

Introduction

Soil augers and samplers are used in forestry, environmental and agricultural applications, but are not limited to these uses. This equipment is commonly used for obtaining samples at or near the surface. With the use of extensions, augers have the capability to reach depths of up to 15 ft. However, it is recommended to use a power auger for depths greater than 5 ft. Augers can be used for sampling when there is not a need for a clean or undisturbed sample. Generally, augers are used to bore to a depth where a sample is to be obtained using a soil sampler or core sampler.

Augers

Hand-operated augers are made from several materials including steel, aluminum, stainless steel, brass and even wood. The auger material selected should not interfere with the tests that need to be completed on the samples. For example, galvanized and brass materials should never be used when agricultural samples are being tested for nutrient levels, since they can contaminate the sample with micronutrients and contribute to false test results. Using dirty and rusted equipment will also affect your results. Always clean your equipment after each use to prevent cross contamination and rusting.

To use a hand auger, you will need a handle, rod and auger head that is best suited to your soil type and protocol. Extensions will also be needed for greater depths. For very shallow augering, one-piece augers are also available. The auger tip drills into the ground as the handle is turned in a clockwise rotation. Soil is forced into and retained in the auger to be brought to the surface and emptied. Carefully replace the auger in the hole and repeat the process until the desired depth is reached. Soil augers are simple in design, but considerable skill is required to use them efficiently and safely. Use of leg muscles, as opposed to back muscles, when pulling the auger from the hole will help avoid serious back injuries. Twisting will also help break the auger free of the soil during removal. Rotation should again be in a clockwise direction to prevent separation of auger head from extension and/or handle.

There are a wide variety of auger heads available in the world market today; each designed for use in particular soil types. There are three basic designs for standard augering as well as several special designs for very specific situations. Auger heads can be changed as different soil types are encountered.



Screw Auger: Also called the spiral auger. Used in very cohesive, soft or hard soils. This type of auger cannot be used in very dry or sandy soils since these soil types will not adhere to the bit. Good for boring holes quickly, but more difficult to remove from the hole.



Dutch Auger: Also commonly known as the Edelman auger, this is designed for wet, clay, high fibrous, heavily rooted swampy areas, and extremely wet boggy soil. Like the screw auger, the Dutch auger does not work well in dry, sandy or less cohesive soils. A sand version is available where the blades are much wider and closer together to help capture the loose material, but a bucket auger can retain this material with greater ease.



Bucket Auger: Known by several names, including barrel, orchard, post-hole and core auger, they are made of a cylinder or barrel to hold the soil, which is forced into the barrel by the cutting lips. Bucket augers work well in most soil conditions. Therefore, it is considered the most universal auger. These augers are available with different tips designed for specific soil types, such as mud and sand. The sand auger tips are formed to touch in order to hold the very dry and sandy soils. Tips of the mud auger are spaced further apart than the regular soil bucket to allow for easier removal of heavy, wet soil and clay. These also have an opening in the cylinder for removal of the cohesive soils. Bucket augers bore more slowly than the screw and Dutch but are easier to remove from the hole and can provide a semi undisturbed sample.



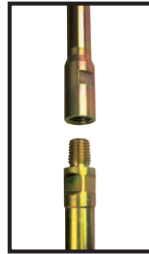
Planer Auger: Similar to the bucket auger with its cylinder shape, but designed to flatten and clean out the bottom of the pre-drilled hole in preparation for core sampler to obtain a quality undisturbed sample.



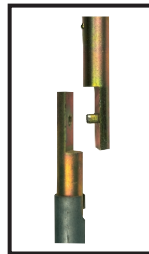
Stony Soil Auger: Available from Eijkelkamp. Used in stony soils, gravely soils containing small stones and asphalt.



Stone Catcher: Also from Eijkelkamp. Used to remove larger rocks from auger hole so that boring can be continued with another auger. Also good for very hard, rigid soils such as iron pans, chalk and lime profiles.



Threaded: Sometimes referred to as the conical screw. When using extension rods, the threaded connection will give a firmer, more stable connection. The conical screw is better in hard soils or when hammering or jarring is required. Clockwise rotation when both augering and removing auger from the hole is always used to prevent unscrewing of connections. This type has the largest amount of design differences throughout the industry. Each manufacturer has its own numbers of threads per inch, diameter of connection, and varies between National Course and Tapered threading amongst others. It should never be assumed that one manufacturer's thread would work with another's.



Bayonet: Two parts to be joined are clamped into each other, then a coupling sleeve is slid across the connection and rotated until it locks in place. Bayonet style provides an easy connection and disconnection without the use of tools. Clockwise rotation should always be used with this type to prevent disconnection.



Quick Connect: Allows for both right- and left-handed (clockwise and counter clockwise) rotation without the possibility of disconnection. Allows for easy connection and disconnection without the need for tools. The positive locking spring-loaded pin simply snaps into place.



Pin Lock: Can be rotated both left- and right-handed without the possibility of separation. Easy to quickly change the auger head or add extensions without the need for tools. The Gopher auger system utilizes the SquareLink connection with the handle securely fitting inside the square tube connection and held in position with a pin.

When the auger rotates during sampling, the stress is not on the pin but is handled by the strong SquareLink connection. This design eliminates the number of bent or broken pins that sometimes occurs with other pin lock connection systems.

Soil Samplers

When your protocol requires the collection of a virtually undisturbed sample from the surface or bottom of a pre-drilled hole, a soil sampler or core sampler should be used. Samplers are most frequently used with an inner retaining cylinder or liner to allow easy transfer of the sample to the laboratory. Choosing the liner material depends again on the tests that will be completed on the sample. Checking the protocol or contacting the testing laboratory for suggested sampling and transfer material is recommended.

Samplers are available in various lengths and diameters. Like augers, samplers are available in different materials, most commonly carbon steel and stainless steel. Special tools are available to assist with deeper sampling, such as the slide hammer and mallets. These should only be used with threaded connections, since the pins and pegs of other connections will break off under the stress of repetitive pounding and force.

Connection Types

There are four basic connections used by manufacturers today. Among these basic styles each manufacturer may also have several sizes and shapes available for each connection type.

Since there is such a wide variety of connections and sizes, interchangeability among manufacturers is generally not possible. Some manufacturers have adaptors available within their product lines but not to other manufacturers. Art's Manufacturing Supply (AMS) does have a few adaptors available to competitors connections. The four basic connection types are:

Materials

The most common material used in the manufacturing of augers is high carbon steel. Due to its strength, it is widely used to forge the bits of hand augers and, in the case of bucket augers, attached to a stainless steel cylinder. An all stainless steel auger is also available from most manufacturers, which should be used when sampling for

low-toxicity or low-level contaminants and when an acid bath decontamination procedure is required. For EPA testing, this would be the ideal choice. Stainless steel is not as hard as other steels. Therefore, it has a higher tendency to bend and dent. Great care should be used when using and transporting these augers to extend the life of the auger. Eijkelkamp, the Dutch manufacturer, forges its augers from iron-manganese steel. The company has carried out extensive studies on its equipment in respect to trace metal analysis to be completed on the soil samples taken. It has shown that the iron-manganese steel used to make its hand-forged augers is one of the toughest steel types available. Iron-manganese does contain a good trace of vanadium, but there is seldom environmental interest in this trace metal. Although steel is much harder, it cannot compare with the chemical stability of stainless steel. Aluminum is also used, but is the weakest of the metals and is not suggested for most augering needs. However, some procedures may require its use. Finally, wood augers can also be used. Screw augers are generally the only augers made from wood. Wood should only be used in very soft soil and is usually used as a hole borer for planting and watering purposes. Like all equipment used for soil sampling and testing, selection of material depends heavily on the testing to be completed. Always refer to the protocol to be followed and the recommendations of the Standardization Institute, such as ASTM and NNI.

Liners

Liners are used in conjunction with soil samplers or core samplers. The use of a liner will minimize contamination of the sample being studied and provide for easy transfer to the laboratory. Liners are available in a wide variety of materials. The most commonly used are plastic liners made of PETG, butyrate, Teflon or acetate. Some manufacturers also have available liners made of brass, aluminum and stainless steel. Choosing the proper liner to use will depend on the tests that will be performed on the sample. Check the protocol to be followed or contact the testing laboratory for recommendations.

Common Questions

- Q.** I am trying to obtain a core sample in sand but cannot keep the sand in the sampler when I remove it from the ground. Is there a way to prevent this?
- A.** Yes, AMS does have a core catcher designed specifically for this purpose. It can be used with any core sampler that accepts a 2'-dia. liner. After entering the sampler through the core catcher, the weight of the sample closes the catcher as it is raised, trapping the sample

inside. Can be reused for approximately 20-60 samples.

- Q.** The bits on my auger are very worn and bent, making it increasingly difficult to auger. Can these be fixed?
- A.** Yes, depending on the manufacturer, some will replace the bits for you for a minimal charge.
- Q.** How long of a continuous core sample can I collect?
- A.** Samplers are available in various lengths ranging from 2-12". As many 12" extensions may be connected to obtain a continuous core as needed. The maximum the sampler can be expected to penetrate is 6 ft. in depth with 3 ft. being more the norm.

Sources For More Information

www.ams-samplers.com

www.eijkelkamp.com

www.frtr.gov/site/4_1_2.html

ASTM Standards:

D1452-80 Practice for Soil Investigation and Sampling by Auger Borings

D4700-91 Soil Sampling from the Vadose Zone

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