



Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter¹

This standard is issued under the fixed designation D 5084; 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.

ε¹ NOTE—Figure 2 was corrected editorially in January 2002.

1. Scope *

1.1 These test methods cover laboratory measurement of the hydraulic conductivity (also referred to as *coefficient of permeability*) of water-saturated porous materials with a flexible wall permeameter at temperatures between about 15 and 30°C (59 and 86°F). Temperatures outside this range may be used, however, the user would have to determine the specific gravity of mercury and R_T (see 10.3) at those temperatures using data from *Handbook of Chemistry and Physics*. There are six alternate methods or hydraulic systems, that may be used to measure the hydraulic conductivity. These hydraulic systems are as follows:

- 1.1.1 *Method A*—Constant Head
- 1.1.2 *Method B*—Falling Head, constant tailwater elevation
- 1.1.3 *Method C*—Falling Head, rising tailwater elevation
- 1.1.4 *Method D*—Constant Rate of Flow
- 1.1.5 *Method E*—Constant Volume—Constant Head (by mercury)
- 1.1.6 *Method F*—Constant Volume—Falling Head (by mercury), rising tailwater elevation

1.2 These test methods may be utilized on all specimen types (undisturbed, reconstituted, remolded, compacted, etc.) that have a hydraulic conductivity less than about 1×10^{-6} m/s (1×10^{-4} cm/s), providing the head loss requirements of 5.2.3 are met. For the constant-volume methods, the hydraulic conductivity typically has to be less than about 1×10^{-7} m/s.

1.2.1 If the hydraulic conductivity is greater than about 1×10^{-6} m/s, but not more than about 1×10^{-5} m/s; then the size of the hydraulic tubing needs to be increased along with the porosity of the porous end pieces. Other strategies, such as using higher viscosity fluid or properly decreasing the cross-sectional area of the test specimen, or both, may also be possible. The key criterion is that the requirements covered in Section 5 have to be met.

1.2.2 If the hydraulic conductivity is less than about 1×10^{-10} m/s, then standard hydraulic systems and tempera-

ture environments will typically not suffice. Strategies that may be possible when dealing with such impervious materials may include the following. Tightening the temperature control. The adoption of unsteady state measurements by using high-accuracy equipment along with the rigorous analyses for determining the hydraulic parameters (this approach reduces testing duration according to Zhang et al. (1)²). Properly shortening the length or enlarging the cross-sectional area, or both, of the test specimen. Other items, such as use of higher hydraulic gradients, lower viscosity fluid, elimination of any possible chemical gradients and bacterial growth, and strict verification of leakage, may also be considered.

1.3 The hydraulic conductivity of materials with hydraulic conductivities greater than 1×10^{-5} m/s may be determined by Test Method D 2434.

1.4 All observed and calculated values shall conform to the guide for significant digits and rounding established in Practice D 6026.

1.4.1 The procedures used to specify how data are collected/recorded and calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that should generally be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.5 The values stated in SI units are to be regarded as the standard, unless other units are specifically given. By tradition in U.S. practice, hydraulic conductivity is reported in centimeters per second, although the common SI units for hydraulic conductivity is meters per second.

1.6 *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.*

¹ This standard 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 Soil and Rocks.

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² The boldface numbers in parentheses refer to the list of references appended to this standard.

*A Summary of Changes section appears at the end of this standard.