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100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Test Method for Volume Weights, Water-Holding Capacity, and Air Capacity of Water-Saturated Peat Materials¹

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1. Scope

1.1 This empirical test method² was designed to evaluate the aeration, water penetration, and water retention properties of peat under field conditions of water saturation.

1.2 *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 limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils³

3. Summary of Test Method

3.1 The test method sets up standardized conditions for measuring the volume and weight of water-saturated peat. From these data, saturated volume weights, water-holding capacity on a weight and volume basis, dry peat volumes, and air volumes can be determined.

4. Significance and Use

4.1 A test method that will measure under conditions of water saturation, the air spaces of peat and the water-holding capacity on a volume basis as well as the weight basis provides useful information in evaluating peat materials. If large air spaces are present, high water penetration and aeration exist. If air spaces are smaller, retention of water is increased. Water retention would be greater in humified peat materials (small air spaces), whereas water penetration and aeration would be greater in unhumified peat (larger air spaces). The air spaces can also be a measure of the oxygen available to the plant roots.

5. Apparatus

5.1 *Dispensing Apparatus*—Two dispensing burets, 250-mL

¹ This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.18 on Peats and Related Materials.

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² This test method is currently undergoing an extensive review by ASTM Committee D-18.

³ *Annual Book of ASTM Standards*, Vol 04.08.

capacity in 1-mL subdivisions, ± 2 -mL tolerance, pinchcock type; a one-hole No. 6 rubber stopper; straight polyethylene drying tube with serrated rubber tubing fittings, 150 mm long, $\frac{3}{4}$ in. (19 mm) in outside diameter, $\frac{5}{8}$ in. (16 mm) in inside diameter;⁴ and a stainless steel sieve circle about 16 mesh and 28.7 mm in diameter to be attached to one end of the drying tube and sealed. (A soldering iron is useful.) Adjust the length of the tube to match conveniently the graduation of the buret; then scallop the end without the sieve to allow for water drainage, and insert the tube into the dispensing buret with the sieve side up.

6. Sample

6.1 Place a representative field sample on a square rubber sheet, paper, or oil cloth. Reduce the sample to the quantity required by quartering and place in a moistureproof container. Work rapidly to prevent moisture losses.

7. Procedure

7.1 Determine the moisture content on a separate test specimen by Method I or II of Test Methods D 2974.

7.1.1 Weigh the buret fitted with the plastic tube and screen. Working rapidly to prevent moisture losses, mix the sample thoroughly, place on top of a 4-mesh sieve, and shake until sieving is complete. Use only the portion that has passed through the sieve for the determination. Firmly pack the buret with 10 in. (250 mm) of the 4-mesh sample as follows: Attach the rubber stopper to the delivery end of the buret. Add 20-mL portions of the sample, firmly tapping on the rubber stopper 3 times vertically from a height of 6 in. (150 mm) for a final height of 10 in. (This will ensure that the height of the final wet volume is 7.5 to 10 in. (190 to 250 mm)). Remove the stopper and weigh the buret to nearest 1 g.

7.1.2 Position the buret to use a sink as the drain. Place a 5-gal (20-L) bottle equipped with a siphon device above the level of the buret. Connect the clamped rubber tubing of the siphon device to the buret by inserting glass tubing about 5 in. (125 mm) long and constricted at one end into the one-hole rubber stopper fitted tightly into the top of the buret. Attach the rubber tubing with the pinch clamp to the delivery end of the buret. Open both clamps and pass water through the sample for not less than 24 h, maintaining a water reservoir over the

⁴ A Cenco No. 14782-2 drying tube has been found suitable for this purpose.

 **D 2980**

sample at all times. (Moss-type samples may float but gradually settle as the sample becomes wet.) After initial soaking, regulate the water flow through the column by adjusting the screw clamp at the delivery end of the buret. (The in-flow of water should be about equal to the out-flow; a flow of about 1 drop/s is suitable.) When the sample is supersaturated, close both clamps and let the sample settle in water for about 5 min. The top surface of the sample should be as level as possible.

7.1.3 Raise the buret and replace the rubber stopper on the delivery end of the buret with a 250-mL dispensing buret filled with water, using the rubber stopper for the connection. Connect the two burets tightly, with no air leaks. Remove the siphon device and open the outlet clamps on both burets to empty. (The suction created is equivalent to about 15 in. of water. Check for air leaks to ensure that the standard suction is exerted on the sample. It is important to remove excess water as described.) Measure the height of the wet peat. The height should be 7.5 to 10 in. (190 to 250 mm). Record the volume in millilitres and weigh the buret, the plastic tube with the sieve, and the wet peat to the nearest 1 g. Wet the sample again as above for not less than 1 h, drain by suction, record the volume, and weigh. Repeat until consistent results are obtained.

8. Calculation

8.1 Calculate the saturated volume weights, S , in grams per millilitre as follows:

As-received:

$$S = W_r/V_w \quad (1)$$

Oven-dried:

$$S = W_d/V_w \quad (2)$$

Wet:

$$S = W_w/V_w \quad (3)$$

where:

W_r = weight of test specimen as received, g,

V_w = wet volume, mL,

W_d = weight of dried test specimen,

$$g = W_r \times (100 - M)/100,$$

M = moisture, %, and

W_w = weight of wet test specimen, g.

8.2 Calculate the water-holding capacity in percent as follows:

8.2.1 *Weight basis, W :*

As-received:

$$W = [(W_w - W_r) \times 100]/W_r \quad (4)$$

Oven-dried:

$$W = [(W_w - W_d) - W_d] \times 100/W_d \quad (5)$$

8.2.2 *Volume basis, V :*

$$V = [(W_w - W_d) \times 100]/(V_w \times 1.0) \quad (6)$$

8.3 Calculate the dry peat volume, P , in percent as follows:

$$P = (W_d \times 100)/(V_w \times 1.4) \quad (7)$$

8.4 Calculate the air volume, A , in percent as follows:

$$A = 100 - (V + P) \quad (8)$$

9. Report

9.1 Report the saturated volume weights to the nearest 0.01 g. Report percentage results to the nearest whole number.

10. Precision and Bias

10.1 *Precision*—Due to the nature of the soil or rock materials tested by this method it is either not feasible or too costly at this time to produce multiple specimens which have uniform physical properties. Any variation observed in the data is just as likely to be due to specimen variation as to operator testing variation. Subcommittee D18.18 welcomes proposals that would allow for development of a valid precision statement.

10.2 *Bias*—There is no accepted reference value for this test method, therefore, bias cannot be determined.

11. Keywords

11.1 peat; water; water retention

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