Designation: D6519 – 08

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

This standard is issued under the fixed designation D6519; 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 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 D6286 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. Sampling data should be reported in the substance log in accordance with Guide D5434.

1.2 The hydraulically operated stationery 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.

1.3 *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 to establish and adopt appropriate safety and health practices. 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]

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This practice offers a set of instructions for performing one or more specific operations. This document 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 ASTM standard 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 the 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 investigation. 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.*

2. Referenced Documents

2.1 *ASTM Standards-Soil Classification:*[3]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

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

[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

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

[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.

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

D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock

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

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

D6286 Guide for Selection of Drilling Methods for Environmental Site Characterization

2.3 *ASTM Standards—Soil Sampling:*

D420 Guide to Site Characterization for Engineering Design and Construction Purposes (Withdrawn 2011)[4]

D1587 Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes

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

D4220 Practices for Preserving and Transporting Soil Samples

D6169 Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations

3. Terminology

3.1 *Definitions:*

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

3.1.2 *incremental drilling and sampling*—insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling is often needed to penetrate harder or deeper formations.

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

3.1.4 *sample interval*—defined zone within a subsurface strata from which a sample is gathered.

3.1.5 *soil core*—cylindrically shaped soil specimen recovered from a sampler.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *friction clutch*—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 activated stationary piston sampler*—a stationary piston sampler in which the thin-walled tube is forced over a fixed piston into the soil strata by hydraulic fluid pressure or pneumatic pressure. Also known as an "Osterberg" piston sampler, which was developed by Professor Jori Osterberg of Northwestern University.

4. Summary of Practice

4.1 Hydraulic stationary piston sampling of soils consists of advancing a sampling device 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 sample is then sheared by rotating the sampler. 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 activated 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, are unsuccessful. Examples of a few types of investigations in which hydraulic stationary piston samplers may be used include building site 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 activated 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).

5.2 Hydraulically activated 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, moisture content, permeability, sheer 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 composition of soil and contained pore fluids. Using sealed or protected sampling tools, cased boreholes, and proper advancement techniques can help in the acquisition of good representative samples. A general knowledge of subsurface conditions at the site is beneficial.

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

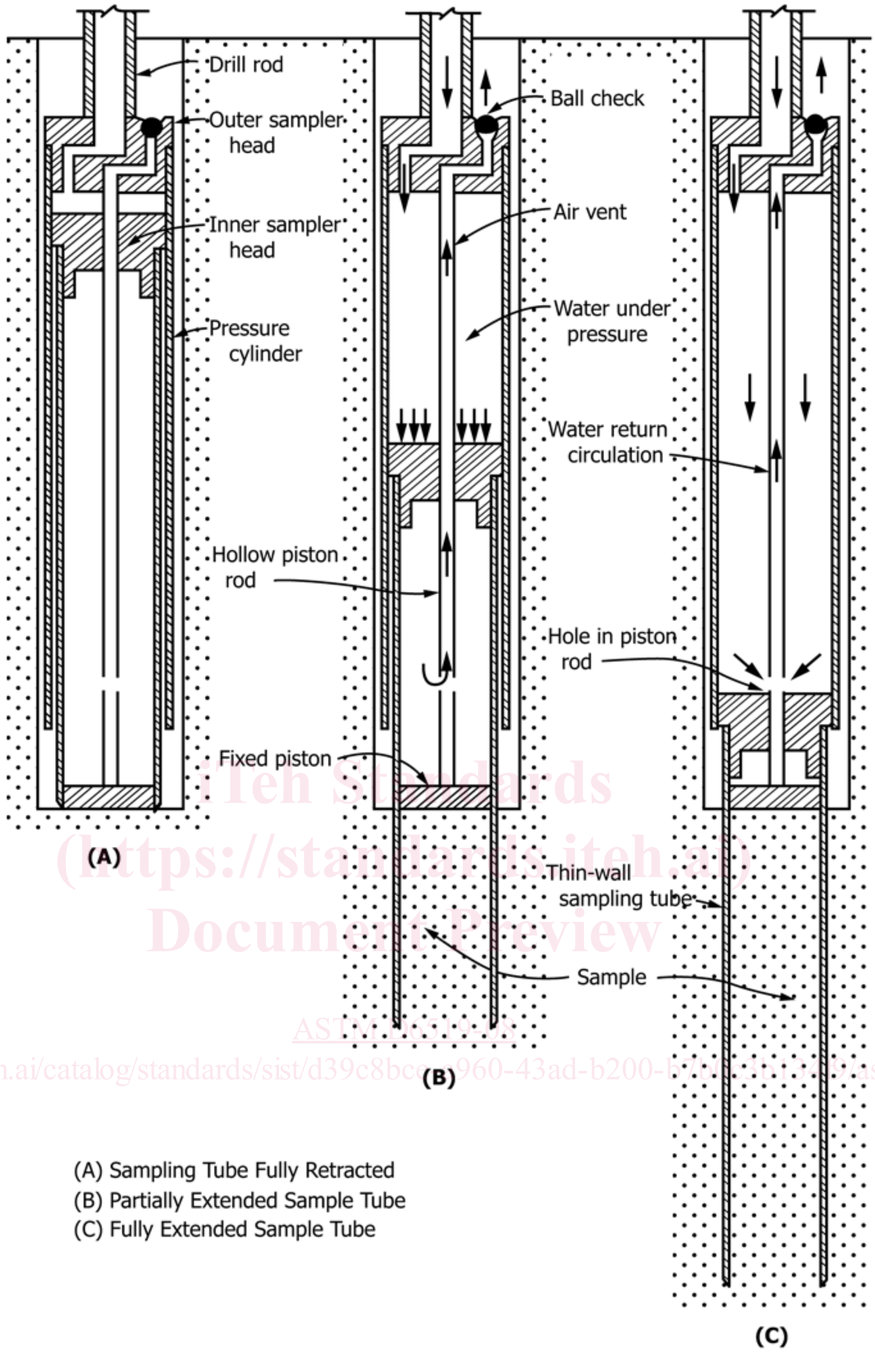

FIG. 1 Sampler in Operation

5.3 The use of this practice may not be the correct method for investigations of softer formations in all cases. As with all sampling methods, subsurface conditions affect the performance of the sample gathering equipment and methods used. For example, research indicates that clean sands may undergo volume changes in the sampling process, due to drainage.[5] The hydraulically activated stationary piston sampler is generally not effective for cohesive formations with unconfined, undrained shear strength in excess of 2.0 tons per square foot, coarse sands, compact gravelly tills containing boulders and cobbles, compacted gravel, cemented soil, or solid rock. These formations may damage the sample or cause refusal to penetration. A small percentage of gravel or gravel cuttings in the base of the borehole can cause the tube to bend and deform, resulting in sample disturbance. Certain cohesive soils, depending on their water content, can create friction on the thin-walled tube which can exceed the hydraulic delivery force. Some rock formations can weather into soft or loose deposits where the hydraulically activated stationary piston sampler may be functional. The absence of groundwater can

[5] Marcosion and Bieganovsky, "Liquefaction Potential of Dams & Foundations, Report 4, Determination of In situ Density of Sands," *Research Report S-76-2,* U.S. Army Engineer Water Way Experimental Station, Vicksburg, MS, 1977.