Designation: D6907 – 05 (Reapproved 2016)

Standard Practice for Sampling Soils and Contaminated Media with Hand-Operated Bucket Augers[1]

This standard is issued under the fixed designation D6907; 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 the procedures and equipment used to collect surface and subsurface soil and contaminated media samples for chemical analysis using a hand-operated bucket auger (hereafter referred to as a bucket auger; sometimes referred to as a barrel auger). Several types of bucket augers exist and are designed for sampling various types of soil. All bucket augers collect disturbed samples, but bucket augers can also be used to auger to the desired sampling depth and then, using a core-type sampler, collect a relatively undisturbed sample.

1.2 This practice does not cover the use of large (12-in. or greater diameter) bucket augers mechanically operated by large drill rigs or similar equipment, such as those described in Practice D1452, section 3.2.4.

1.3 The term bucket auger is used to differentiate this type of hand operated auger from others of the solid or hollow stem types that are also hand held or operated.

1.4 This practice does not address sampling objectives (see Practice D5792), general sample planning (see Guide D4687), sampling design (for example, where to collect samples and what depth to sample [see Guide D6044]), sampling for volatile organic compounds (see Guide D4547), equipment cleaning and decontamination (see Practice D5088), sample handling after collection such as compositing and subsampling (see Guide D6051), and sample preservation. For information on other types of augers, see Practice D1452 and Guide D4700.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1452 Practice for Soil Exploration and Sampling by Auger Borings
D4547 Guide for Sampling Waste and Soils for Volatile Organic Compounds
D4687 Guide for General Planning of Waste Sampling
D4700 Guide for Soil Sampling from the Vadose Zone
D5088 Practice for Decontamination of Field Equipment Used at Waste Sites
D5283 Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation
D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock
D5681 Terminology for Waste and Waste Management
D5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
D6044 Guide for Representative Sampling for Management of Waste and Contaminated Media
D6051 Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities
D6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities
D6282 Guide for Direct Push Soil Sampling for Environmental Site Characterizations
D6286 Guide for Selection of Drilling Methods for Environmental Site Characterization

3. Terminology

3.1 *Definitions*—Except where noted, all terms and symbols in this practice are in accordance with the following publications. In order of consideration they are:

3.1.1 Terminology D5681 for Waste and Waste Management,

3.1.2 Compilation of ASTM Standard Terminology, and

[1] This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.03 on Sampling Equipment.

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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.

3.1.3 Webster's New Collegiate Dictionary.

4. Summary of Practice

4.1 Typically, bucket augers are tubular devices with cutting bits on the bottom that are pushed and twisted into the media and removed when the tubular "bucket" section is full. The borehole is advanced one bucket at a time. The practical depth of investigation using a bucket auger is related to the material being sampled.

4.2 When a sampling interval starting at the surface is to be sampled, the same auger can be used to collect all materials to the bottom of the interval. However, if discrete grab samples are to be collected to characterize multiple depths or a depth interval commences below the surface, a clean bucket auger should be used to collect the sample. The top material in a bucket should generally be discarded to minimize chances of cross-contamination of the sample from material that sloughs from the borehole wall.

4.3 All augers collect disturbed samples that are generally not suitable for analysis of volatile organic compounds.

NOTE 1—Bucket augers may be used to obtain samples of materials containing volatile organic compounds for field screening purposes. A core or tube type sampler can be pushed into undisturbed soil at the bottom of an augered hole to collect a relatively undisturbed sample suitable for chemical analysis.

5. Significance and Use

5.1 Bucket augers are relatively inexpensive, readily available, available in different types depending on the media to be sampled, and most can be easily operated by one person. They collect a reasonably cylindrical but disturbed sample of surface or subsurface soil or waste. They are generally not suited for sampling gravelly or coarser soil and are unsuitable for sampling rock.

5.2 Bucket augers are commonly used equipment because they are inexpensive to operate, especially compared to powered equipment (that is, direct push and drill rigs). When evaluated against screw augers, bucket augers generally collect larger samples with less chance of mixing with soil from shallow depths because the sample is retained within the auger barrel. Bucket augers are commonly used to depths of 3 m but have been used to much greater depths depending upon the soil or waste characteristics. The sampling depth is limited by the force required to rotate the auger and the depth at which the borehole collapses (unless bore casings or liners are used).

5.3 Bucket augers may not be suitable for the collection of samples for determination of volatile organic compounds because the sample is disturbed during the collection process, which may lead to losses resulting in a chemically unrepresentative sample.

6. Apparatus

6.1 *Bucket Augers:*

6.1.1 Bucket augers for soil sampling generally consist of a tubular auger head with cutting bits, an extension rod or rods, and a "T" handle (see Fig. 1). The auger is rotated using the "T" handle until the bucket is full, the device retrieved and emptied, and the process repeated.

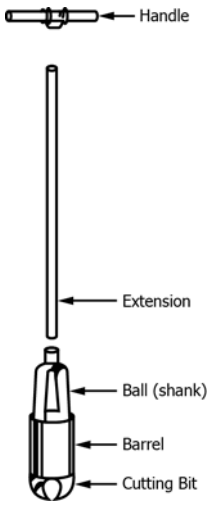

FIG. 1 Bucket Auger

6.1.2 The advantages and disadvantages of bucket augers are listed in Table 1.

6.1.3 Bucket augers are generally available with tungsten carbide hard surface carbon steel bits, stainless steel cylinder and carbon steel bail (shank), or in all stainless steel (see Fig. 1). Several types of bucket augers are described below. In use, bits should be kept sharp for efficient sampling.

6.1.4 *Regular Bucket Auger*—Used for ordinary soil and waste sampling and for creating a pilot hole from which subsequent undisturbed core samples can be collected at depth using a core sampler. (See Fig. 2a).

6.1.5 *Sand Bucket Auger*—Designed for use in extremely dry, sandy soils. The bits are specially formed to retain loose sand by being close together (see Fig. 2b).

6.1.6 *Mud Bucket Auger*—Features an open cylinder design to facilitate easier removal of heavy, wet soil or clayey soil samples. Bits are spaced further apart than the regular auger to ease entry of sticky soils (see Fig. 2c).

TABLE 1 Advantages and Disadvantages of Bucket Augers

Advantages	Disadvantages
1. Inexpensive to purchase and operate. 2. Readily available. 3. Operable by one or two people. 4. Available in a variety of types suitable for a wide variety of soil types. 5. Larger volumes of soil obtained compared to hand-held tube samplers. 6. Collect a reasonably cylindrical (representative) sample. 7. Depending upon soil characteristics and the auger, samples may be collected at depths of >3 m or more.	1. Samples from lower depths can be contaminated by cave-in or sloughing of bore walls. 2. Samples are disturbed so it is difficult to generate an accurate soil profile. 3. Samples are generally not suitable for quantitative determination of volatile organic compounds due to disturbance. 4. Sampling depth generally limited to 1-2 m. 5. Metal from bucket augers may contaminate samples (stainless preferred for trace element sampling. 6. Extraction of samples from closed bucket types is cumbersome, and decontamination more difficult than for screw augers. 7. Sampling in or below a water table is difficult.

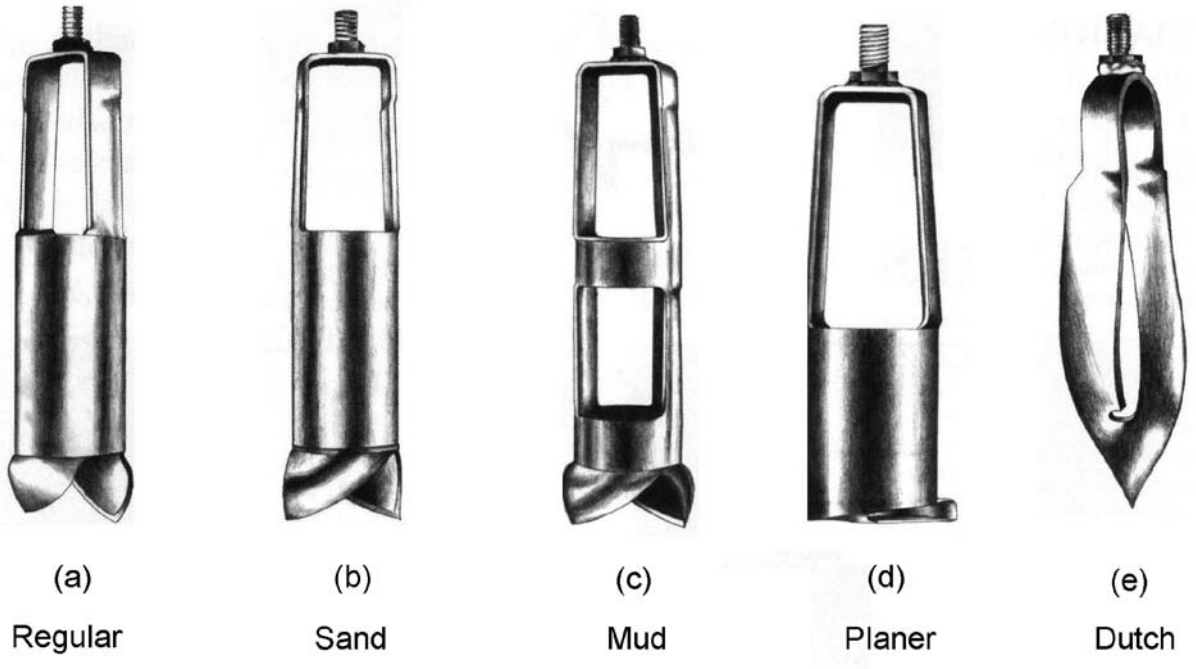

FIG. 2 Bucket Auger Types

6.1.7 *The Planer Auger*—Used to remove loose material from the bottom of an augered hole, prior to core sampling. It may also be used to collect samples of solid materials from the bottom of drums and tanks (see Fig. 2d).

6.1.8 *Dutch Auger*—Designed to make it an excellent tool for collection of samples in heavily rooted, fibrous or swampy areas (see Fig. 2e).

6.1.9 *Other*—Other types of augers include the Eijkelkamp Stony Auger for gravelly soils, the Post-Hole or Iwan Auger for cohesive soft or hard soils, and augers with reusable liners and closed tops to reduce contamination from sloughing sidewalls.

7. Presampling

7.1 Samples should be collected in accordance with an appropriate work plan (see Practice D5283 and Guide D4687) and in accordance with the Data Quality Objectives (see Practice D5792). The plan should include a worker health and safety plan and safety section due to the hazards of sampling contaminated media.

7.2 Field personnel should be trained or be knowledgeable in the sampling procedures.

7.3 The type of auger(s) needed for sampling the site should be determined and obtained; see 6.1 through 6.1.9 for available types. All needed equipment and supplies (including pre-cleaned sample containers suitable for the analytes of interest) should be assembled and transported to the field site before sampling commences. Multiple augers should be taken to the site if field decontamination between sampling events is not planned.

7.4 Sampling equipment should be cleaned prior to sampling (see Practice D5088).

7.5 Schedules should be prepared to coordinate sampling with staff, client, analytical laboratory, and regulatory agencies, if appropriate.

7.6 A general site survey should be performed prior to site entry in accordance with the site-specific health and safety plan.

7.7 Sampling locations should be marked as specified in the work plan. If required, sampling locations may be adjusted and the changes recorded in the field logbook. All sampling locations should be checked for subsurface utilities prior to sampling.

8. Procedure[3]

8.1 Record all relevant information and observations about the sample location.

8.2 Clear the area to be sampled of any surface debris (for example, twigs, rocks, and litter). It may be advisable to remove the first several centimeters of surface material (unless surface material is desired) within a radius of approximately 15 cm of the drilling location.

8.3 Begin augering by rotating the "T" handle in a clockwise direction while pressing the auger into the soil. When the bucket is full remove and deposit accumulated waste onto a plastic sheet or tarp spread a short distance from the hole. This facilitates refilling the borehole (if allowed), and it avoids possible contamination of the surrounding area. If surface soil is to be sampled, the auger is advanced to the desired depth and

[3] Compendium of ERT Soil Sampling and Subsurface Geophysics Procedures, EPA /540/P/91/006, SOP 2012, US EPA, 1991.

the cuttings deposited in a sample container or suitable container for subsampling (see Guide D6051).

8.4 If disturbed subsurface samples are to be collected, auger to the top of the desired depth interval and carefully remove the auger. Carefully insert a clean auger, rotate the auger to collect the sample, and carefully remove auger to minimize contamination of the sample with borehole wall material. Place the cuttings in a sample container or a container for subsampling. If sampling directly from the auger, discard the upper portion of the sample that may contain material that sloughed from the borehole wall. If a composite sample is to be collected, continue the process to the bottom of the desired interval. Representatively subsample the soil or waste (see Guide D6051) and place the sample(s) in a suitable container(s). Label and preserve all samples as appropriate, record the sampling activity, and transport the samples to the laboratory for analysis.

8.5 Casing is required in unstable soils where the borehole collapses. The inside diameter of the casing must be slightly larger than the diameter of the auger being used. The casing is driven to a depth not greater than the top of the next sample and material inside the casing is removed with the auger. The auger can then be inserted into the borehole and turned below the bottom of the casing to obtain a sample or extend the borehole. If deep cased holes are necessary it may be better to consider other mechanical drilling (see Guide D6286) or direct push methods (see Guide D6282).

8.6 If undisturbed subsurface samples are desired, auger to the top of the interval to be sampled and carefully remove the auger. A planer auger can then be used to clean and level the bottom of the borehole. Lower a clean core-type sampler (see D6232 for information on core samplers) to the bottom of the borehole without touching the borehole wall and gradually force the core tube into the soil or waste. Remove the sampler from the borehole, extrude and discard the apparently unrepresentative material or the top 2.5 cm of the core (this may represent material collected before penetration of the layer of interest), and extrude the remaining core into a sample container. Label the sample, preserve as necessary, and transport for analysis. For samples to be analyzed for volatile organic compounds, see the special sampling instructions in Guide D4547.

8.7 Decontaminate the auger and other equipment in accordance with the protocol specified in the work plan (see Practice D5088) before collecting the next sample and after the last sample is collected.

8.8 Generally, shallow holes can be backfilled by hand tamping with the removed material but local and state regulations may require the boreholes to be filled with clean material. Clean materials commonly used include bentonite, cement, or clean fill from a non-contaminated area.

9. Report

9.1 The data obtained shall be recorded in the field logbook (see Guide D4687 and Guide D5434).

10. Keywords

10.1 auger; barrel auger; bucket auger; environmental; sampling; sampling equipment; soil; soil sampling; waste; waste management