



Designation: D7870/D7870M – 20

Standard Practice for Moisture Conditioning Compacted Asphalt Mixture Specimens by Using Hydrostatic Pore Pressure¹

This standard is issued under the fixed designation D7870/D7870M; 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 practice includes procedures for preparing compacted asphalt mixture specimens, exposing the specimens to hydrostatic pore pressure inside an enclosed chamber, and guidance on testing the specimens for the effect of water on the tensile strength or change in other properties of the asphalt mixture, such as density, modulus, etc.

1.2 Specimens conditioned according to this practice can be tested using methods and test procedures referenced in this document, and those results may provide information as to the effect of the moisture conditioning of this practice on the moisture sensitivity of those mixtures.

1.3 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.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with 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:*²

- D8 Terminology Relating to Materials for Roads and Pavements
- D979/D979M Practice for Sampling Bituminous Paving Mixtures
- D1561/D1561M Practice for Preparation of Bituminous Mixture Test Specimens by Means of California Kneading Compactor
- D2726/D2726M Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures
- D3665 Practice for Random Sampling of Construction Materials
- D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
- D4013 Practice for Preparation of Test Specimens of Bituminous Mixtures by Means of Gyrotory Shear Compactor (Withdrawn 2013)³
- D4867/D4867M Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
- D5361/D5361M Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
- D6752/D6752M Test Method for Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method
- D6925 Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyrotory Compactor
- D6926 Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus
- D6927 Test Method for Marshall Stability and Flow of Asphalt Mixtures
- D6931 Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures

¹ This practice is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.22 on Effect of Water and Other Elements on Asphalt Coated Aggregates.

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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 The last approved version of this historical standard is referenced on www.astm.org.

2.2 AASHTO Standard:⁴

AASHTO T 378 Standard Method of Test for Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

3. Terminology

3.1 Refer to Terminology **D8** for definitions relating to materials for roads and pavements.

4. Significance and Use

4.1 This practice provides an accelerated conditioning method under cyclic loading. This system is capable of operating at higher than normal temperatures and creating pore pressure within a compacted asphalt mixture to achieve an acceleration of the effects that a mixture would experience over time from traffic at normal temperatures and conditions. The accelerated conditioning in this practice is intended to simulate the stresses induced in a wet pavement by a passing vehicle tire. The pulse shape produced by this system approximates a Lorentzian function with a half peak width of approximately 1 s at 276 kPa [40 psi].

4.2 The factors that influence the potential for moisture damage to occur include aggregate mineralogy, mixture air voids, water, cyclic applied stress, and elevated temperature. This practice provides a method and apparatus that is capable of producing three of these factors: water, stress, and high temperature. Aggregate mineralogy and air voids are mixture properties.

4.3 Specimens conditioned by this system can be tested using a variety of different tests, including Test Method **D6931**, Test Method **D6927**, bulk specific gravity difference obtained by Test Method **D6926** or **D6752/D6752M** for before and after conditioning, dynamic modulus, flow number, AASHTO T 378, and visual inspection for stripped aggregates.

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 acceptance guideline provides a means of evaluating and controlling some of those factors.

5. Apparatus⁵

5.1 Balance in accordance with Test Method **D2726/D2726M**.

5.2 Water bath capable of maintaining a temperature of 25 ± 1 °C [77 ± 2 °F].

⁴ 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 The sole source of supply of the apparatus known to the committee at this time is InstronTek, Inc., 1 Triangle Drive, Research Triangle Park, NC. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

5.3 System (similar to Fig. 1) having a specimen chamber capable of testing one or more specimens with diameters of 150 mm [6 in.] or less. The system should be capable of applying a cyclic pressure peak of approximately Lorentzian function in shape with a peak pressure within ±30 kPa [±4 psi] of the pressure set point and a width of the pressure peak at half maximum of 1 ± 0.5 s.

5.3.1 The system shall be equipped with appropriate valves for automatically purging (de-airing) and removing air from the specimen chamber and allowing replacement of the accessible air void spaces with water.

5.3.2 The specimen chamber shall be capable of withstanding pressures of up to 690 kPa [100 psi].

5.3.3 The system should be equipped with temperature controls to allow set point temperatures of between 30 and 60 °C [86 to 140 °F] with measurements accurate to within ±1 °C [±2 °F].

5.3.4 The system shall be capable of producing and controlling cyclic pressures between 200 and 420 kPa [30 to 50 psi] with measurements accurate to within ±30 kPa [±4 psi].

5.3.5 The system should be capable of applying and controlling cyclic pressure and temperature and controlling the water temperature and pressure within the enclosed specimen chamber at a desired level.

5.4 One or more containers sufficient in size to hold water and specimen(s).

6. Preparation of Test Specimens

6.1 Preparation of Lab Mixed Lab Compacted (LMLC) Test Specimens:

6.1.1 Prepare mixtures in batches of sufficient size to make at least three specimens for each test as specified in 6.1.2.

6.1.2 Use specimens 100 mm [4 in.] in diameter and 63 ± 2 mm [2.5 ± 0.08 in.] high or 150 mm [6 in.] in diameter and 100 ± 5 mm [4 ± 0.2 in.] high. The percent air void of each sample used for conditioning shall be in the range of 6.5 to 7.5 %. If compacting to a target percent air void to match compaction at the time of construction, all individual samples conditioned shall not be more than ±0.5 % different from the target percent air void. Average the air voids of the specimens being conditioned at one time in order to get as close to the air void value of 7 % or target void level measured or expected in the field at the time of construction. Follow the procedures in Test Method **D4867/D4867M** and Practice **D5361/D5361M** to prepare the samples. Compact the specimens by using any one of the following: Test Method **D6925**, or Practices **D1561/D1561M**, **D4013**, and **D6926**.

6.1.3 Extract the specimen from the mold and cool to room temperature.

6.2 Preparation of Plant Mixed Lab Compacted (PMLC) Specimens:

6.2.1 Select a truck to be sampled in accordance with Practice **D3665**.

6.2.2 Secure a specimen from the truck at the plant in accordance with Practice **D979/D979M**.

6.2.3 Compact the specimens in accordance with 6.1.1.

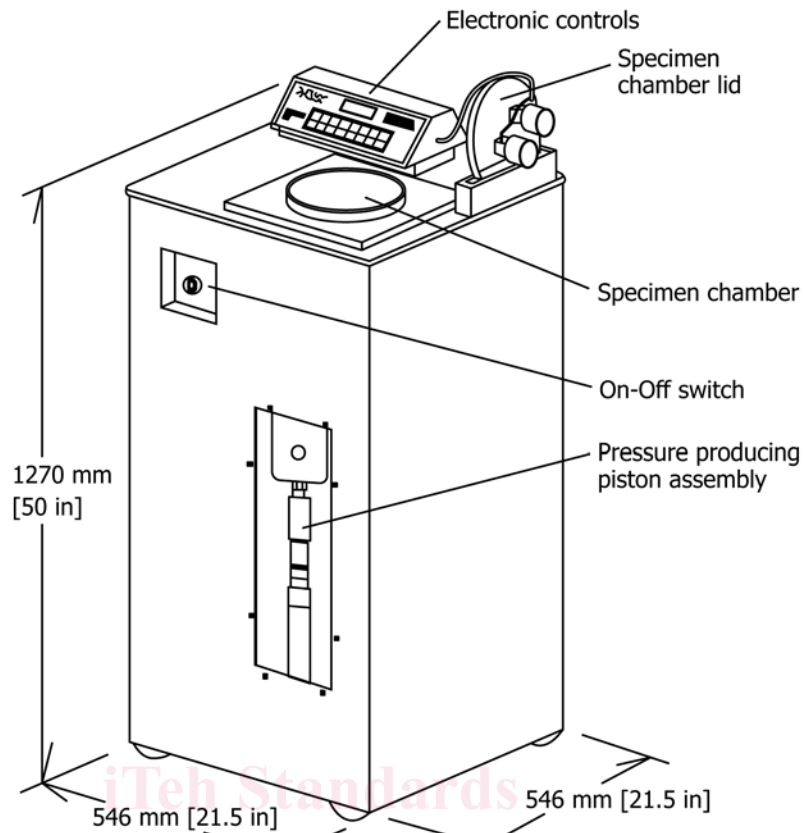


FIG. 1 Moisture Conditioning System

7. Procedure

7.1 Follow manufacturer's recommendation for setting up the moisture conditioning system. The system shall be capable of conditioning a total of three 100 mm [4 in.] in diameter and 63 ± 2 mm [2.5 ± 0.08 in.] high or two 150 mm [6 in.] in diameter and 100 ± 5 mm [4 ± 0.2 in.] high samples.

NOTE 2—Specimens with 100 mm [4 in.] diameter may saturate quicker and condition differently than specimens with 150 mm [6 in.] diameter. Specimen size variation should be considered when comparing results for different size specimens to each other for a given asphalt mixture.

7.2 Place the first specimen in the system and fill with sufficient water at 20 to 40 °C [68 to 104 °F] to cover the specimen.

7.3 Place a specimen plate on top of the specimen separator spacers. Specimen separator spacers are used to ensure proper separation between specimens. Place the second specimen on top of the specimen plate (see Fig. 2). Specimen shall not be stacked directly on top of each other at any time during or after the conditioning process.

7.4 Pour sufficient water in the system to cover the second specimen. Water temperature should be less than the test temperature.

7.5 Repeat 7.4 and 7.5 if conditioning three specimens at one time (see Fig. 3).

7.6 Fill the specimen tank with water and secure the lid. Water temperature should be less than the test temperature.

7.7 Partially fill both of the overfill cups on the lid in order to replenish the chamber with water during the de-airing process. De-airing will continue periodically throughout the conditioning process. The overfill cups are necessary to ensure water is supplied to the system, as air is pushed (pumped) out of the specimen(s) during pore pressure generation.

7.8 Set number of cycles to 3500.

7.9 Set pressure to 40 psi.

7.10 For mixtures containing PG high temperature grades higher than 60, set the temperature to 60 °C.

7.11 For mixtures with PG high temperature grades less than 60 and all warm mix asphalt (WMA) mixtures, set temperature to 50 °C.

7.12 Allow the system to heat the water and the specimen(s) in the specimen chamber to the set point temperature, to initiate the pressure cycle operation, and complete the conditioning process. These steps should be automatically controlled and performed by the system within the specified limits.

7.13 When the cycling process is completed, open the drain valve and allow all water to drain. This step shall be performed automatically by the system or manually a maximum of 20 min after the cycling process is completed.

7.14 Remove the lid.

7.15 Close the drain valve, after all water has been drained from the chamber.