Designation: D 2325 – 68 (Reapproved 2000)

Standard Test Method for Capillary-Moisture Relationships for Coarse- and Medium-Textured Soils by Porous-Plate Apparatus [1]

This standard is issued under the fixed designation D 2325; 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 capillary-moisture relationships for coarse- and medium-textured soils as indicated by the soil-moisture tension relations for tensions between 10 and 101 kPa (0.1 and 1 atm). Under equilibrium conditions, moisture tension is defined as the equivalent negative gage pressure, or suction, corresponding to a soil moisture content. This test method determines the equilibrium moisture content retained in a soil subjected to a given soil-water tension. This test method is not suitable for very fine-textured soils.

NOTE 1—For determination of capillary-moisture relationships for fine-textured soils, refer to Test Method D 3152.

1.2 *This standard does not purport to address all of the safety problems, 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 421 Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants [2]

D 698 Test Method for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft–lbf/ft ^{3}(600 kN·m/m ^{3}))

D 3152 Test Method for Capillary-Moisture Relationships for Fine-Textured Soils by Pressure-Membrane Apparatus [2]

3. Summary of Test Method

3.1 Saturated soil samples are placed in contact with a saturated porous plate installed within a pressure chamber. The bottom of each plate is covered by a rubber membrane, or otherwise sealed to be airtight. The bottom of each plate is maintained at atmospheric pressure by means of a small drain tube or opening through the side of the pressure chamber. A desired air pressure admitted to the pressure chamber, and consequently to the top of the porous plate, creates a pressure drop across the porous plate. The saturated soil samples on the plates establish equilibrium with the water in the plate. The water, held at a tension less than the pressure drop across the porous plate, will then move out of the soil, through the plate, and out through the drain tube. When water has ceased to flow from the sample and porous plate (indicating equilibrium for that particular tension), the moisture content of each sample is determined. A series of these tests at various tensions is required to prepare a complete curve of the capillary-moisture relationship for any particular soil.

4. Apparatus

4.1 An assembly of the apparatus is shown in Fig. 1.

4.1.1 *Porous Plate Apparatus*, consisting of the following:

4.1.1.1 *Pressure Container*, (such as a pressure cooker), of approximately 15-L (16-qt) capacity.

4.1.1.2 *Porous Ceramic Plates*, 1 to 4 (see Fig. 2), approximately 280 mm (11¼ in.) in diameter and 6 mm (¼ in.) in thickness, with an air entry value of 203 kPa (2 atm).

4.1.1.3 *Brass Spout*—The brass spout (one per porous plate) shall consist of a brass tube and associated washers, gaskets, and brass nuts. It shall provide an airtight joint when inserted through the porous plate 38 mm (1.5 in.) from the edge of the plate. The length of the unthreaded portion of the brass tube shall be 9.5 mm (⅜ in.); the length of the threaded portion shall be 15.8 mm (⅝ in.); the inside diameter of the tube shall be 1.7 mm (1⁄16in.); the outside diameter of the upper unthreaded portion shall be 4 mm (5⁄32 in.); the outside diameter of the lower threaded portion shall be 4.8 mm (3⁄16in.). The tap size for the hole through the porous plate shall be 5.5 mm (7⁄32in.).

4.1.1.4 *Disks of 10-mesh Brass Screen*, from 1 to 4, of slightly smaller diameter than bottom of porous ceramic plates.

4.1.1.5 *Rubber Membrane*—The membrane shall consist of sheet neoprene, 0.79 mm (1⁄32in.) in thickness, with a hardness of 35 by the Shore Durometer. Place a disk of brass screen over the bottom of each porous ceramic plate to provide space for the flow of water between the membrane and the ceramic plate (see Fig. 2). Then place the rubber membrane snugly over the brass screen, glue it securely to the outer edge of the ceramic plate, and wrap the edge tightly with wire (see Fig. 2).

4.1.1.6 *Tubing*—A flexible tubing tube, 3 mm (⅛ in.) in

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.04 on Hydrologic Properties of Soils and Rocks.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

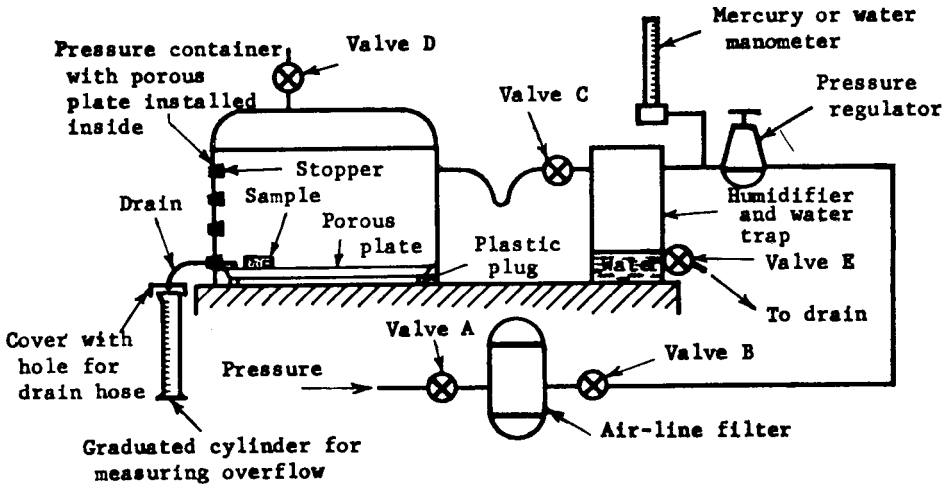

FIG. 1 Suggested Porous Plate Tension Apparatus

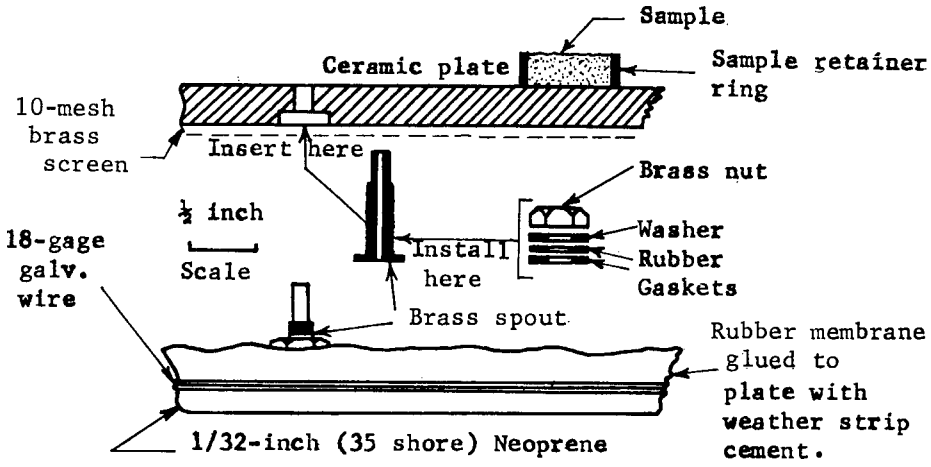

FIG. 2 Porous Plate Construction

diameter, to carry the outflow water from the brass spout on each porous plate to a short length of rigid tubing passing through a rubber stopper installed in the wall of the pressure container.

4.1.1.7 *Assembly*—Support and separate plates by means of plastic plugs approximately 15 mm (0.6 in.) in diameter by 25 mm (1 in.) in length.

4.1.2 *Sample Retainer Rings*—Rigid plastic rings, 10 mm (0.4 in.) in height by 50 mm (2 in.) in inside diameter with a wall thickness of approximately 3 mm (⅛ in.), capable of holding approximately 25 g of disturbed sample. The same rings shall be used to contain the undisturbed samples. The rings shall be numbered in pairs (A1 and A′1, and A′2, etc.).

4.1.3 *Manometer*, mercury type for measuring pressures of 34 to 101 kPa (⅓ to 1 atm); water type for measuring pressures below 34 kPa.

4.1.4 *Pressure Regulator*—A sensitive control valve or regulator for fine pressure control.

4.1.5 *Water Trap and Humidity Control*—A transparent plastic cylinder approximately 100 mm (4 in.) in outside diameter by 150 mm (6 in.) high with a wall thickness approximately 6 mm (¼ in.). The cylinder shall be sealed on both ends with an air inlet and outlet near the top of the cylinder and a drain outlet approximately 25 mm (1 in.) from the bottom. (This cylinder traps water if back pressure draws water out of the pressure container, and the 25 mm (1 in.) of water in the bottom maintains a humid atmosphere for the air to pass through.)

4.1.6 *Test Specimen Cutter*—A cylindrical ring with a sharp cutting edge on one end. The inside diameter shall be 50 mm (2 in.) and the height shall be 20 mm (0.8 in.). A metal blank 50 mm (2 in.) in diameter by 10 mm (0.4 in.) thick with a detachable handle, shall be available.

4.1.7 *Spatula*—A short, wide-blade spatula (or small pancake turner) for removing samples from pressure plates.

4.1.8 *Test Specimen Packer Disk*—A flat steel disk, 50 mm (2 in.) in diameter and 3 mm (⅛ in.) thick, that can be loaded to 9000 g.

NOTE 2—A pocket-type penetrometer has been found convenient for loading the disk.

4.1.9 *Plate Hook*—A three-pronged hook assembly for lifting porous plate.

4.1.10 *Moisture Sample Containers*—Suitable containers made of material resistant to corrosion and not subject to change in weight or disintegration on repeated heating and cooling. Containers shall have close-fitting lids to prevent loss of moisture from samples before initial weighing and to