



Designation: D2434 – 19

## Standard Test Method for Permeability of Granular Soils (Constant Head)<sup>1</sup>

This standard is issued under the fixed designation D2434; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope

1.1 This test method covers the determination of the coefficient of permeability by a constant-head method for the laminar flow of water through granular soils. The procedure is to establish representative values of the coefficient of permeability of granular soils that may occur in natural deposits as placed in embankments, or when used as base courses under pavements. In order to limit consolidation influences during testing, this procedure is limited to disturbed granular soils containing not more than 10 % soil passing the 75-μm (No. 200) sieve.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 *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.*

1.4 *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:*<sup>2</sup>

**D422 Test Method for Particle-Size Analysis of Soils** (Withdrawn 2016)<sup>3</sup>

<sup>1</sup> 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 and Hydraulic Barriers.

Current edition approved Oct. 1, 2019. Published October 2019. Originally approved in 1965. Last previous edition approved in 2006 as D2434–68(2006), which was withdrawn January 2015 and reinstated in October 2019. DOI: 10.1520/D2434-19.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**D4253 Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table**

**D4254 Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density**

### 3. Fundamental Test Conditions

3.1 The following ideal test conditions are prerequisites for the laminar flow of water through granular soils under constant-head conditions:

3.1.1 Continuity of flow with no soil volume change during a test,

3.1.2 Flow with the soil voids saturated with water and no air bubbles in the soil voids,

3.1.3 Flow in the steady state with no changes in hydraulic gradient, and

3.1.4 Direct proportionality of velocity of flow with hydraulic gradients below certain values, at which turbulent flow starts.

3.2 All other types of flow involving partial saturation of soil voids, turbulent flow, and unsteady state of flow are transient in character and yield variable and time-dependent coefficients of permeability; therefore, they require special test conditions and procedures.

### 4. Apparatus

4.1 *Permeameters*, as shown in **Fig. 1**, shall have specimen cylinders with minimum diameters approximately 8 or 12 times the maximum particle size in accordance with **Table 1**. The permeameter should be fitted with: (1) a porous disk or suitable reinforced screen at the bottom with a permeability greater than that of the soil specimen, but with openings sufficiently small (not larger than 10 % finer size) to prevent movement of particles; (2) manometer outlets for measuring the loss of head,  $h$ , over a length,  $l$ , equivalent to at least the diameter of the cylinder; (3) a porous disk or suitable reinforced screen with a spring attached to the top, or any other device, for applying a light spring pressure of 22 to 45-N (5 to 10-lbf) total load, when the top plate is attached in place. This will hold the placement density and volume of soil without significant change during the saturation of the specimen and the permeability testing to satisfy the requirement prescribed in **3.1.1**.