



Designation: D3550/D3550M – 17

Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils¹

This standard is issued under the fixed designation D3550/D3550M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This practice covers procedure for thick wall, split barrel drive sampling of soil to obtain representative samples of soil for classification and laboratory testing. The sampler is considered to be a thick wall sampler with sharpened cutting shoe and ball check vent. The middle barrel section is split barrel design containing ring liners. The sampler is often driven, but can also be pushed in softer deposits. Penetration resistance data may be recorded. This standard uses procedures similar to Test Method **D1586** on Penetration Resistance and Split Barrel Sampling of Soils. However, in this practice, differing hammer weights, drop heights, and different size samplers are used, so the data must not be reported as conforming to Test Method **D1586** and cannot be used to determine Normalized penetration resistance data for sands in accordance with Practice **D6066**.

1.2 This practice involves use of rotary drilling equipment (Guide **D5783**, Practice **D6151**). Other drilling and sampling procedures (Guide **D6286**, Guide **D6169**) are available and may be more appropriate. Considerations for hand driving or shallow sampling without boreholes are not addressed. Sub-surface explorations should be recorded in accordance with Guide **D5434**. Soil samples should be classified in accordance with Practice **D2488**.

1.3 The soil samples from this test will have some degree of disturbance because the sampler is a driven thick walled sample tube. Table 2 of Guide **D6169** on Soil and Rock Sampling provides guidance for selection of soil samplers for samples that may require intact samples defined by Terminology **D653** for laboratory testing. The degree of disturbance must be evaluated by the user (engineer) to determine the

suitability of the sample for use in laboratory tests. If samples are not suitable for laboratory testing, other soil samplers should be used (see **4.4.1**).

1.4 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

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values shall conform to the guidelines for significant digits and rounding established in Practice **D6026**, unless superseded by this standard.

1.6 *This practice offers an organized collection of information or a series of options and does not recommend a specific course of action. 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 of this document means only that the document has been approved through the ASTM consensus process.*

1.6.1 This practice does not purport to comprehensively address all of the methods and the issues associated with soil sampling. Users should seek qualified professionals for the decisions as to the proper equipment and methods that would be most successful for their site exploration. Other methods may be available for monitoring soil sampling and qualified professionals should have flexibility to exercise judgement as to possible alternatives not covered in this practice.

1.7 *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. The user must comply with prevalent regulatory codes, such as OSHA (Occupational Health and Safety Administration) guidelines while using this*

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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practice. For good safety practice, consult applicable OSHA regulations and other safety guides on drilling.²

1.8 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:³

- D653 Terminology Relating to Soil, Rock, and Contained Fluids
- D1586 Test Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils
- D1587 Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes
- D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)
- D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D4220 Practices for Preserving and Transporting Soil Samples
- D4546 Test Methods for One-Dimensional Swell or Collapse of Soils
- D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock
- 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
- D6026 Practice for Using Significant Digits in Geotechnical Data
- D6066 Practice for Determining the Normalized Penetration Resistance of Sands for Evaluation of Liquefaction Potential
- D6151 Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling
- D6169 Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations
- D6286 Guide for Selection of Drilling Methods for Environmental Site Characterization

3. Terminology

3.1 Definitions:

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

4. Significance and Use

4.1 The thick-wall ring lined drive sampler has been used for over 50 years in the arid southwest regions of the U.S. where unsaturated soils are too difficult to sample using the thin-walled tube (Practice D1587). Variations of the sampler include names such as “Dames and Moore, California, Modified California barrels” with outside barrel diameters ranging from 2.5 to 3.5 in. [60-90 mm].⁴ In addition to the blow count, these drive samplers have the added benefit of having a ring lined specimens that can be evaluated in the laboratory. Versions of the original Dames and Moore type sampler shown in Fig. 1 are still used, but many now use the Diamond Drill Core Manufacturers Association (DCDMA)⁵ specification split barrel drive samplers Fig. 2. The ring lined samplers normally have provisions for a 6-in. [150 mm] waste barrel with or without rings in the top section of the barrel. Drilling in the unsaturated soils is performed almost exclusively with hollow-stem augers (Practice D6151) because it is a dry drilling method. The test can be performed in fluid rotary or other drill holes but use of fluid rotary methods are not recommended in unsaturated soils as the drill fluid may alter the sample properties. Most operators use a 140 lb [75 kg] hammer mass but other hammer masses may be used.

4.2 This practice is used for general soil explorations where samples are required for identification and testing. Disturbed samples can be classified in accordance with Practice D2487 and can be tested for water content, particle size, and Atterberg limits.

4.3 The sampler can be driven with a hammer and the penetration resistance can be recorded. Numerous combinations of hammer size and drop height have been used in practice. Hammer size and drop height should be reported. Users of this practice have derived local correlations of penetration resistance and engineering properties based on local conditions and a particular hammer system and sampler, however, the penetration resistance may differ from Test Method D1586.

4.4 The sampler can be equipped with stacked ring liners, which can be used directly for other laboratory tests. The lab tests are combined with the penetration resistance data, for estimates of soil engineering properties based on engineering experience.

NOTE 1—The most common lab tests are one dimensional consolidation or swell or collapse with wetting, determination of trimmed density, and direct shear testing.

4.4.1 The engineer in charge of the exploration is responsible for evaluating the suitability of the samples for lab testing, evaluating the test result data quality, and for how and what data are to be used in design. If the samples and test

² Drilling Safety Guide, National Drilling Association, 6089 Frantz Rd. Suite 101, Dublin, Ohio, 43017.

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 Problems and Some Solutions in Geotechnical Sampling, H.E. Davis, <http://www.quest-ech.biz/Pages/Geotechnical%20Sampling.htm>

⁵ DCDMA Technical Manual, National Drilling Association, 6089 Frantz Rd. Suite 101, Dublin, Ohio 43017, 1991.