at the design asphalt cement content (P). Incorporate additives and modifiers, if any, to be used.

9.8 Determine and record the mass of the sample tray(s) and catch pan to the nearest 0.1 g.

9.9 Evenly distribute the sample in the sample tray(s).

9.10 Determine the mass of the sample, sample tray(s), and catch pan to the nearest 0.1 g. Calculate and record the initial mass of the sample (M_I).

9.11 Heat the calibration sample in the convection-type furnace at 540 ± 5°C; or in the direct irradiation type furnace using the DEFAULT mode until the change in mass of the sample during three consecutive 1-min intervals does not exceed 0.01 % of the sample mass (M_I).

9.12 Measure and record the mass (M_L) of the sample after ignition to the nearest 0.1 g. The mass can be obtained immediately upon completion of the test from the printout or display.

9.13 Calculate the calibration factor (C_F) as follows:

$$C_F = \left(\frac{M_I - M_L}{M_I} \times 100\right) - P \quad (1)$$

where:

M_I = total mass of the mixture calibration sample prior to ignition,
M_L = total mass of the mixture calibration sample after ignition, and
P = percentage of actual asphalt cement in the mix by mass of the total mix expressed as a percentage.

9.14 Repeat steps ~~9.8~~9.8 – 9.13 ~~through 9.13~~for two additional calibration samples. Calculate the average calibration factor (C_F) by averaging the three C_F values.

9.15 *Calibration Temperature Adjustments*—

9.15.1 For the convection-type furnace, if the calibration factor exceeds 1.0 %, lower the test temperature to 482 ± 5°C and repeat steps ~~9.2~~9.2 – 9.14 ~~through 9.14~~. Use the calibration factor obtained at 482°C even if it exceeds 1.0 %.