



Designation: D5084 – 24

## Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter<sup>1</sup>

This standard is issued under the fixed designation D5084; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 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 use water as the permeant liquid; see 4.3 and Section 6 on Reagents for water requirements.

1.3 These test methods may be utilized on all specimen types (intact, reconstituted, remolded, compacted, etc.) that have a hydraulic conductivity less than about  $1 \times 10^{-6}$  m/s ( $1 \times 10^{-4}$  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  $1 \times 10^{-7}$  m/s.

1.3.1 If the hydraulic conductivity is greater than about  $1 \times 10^{-6}$  m/s, but not more than about  $1 \times 10^{-5}$  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.

1.3.2 If the hydraulic conductivity is less than about  $1 \times 10^{-11}$  m/s, then standard hydraulic systems and temperature environments will typically not suffice. Strategies that may be possible when dealing with such impervious materials may include the following: (a) controlling the temperature more precisely, (b) 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)<sup>2</sup>), and (c) shortening the length or enlarging the cross-sectional area, or both, of the test specimen (with consideration to specimen grain size (2)). Other approaches, 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.

1.4 The hydraulic conductivity of materials with hydraulic conductivities greater than  $1 \times 10^{-5}$  m/s may be determined by Test Method D2434.

1.5 All observed and calculated values shall conform to the guide for significant digits and rounding established in Practice D6026.

1.5.1 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.

1.6 This standard also contains a Hazards section (Section 7).

1.7 The time to perform this test depends on such items as the Method (A, B, C, D, E, or F) used, the initial degree of

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<sup>2</sup> 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