Designation: D6519/D6519M – 23

Standard Practice for Sampling of Soil Using the Hydraulically Operated Stationary Piston Sampler[1]

This standard is issued under the fixed designation D6519/D6519M; 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 covers a procedure for sampling of cohesive, organic, or fine-grained soils, or combination thereof, using a thin-walled metal tube that is inserted into the soil formation by means of a hydraulically operated piston. It is used to collect relatively intact soil samples suitable for laboratory tests to determine structural and chemical properties for geotechnical and environmental site characterizations.

1.1.1 Guidance on preservation and transport of samples in accordance with Practice D4220/D4220M may apply. Samples for classification may be preserved using procedures similar to Class A. In most cases, a thin-walled tube sample can be considered as Class B, C, or D. Refer to Guide D6169/D6169M for use of the hydraulically operated stationary piston soil sampler for environmental site characterization. This sampling method is often used in conjunction with rotary drilling methods such as fluid rotary; Guide D5783; and hollow stem augers, Practice D6151/D6151M. Sampling data shall be reported in the field log in accordance with Guide D5434.

1.2 The hydraulically operated stationary piston sampler is limited to soils and unconsolidated materials that can be penetrated with the available hydraulic pressure that can be applied without exceeding the structural strength of the thin-walled tube. This standard addresses typical hydraulic piston samplers used on land or shallow water in drill holes. The standard does not address specialized offshore samplers for deep marine applications that may or may not be hydraulically operated. This standard does not address operation of other types of mechanically advanced piston samplers. For information on other soil samplers, refer to Guide D6169/D6169M.

1.3 *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 of the other. Combining values from the two systems may result in non-conformance with the standard. Reporting of results in units other than shall not be regarded as nonconformance with this standard.

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values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.5 *This practice does not purport to address all the safety concerns, if any, associated with its use and may involve use of hazardous materials, equipment, and operations. It is the responsibility of the user of this practice to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use. Also, the user must comply with prevalent regulatory codes, such as OSHA (Occupational Health and Safety Administration) guidelines, while using this practice. For good safety practice, consult applicable OSHA regulations and other safety guides on drilling.*[2]

1.6 *This practice offers a set of instructions for performing one or more specific operations. This practice cannot replace education or experience and should be used in conjunction with professional judgement. Not all aspects of this practice may be applicable in all circumstances. This practice is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title means only that the document has been approved through the ASTM consensus process. This practice does not purport to comprehensively address all of the methods and potential issues associated with sampling of soil. Users should seek qualified professionals for decisions as to the proper equipment and methods that would be most successful for their site exploration. Other methods may be available for drilling and sampling of soil, and qualified professionals should have flexibility to exercise judgment as to possible alternatives not covered in this practice. The practice is current at the time of issue, but new alternative methods may become available prior to revisions, therefore, users should consult with manufacturers or producers prior to specifying program requirements.*

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Evaluations

Current edition approved Nov. 1, 2023. Published November 2023. Originally approved in 2000. Last previous edition approved in 2015 as D6519 – 15. DOI: 10.1520/D6519_D6519M-23.

[2] *Drilling Safety Guide*, National Drilling Assn., 3008 Millwood Ave., Columbia, SC 29205.

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

1.7 *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—Testing and Soil Classification:*[3]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedures)

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock (Withdrawn 2021)[4]

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

2.2 *ASTM Standards—Drilling Methods:*

D5782 Guide for Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

D5783 Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

D5784/D5784M Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water Quality Monitoring Devices

D6151/D6151M Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling

D6286/D6286M Guide for Selection of Drilling and Direct Push Methods for Geotechnical and Environmental Subsurface Site Characterization

2.3 *ASTM Standards—Soil Sampling:*

D1587/D1587M Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes

D4220/D4220M Practices for Preserving and Transporting Soil Samples (Withdrawn 2023)[4]

D5088 Practice for Decontamination of Field Equipment Used at Waste Sites

D5299/D5299M Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

D6169/D6169M Guide for Selection of Subsurface Soil and Rock Sampling Devices for Environmental and Geotechnical Investigations

D6282/D6282M Guide for Direct Push Soil Sampling for Environmental Site Characterizations (Withdrawn 2023)[4]

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] The last approved version of this historical standard is referenced on www.astm.org.

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms in this standard, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *friction clutch, n*—a device to lock the thin-walled tube head to the outer barrel of the stationary piston sampler to prevent uncontrolled thin-walled tube rotation.

3.2.2 *hydraulically operated stationary piston sampler, n*—a stationary piston sampler in which the thin-walled tube is advanced over a fixed piston into the soil strata by hydraulic fluid pressure or pneumatic pressure. It is also known as an "Osterberg" piston sampler, which was developed by Professor Jori Osterberg of Northwestern University.

3.2.3 *incremental drilling and sampling, n*—insertion method where rotary drilling and sampling events are alternated for incremental sampling, incremental drilling is often needed to penetrate stiffer or deeper formations.

3.2.4 *sample interval, n*—defined zone within a subsurface strata from which a sample is gathered.

3.2.5 *sample recovery, n*—the length of material recovered divided by the length of sampler advancement and stated as a percentage.

3.2.6 *soil core, n*—cylindrically shaped soil specimen recovered from a sampler.

4. Summary of Practice

4.1 Hydraulically operated stationary piston sampling of soils consists of advancing a thin-walled sampling tube into subsurface soils generally through a predrilled bore hole to the desired sampling depth. See Fig. 1 for a schematic drawing of the sampling process. The sampler is sealed by the stationary piston to prevent any intrusion of formation material. At the desired depth, fluid or air is forced into the sampling barrel, above the inner sampler head, forcing the thin-walled tube sampler over the piston into the soil formation. The hydraulically operated stationary piston sampler has a prescribed length of travel. At the termination of the sampler travel length the fluid flow is terminated. The sample is allowed to stabilize in the thin-walled tube. The sampler is retrieved from the borehole, and the thin-walled tube with the sample is removed from the sampler. The sample tube is then sealed properly or field-extruded as desired. The stationary piston sampler is cleaned and a clean thin-walled tube installed. The procedure is repeated for the next desired sampling interval. Sampling can be continuous for full-depth borehole logging or incremental for specific interval sampling.

5. Significance and Use

5.1 Hydraulically operated stationary piston samplers are used to gather soil samples for laboratory or field testing and analysis for geologic investigations, soil chemical composition studies, and water quality investigations. The sampler is sometimes used when attempts to recover unstable soils with thin-walled tubes, Practice D1587/D1587M, are unsuccessful. Examples of a few types of investigations in which hydraulic stationary piston samplers may be used include building site

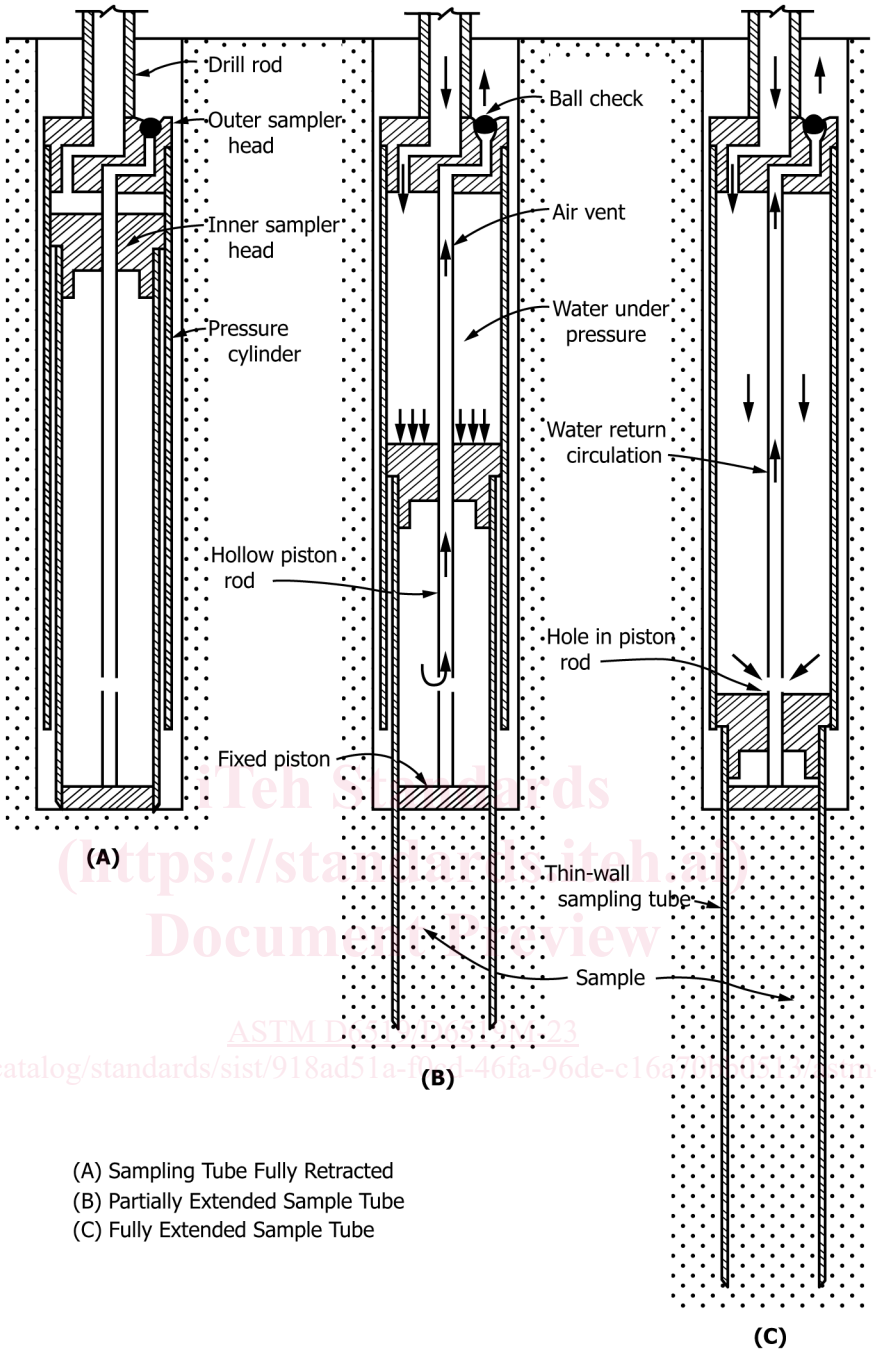

FIG. 1 Sampler in Operation

foundation studies containing soft sediments, highway and dam foundation investigations where softer soil formation need evaluation, wetland crossings utilizing floating structures, and hazardous waste site investigations. Hydraulically operated stationary piston samplers provide specimens necessary to determine the physical and chemical composition of soils and, in certain circumstances, contained pore fluids (see Guide D6169/D6169M).

5.2 Hydraulically operated stationary piston samplers can provide relatively intact soil samples of soft or loose formation materials for testing to determine accurate information on the physical characteristics of that soil. Samples of soft formation materials can be tested to determine numerous soil characteristics such as; soil stratigraphy, particle size, water content, permeability, shear strength, compressibility, and so forth. The chemical composition of soft formation soils can also be determined from the sample if provisions are made to ensure that clean, decontaminated tools are used in the sample gathering procedure. Field-extruded samples can be field-screened or laboratory-analyzed to determine the chemical