



Designation: D8037/D8037M – 24

Standard Practice for Direct Push Hydraulic Logging for Profiling Variations of Permeability in Soils¹

This standard is issued under the fixed designation D8037/D8037M; 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 practice describes a method for rapid delineation of variations in formation permeability in the subsurface using an injection logging tool. Clean water is injected from a port on the side of the probe as it is advanced at approximately 2cm/s into virgin soils. Logging with the injection tool is typically performed with direct push equipment, however other drilling machines may be modified to run the logs by direct push methods (for example, addition of a suitable hammer and/or hydraulic ram systems). Injection logs exceeding 100 ft [30m] depth have been obtained. Direct push methods are not intended to penetrate consolidated rock and may encounter refusal in very dense formations or when cobbles or boulders are encountered in the subsurface. However, injection logging has been performed in some semi-consolidated or soft formations.

1.2 This standard practice describes how to obtain a real time vertical log of injection pressure and flow rate with depth. The data obtained is indicative of the variations of permeability in the subsurface and is typically used to infer formation lithology. The person(s) responsible for review, interpretation and application of the injection logging data should be familiar with the logging technique as well as the soils, geology and hydrogeology of the area under investigation.

1.3 The injection logging system may be operated with a built in electrical conductivity sensor to provide additional real time information on stratigraphy and is essential for targeting test zones. Other sensors, such as fluorescence detectors (Practice **D6187**), a membrane interface probe (Practice **D7352**) or a cone penetration tool (Test Method **D5778**) may be used in conjunction with injection logging to provide additional information. The use of the injection logging tool in concert with an electrical conductivity array or cone penetration tool is highly recommended (although not mandatory) to further define hydrostratigraphic conditions, such as migration

pathways, low permeability zones (for example, aquitards) and to guide confirmation sampling. The EC log and injection pressure log may be compared in some settings to identify the presence of ionic contaminants or ionic injectates used for remediation.

1.4 The injection logging system does not provide quantitative permeability or hydraulic conductivity information. However, injection pressure and flow data may be used to provide a qualitative indication of formation permeability. Semi-quantitative values of permeability may be obtained by correlation of injection logging data with other methods (**1-4**).² Also, a log of estimated hydraulic conductivity (**5**) may be calculated for the saturated zone using an empirical model included in some versions of the log viewing software. The data allows for estimates of hydraulic conductivity (K) at the inch-scale using the corrected injection pressure and flow rate.

1.5 This tool is to be used as a logging tool for the rapid delineation of variations in permeability, lithology and hydrostratigraphy in unconsolidated formations. Direct push soil sampling (Guide **D6282/D6282M**) and slug testing (Practice **D7242/D7242M**) by means of groundwater sampling devices (Guide **D6001/D6001M**) or direct push monitoring wells (Guide **D6724/D6724M** and Practice **D6725/D6725M**) may be used to validate injection log interpretation, permeability and hydraulic conductivity estimates. Other aquifer tests (Guide **D4043**) in larger wells can also be used to obtain additional information about permeability and hydraulic conductivity. However, correlation of results from long screened wells with the fine detail of the hydraulic injection log data may be difficult at best due to the effect of scale in measurements of transmissivity (**6**).

1.6 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice **D6026**, unless superseded by this standard.

1.7 *Units*—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

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.

Current edition approved Oct. 1, 2024. Published November 2024. Originally approved in 2016. Last previous edition approved in 2016 as E3318 – 16. DOI: 10.1520/D8037_D8037M-24.

² The boldface numbers in parentheses refer to a list of references at the end of this standard.