



Standard Test Method for Logging In Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and Vertical Access Tubes¹

This standard is issued under the fixed designation D6031/D6031M; 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 collection and comparison of logs of thermalized-neutron counts and back-scattered gamma counts along horizontal or vertical air-filled access tubes.

1.2 The in situ water content in mass per unit volume and the density in mass per unit volume of soil and rock at positions or in intervals along the length of an access tube are calculated by comparing the thermal neutron count rate and gamma count rates respectively to previously established calibration data.

1.3 The values stated in either inch-pound units or SI units [presented in brackets] 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 non-conformance with the standard.

1.3.1 The gravitational system of inch-pound units is used when dealing with inch-pound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass is slugs. The rationalized slug unit is not given, unless dynamic ($F = ma$) calculations are involved.

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. For specific hazards, see Section 6.*

2. Referenced Documents

2.1 ASTM Standards:²

D1452 Practice for Soil Exploration and Sampling by Auger Borings

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

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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.

D1586 Test Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils

D1587 Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes

D2113 Practice for Rock Core Drilling and Sampling of Rock for Site Exploration

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) (Withdrawn 2007)³

D2937 Test Method for Density of Soil in Place by the Drive-Cylinder Method

D3017 Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

D3550 Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils

D4428/D4428M Test Methods for Crosshole Seismic Testing

D4564 Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method (Withdrawn 2013)³

D5195 Test Method for Density of Soil and Rock In-Place at Depths Below Surface by Nuclear Methods

D5220 Test Method for Water Mass per Unit Volume of Soil and Rock In-Place by the Neutron Depth Probe Method

3. Significance and Use

3.1 This test method is useful as a repeatable, nondestructive technique to monitor in-place density and moisture of soil and rock along lengthy sections of horizontal, slanted, and vertical access holes or tubes. With proper calibration in accordance with **Annex A1**, this test method can be used to quantify changes in density and moisture content of soil and rock.

3.2 This test method is used in vadose zone monitoring, for performance assessment of engineered barriers at waste facilities, and for research related to monitoring the movement of liquids (water solutions and hydrocarbons) through soil and

³ The last approved version of this historical standard is referenced on www.astm.org.