



Designation: D1452/D1452M – 16

Standard Practice for Soil Exploration and Sampling by Auger Borings¹

This standard is issued under the fixed designation D1452/D1452M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

1. Scope*

1.1 This practice covers equipment and procedures for the use of earth augers in shallow depth geotechnical exploration. This practice does not apply to hollow-stem augers. Uses of hollow-stem auger drilling methods for geotechnical exploration are addressed in Test Method D6151. Samples recovered from this standard are considered as belonging to Group A or B in accordance with D4220. The samples are disturbed and can generally be used for classification testing (D2487, D2488), determination of compaction characteristics (D698, D1557), or any other standard that requires bulk samples. For obtaining intact samples use of thin-walled sample tubes (D1587) in conjunction with fluid rotary drilling (D5783) or hollow-stem augers (D6151) may be considered.

1.2 This practice does not include considerations for geoenvironmental site characteristics and installation of monitoring wells which are discussed in Guide D5784.

1.3 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

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values shall conform to the guidelines for significant digits and rounding established in Practice D6026 unless superseded by this method.

1.5 *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.*

1.6 *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 judgment. 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.

1.7 *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:²

- D653 Terminology Relating to Soil, Rock, and Contained Fluids
- D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
- D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
- D1586 Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
- D1587 Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes
- D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D2488 Practice for Description and Identification of Soils (Visual-Manual Procedures)
- D4220 Practices for Preserving and Transporting Soil Samples
- D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock
- D4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation

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 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

Well) (Withdrawn 2010)³

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

D6026 Practice for Using Significant Digits in Geotechnical Data

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

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *cutter bit*—a bit where there are no moving parts, but drilling occurs due to shearing, scraping or abrasion of the rock. Cutter bits can be either polycrystalline diamond compact (PDC) or grit hot-pressed inserts (GHI) or natural diamond.

3.2.2 *pilot bit*—a small bit that drills a first hole to guide a larger drill bit - the cutting part of a drill; usually pointed and replaceable.

4. Significance and Use

4.1 Auger borings often provide the simplest method of soil exploration and sampling. They may be used for any purpose where disturbed samples can be used and are valuable in connection with groundwater level determination and indication of changes in strata and advancement of hole for split-barrel penetration tests and sampling (Test Method D1586) and thin-walled tube sampling (Practice D1587). Equipment required is simple and readily available. Depths of auger explorations are, however, limited by groundwater conditions, soil characteristics, and the equipment used.

5. Apparatus

5.1 Hand-Operated Augers:

5.1.1 *Screw Type Augers*, (Fig. 1) consisting of a flat thin

metal strip, machine twisted to a spiral configuration of uniform pitch; having at one end, a sharpened or hardened point, with a means of attaching a shaft or extension at the opposite end. Small lightweight augers are generally available in sizes from 1 through 3 in. [25 through 75 mm].

5.1.2 *Ship-Type Auger*, (Fig. 2) similar to a carpenter’s wood bit. It is generally forged from steel and machined to the desired size and configuration. It is normally provided with sharpened and hardened nibs at the point end and with an integral shaft extending through its length for attachment of a handle or extension at the opposite end.

5.1.3 *Open Tubular Augers*, (Fig. 3) ranging in size from 1.5 through 8 in. [40 through 200 mm] and having the common characteristic of appearing essentially tubular when viewed from the digging end.

5.1.4 *Barrel Auger Types*, (Fig. 4) the barrel auger is a complete cylinder. The cutting blades are cupped so that soil is loosened and forced into the barrel as the unit is rotated and pushed into the ground. Each filling of the barrel corresponds to a depth of penetration of 3 to 5 in. [75 to 125 mm]. The most popular barrel diameter is 3.5 in. [90 mm], but sizes ranging from 1.5 to 7 in. [40 to 180 mm] are available.

5.1.4.1 *Sand Augers*, (Fig. 4 (c))—For dry, sandy soils it may be necessary to use a variation of the regular barrel auger that includes a specially-formed bit to retain the sample in the barrel. Sand augers with 2, 3, or 4-in. [50, 75, or 100-mm] diameters are available.

5.1.4.2 *Mud Augers*, (Fig. 4 (d))—Another variation on the regular barrel auger design is available for sampling wet, clayey soils. As shown in Fig. 4(d), the barrel is designed with open sides to facilitate extraction of samples. The bits are the same as those used on the regular barrel auger. Mud augers with 2, 3, or 4-in. [50, 75, or 100-mm] diameters are available.

5.1.5 *Post-Hole Augers*, generally 2 through 8 in. [50 through 200 mm], and having in common a means of blocking the escape of soil from the auger.

5.1.5.1 *Iwan Type*, (Fig. 5) consisting of two tubular steel segments, connected at the top to a common member to form a nearly complete tube, but with diametrically opposed openings. It is connected at the bottom by two radial blades pitched

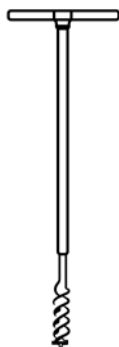


FIG. 1 Screw-Type Auger

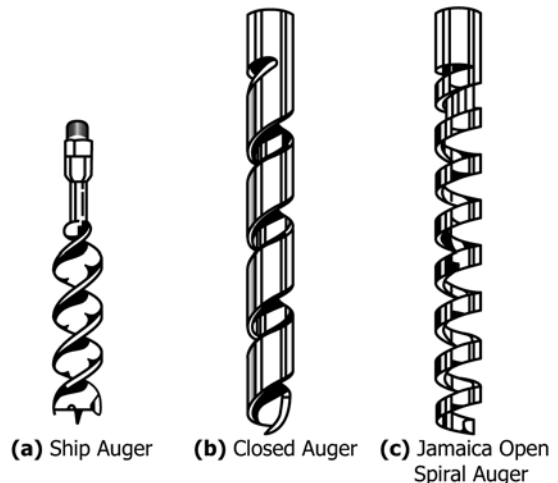


FIG. 2 Ship-Type Auger

³The last approved version of this historical standard is referenced on www.astm.org.

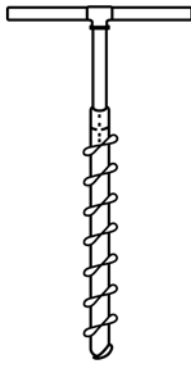
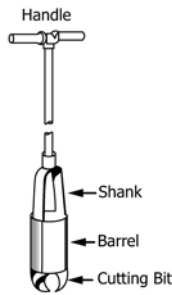


FIG. 3 Open Tubular Auger



(a) Regular Barrel Auger

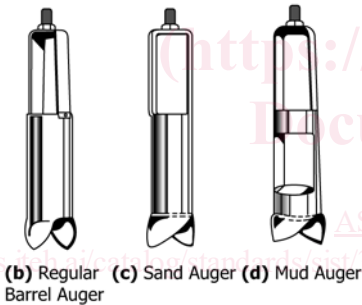


FIG. 4 Barrel Auger Types

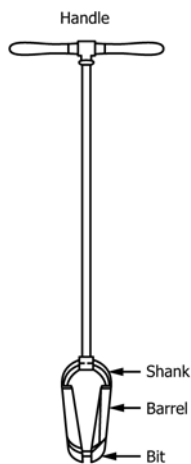


FIG. 5 Iwan-Type Auger

5.1.5.2 *Dutch-Type Augers*, (Fig. 6) is a smaller variation of the post-hole auger design. The pointed bit is continuous with two, narrow part-cylindrical barrel segments, welded onto the shanks. The barrel generally has a 3 in. [75 mm] outside diameter. This tool is best suited for sampling wet, clayey soils.

5.2 *Machine-Operated Augers*—A drill rig is commonly employed to rotate and advance an auger column. The drill rig should be capable of applying the rated power at a rotary velocity of 50 to 100 r/min. The drill rig should have a feed stroke of at least the effective length of the auger sections plus the effective length of the auger couplings.

5.2.1 *Helical Augers*, (Fig. 7) generally 4 through 48 in. [100 through 1200 mm], consisting essentially of a center shaft fitted with a shank or socket for application of power, and having one to six complete 360° [6-rad] spirals for conveyance and storage of cut soil. Cutter bits and pilot bits are available in moderate and hard formation types and normally replaceable in the field. They are normally operated by heavy-duty, high-torque machines, designed for heavy construction work.

5.2.2 *Stinger Augers*, generally 3 through 30 in. [75 through 750 mm], are similar to the helical auger in 5.2.1, but lighter and generally smaller. They are commonly operated by light-duty machines for post and power pole holes.

5.2.3 *Disk Augers*, (Fig. 8) generally 10 through 30 in. [250 through 750 mm], consisting essentially of a flat, steel disk with diametrically opposed segments removed and having a shank or socket located centrally for application of power. Replaceable cutter bits, located downward from the leading edges of the remaining disk, dig and load soil that is held on the disk by valves or shutters hinged at the disk in order to close the removed segments. The disk auger is specifically designed to be operated by machines having limited vertical clearance between spindle and ground surface.

5.2.4 *Bucket Auger*, (Fig. 9) shows various types of bucket augers, generally 12 through 48 in. [300 through 1200 mm], consisting essentially of a disk auger, without shank or socket, but hinge-mounted to the bottom of a steel tube or bucket of approximately the same diameter as the disk auger. A socket or shank for power application is located in the top center of the bucket diametral cross piece provided for the purpose.



FIG. 6 Dutch-Type Auger

to serve as cutters which also block the escape of contained soil. Attachment of handle or extension is at the top connector.