



Designation: D 5220 – 92 (Reapproved 1997)

Standard Test Method for Water Content of Soil and Rock In-Place by the Neutron Depth Probe Method¹

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1. Scope

1.1 This test method covers the calculation of the water content of soil and rock by thermalization or slowing of fast neutrons where the neutron source and the thermal neutron detector are placed at the desired depth in the bored hole lined by an access tube (see Note 1).

1.2 The water content, in mass per unit volume of the material under test, is calculated by comparing the thermal neutron count rate with previously established calibration data (see Annex A1).

1.3 The values expressed in SI units are regarded as the standard. The inch-pound units given in parentheses may be approximate and are provided for information only.

1.4 *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.* Specific hazards are given in Section 7.

2. Referenced Documents

2.1 ASTM Standards:

- D 1452 Practice for Soil Investigation and Sampling by Auger Borings²
- D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils²
- D 1587 Practice for Thin Walled Tube Sampling of Soils²
- D 2113 Practice for Diamond Core Drilling for Site Investigation²
- D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures²
- D 2937 Test Method for Density of Soil in Place by the Drive-Cylinder Method²
- D 3017 Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)²
- D 3550 Practice for Ring-Lined Barrel Sampling of Soils²

¹ This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

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

D 4428/D 4228M Test Method for Crosshole Seismic Testing²

D 5195 Test Method for Density of Soil and Rock in Place at Depths Below the Surface by Nuclear Methods³

3. Summary of Test Method

3.1 This test method uses thermalization of neutron radiation to calculate the in-place water content of soil and rock at various depths by placing a probe containing a neutron source and a thermal neutron detector at desired depths in a bored hole lined by an access tube as opposed to surface measurements in accordance with Test Method D 3017.

3.2 Neutrons emitted by the source are thermalized (slowed) by collisions with materials of low atomic numbers. Hydrogenous materials, such as water and other compounds containing hydrogen, are most effective in thermalizing neutrons. In this apparatus the neutrons thermalized by the material under test are detected by the thermal neutron detector.

3.3 In the absence of interference elements as discussed in Section 5, the number of thermalized neutrons is a function of the hydrogen content of the material under test and the water content is proportional to the hydrogen content.

3.4 By the use of a calibration process the water content is calculated by correlating the count rate to known water contents.

4. Significance and Use

4.1 This test method is useful as a rapid, nondestructive technique for the calculation of the in-place water content of soil and rock at desired depths below the surface.

4.2 With proper calibration in accordance with Annex A1, this test method can be used for quality control and acceptance testing for construction and for research and development applications.

4.3 The non-destructive nature of this test method allows repetitive measurements to be made at a single test location for statistical analysis and to monitor changes over time.

4.4 The fundamental assumptions inherent in this test method are that the material under test is homogeneous and hydrogen present is in the form of water as defined by Test Method D 2216.

³ *Annual Book of ASTM Standards*, Vol 04.09.