



Designation: D 5093 – 90 (Reapproved 1997)

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Test Method for Field Measurement of Infiltration Rate Using a Double-Ring Infiltrometer with a Sealed-Inner Ring¹

This standard is issued under the fixed designation D 5093; 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 describes a procedure for measuring the infiltration rate of water through in-place soils using a double-ring infiltrometer with a sealed inner ring.

1.2 This test method is useful for soils with infiltration rates in the range of 1×10^{-7} m/s to 1×10^{-10} m/s. When infiltration rates $\geq 1 \times 10^{-7}$ m/s are to be measured Test Method D 3385 shall be used.

1.3 This test method provides a direct measurement of infiltration rate, not hydraulic conductivity. Although the units of infiltration rate and hydraulic conductivity are similar, there is a distinct difference between these two quantities. They cannot be directly related unless the hydraulic boundary conditions, such as hydraulic gradient and the extent of lateral flow of water are known or can be reliably estimated.

1.4 This test method can be used for natural soil deposits, recompacted soil layers, and amended soils such as soil bentonite and soil lime mixtures.

1.5 The values stated in SI units are to be regarded as standard. The values in parentheses are for information only.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 653 Terminology Relating to Soil, Rock, and Contained Fluids²

D 3385 Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometers²

3. Terminology

3.1 Definitions:

3.1.1 *infiltration*—downward entry of liquid into a porous body.

3.1.2 *infiltration rate, I*—quantity of liquid entering a porous material (m³) per unit area (m²) per unit time (s),

expressed in units of m/s.

3.1.3 *infiltrometer*—a device used to pond liquid on a porous body and to allow for the measurement of the rate at which liquid enters the porous body.

3.1.4 For definitions of other terms used in this test method, see Terminology D 653.

4. Summary of Test Method

4.1 The infiltration rate of water through soil is measured using a double-ring infiltrometer with a sealed or covered inner ring (Fig. 1). The infiltrometer consists of an open outer and a sealed inner ring. The rings are embedded and sealed in trenches excavated in the soil. Both rings are filled with water such that the inner ring is submerged.

4.2 The rate of flow is measured by connecting a flexible bag filled with a known weight of water to a port on the inner ring. As water infiltrates into the ground from the inner ring, an equal amount of water flows into the inner ring from the flexible bag. After a known interval of time, the flexible bag is removed and weighed. The weight loss, converted to a volume, is equal to the amount of water that has infiltrated into the ground. An infiltration rate is then determined from this volume of water, the area of the inner ring, and the interval of time. This process is repeated and a plot of infiltration rate versus time is constructed. The test is continued until the infiltration rate becomes steady or until it becomes equal to or less than a specified value.

5. Significance and Use

5.1 This test method provides a means to measure low infiltration rates associated with fine-grained, clayey soils, and are in the range of 1×10^{-7} m/s to 1×10^{-9} m/s.

5.2 This test method is particularly useful for measuring liquid flow through soil moisture barriers such as compacted clay liner or covers used at waste disposal facilities, for canal and reservoir liners, for seepage blankets, and for amended soil liners such as those used for retention ponds or storage tanks.

5.3 The purpose of the sealed inner ring is to: (1) provide a means to measure the actual amount of flow rather than a drop in water elevation which is the flow measurement procedure used in Test Method D 3385 and (2) to eliminate evaporation losses.

5.4 The purpose of the outer ring is to promote one-dimensional, vertical flow beneath the inner ring. The use of

¹ This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.04 on Hydrologic Properties of Soil and Rocks.

Current edition approved June 29, 1990. Published August 1990.

² Annual Book of ASTM Standards, Vol 04.08.