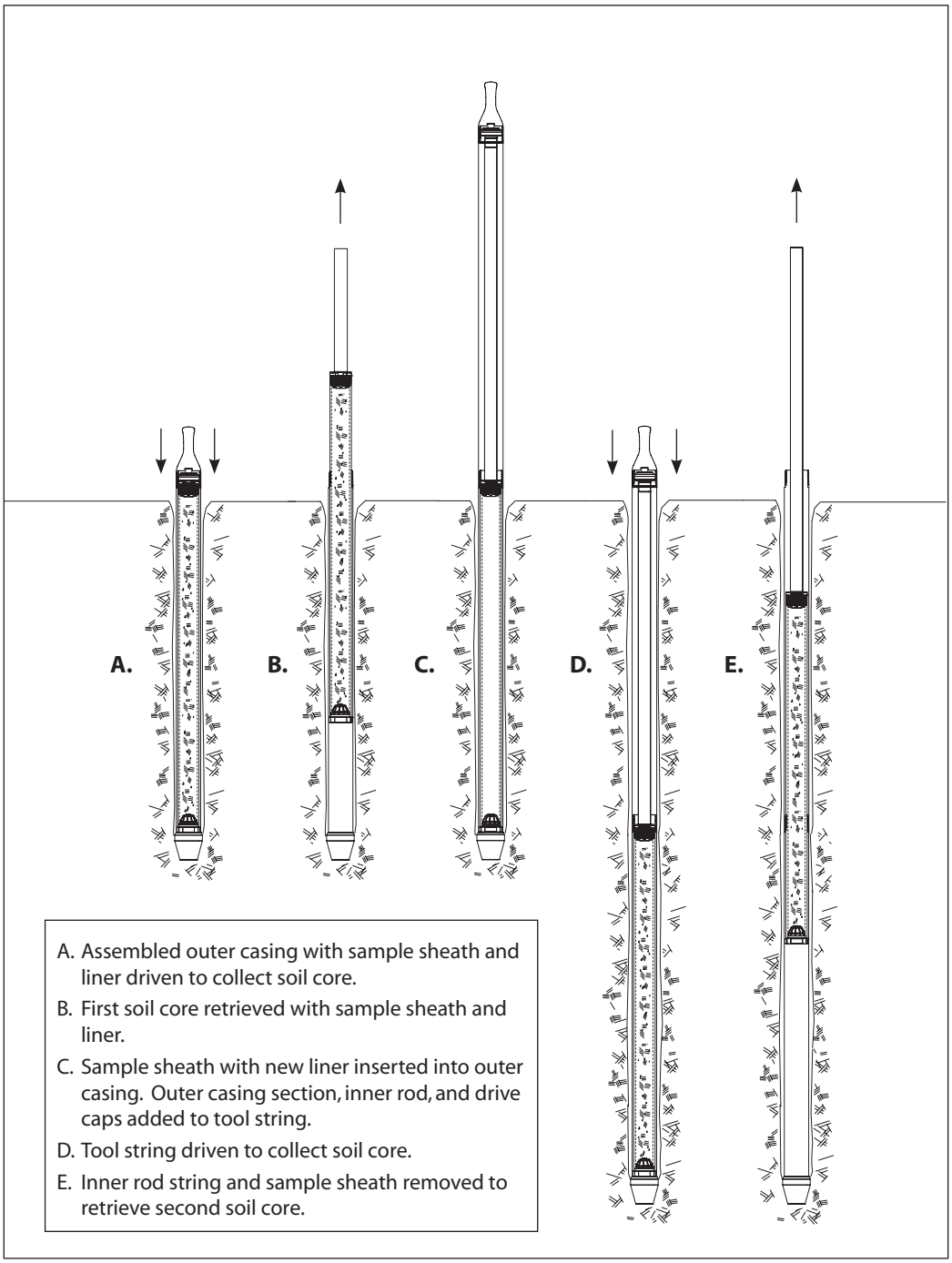
GEOPROBE® DT45 DUAL TUBE SAMPLING SYSTEM

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3176

PREPARED: July, 2010



A. Assembled outer casing with sample sheath and liner driven to collect soil core.
B. First soil core retrieved with sample sheath and liner.
C. Sample sheath with new liner inserted into outer casing. Outer casing section, inner rod, and drive caps added to tool string.
D. Tool string driven to collect soil core.
E. Inner rod string and sample sheath removed to retrieve second soil core.

Collecting soil cores with the DT45 Dual Tube Sampling System.

1.0 Objective

The objective of this procedure is to collect a representative soil sample at depth through an enclosed casing and recover it for visual inspection and/or chemical analysis.

2.0 Background

2.1 Definitions

Geoprobe®*: A brand name of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and testing, soil conductivity and contaminant logging, grouting, and materials injection.

**Geoprobe® and Geoprobe Systems® are registered trademarks of Kejr, Inc., Salina, Kansas.*

DT45 Dual Tube Sampling System: A direct push system for collecting continuous core samples of unconsolidated materials from within a sealed casing of Geoprobe® 4.5-inch (114 mm) OD probe rods. Samples are collected and retrieved within a sample sheath and liner that is threaded onto the leading end of a string of Geoprobe® 2.25-inch (57 mm) OD, or 1.25-inch (32 mm) OD probe rods and inserted to the bottom of the outer casing. Collected samples measure up to approximately 7 liters in volume in the form of a 3-inch x 60-inch (76 mm x 1524 mm) core when using common equipment options.

Liner: A 3.0-inch (76 mm) ID , PETG tube that is inserted into the outer casing on the leading end of the inner rod string for the purpose of containing and retrieving core samples. Liners are available in a simple open tube. Nominal liner lengths are 72, 60, or 48 inches and 1 meter.

***Nominal liner length identifies the length of tools with which the liner is used. The actual end-to-end lengths of the various DT45 liners will differ from the specified nominal lengths.*

Core Catcher: A dome-shaped device positioned at the leading end of a liner to prevent loss of collected soil during retrieval of the liner and soil core. Flexible fingers at the top of the core catcher are pushed outward by soil entering the liner during advancement of the tool string. As the filled liner is subsequently retrieved, the fingers of the core catcher move back inward, effectively closing off the end of the liner and limiting soil loss.

2.2 Discussion

Dual tube sampling gets its name from the fact that two sets of probe rods are used to retrieve continuous soil core samples from the subsurface. One set of rods is driven into the ground as an outer casing (Fig. 2.1). These rods receive the driving force from the hammer and provide a sealed casing through which soil samples may be recovered. The second, smaller set of rods are placed inside the outer casing with a sample liner attached to the leading end of the rod string (Fig. 2.1). These smaller rods hold the liner in place as the outer casing is driven to fill the liner with soil. The inner rods are then retracted to retrieve the full liner.

Standard Geoprobe® 4.5-inch OD probe rods provide the outer casing for the DT45 Dual Tube Soil Sampling System. A cutting shoe is threaded into the leading end of the rod string. When driven into the subsurface, the cutting shoe shears a 3-inch (76 mm) OD soil core which is collected inside the casing in a clear plastic liner.

The second set of rods in the DT45 dual tube system are Geoprobe® 2.25-inch OD, or 1.25-inch OD probe rods. A sample sheath with PETG liner is attached to the end of these smaller rods and then inserted into the casing. The inner probe rods hold the sample sheath tight against the cutting shoe as the outer casing is driven to collect the soil core. Once filled with soil, the sample sheath and liner are removed from the bottom of the outer casing by lifting out the inner rod string.

The outer, 4.5-inch probe rods provide a cased hole through which to sample. The main advantage of sampling through a cased hole is that there is no side slough to contend with. In addition, the outer casing effectively seals the probe hole when sampling through perched water tables. These factors mean that sample cross-contamination is eliminated. The DT45 sampling system is therefore ideal for continuous coring in both saturated and unsaturated zones.

DT45 Discrete Point Drive Tip

A DT45 Discrete Point (34086) can be placed on the leading end of the inner rod string in place of a sample sheath and liner (Fig. 2.2). When installed in the outer casing, the DT45 Discrete Point firmly seats within the cutting shoe and effectively seals the tool string as it is driven into the subsurface. This enables the operator to advance the outer casing to the bottom of a pre-cored hole or through undisturbed soil to reach the top of the sampling interval. The DT45 Discrete Point Drive Tip can only be used with 2.25-inch inner rods.

Grouting

The DT45 system allows bottom-up grouting through the primary tool string. This means that a cement or bentonite grout mix can be pumped through the outer casing as it is withdrawn from the ground. This is in contrast to most other soil samplers which require driving a second set of tools back down the probe hole in order to deliver the grout mix.

Monitoring Well Installation

An expendable cutting shoe enables the operator to install a Geoprobe® prepacked screen monitoring well through the outer casing of the DT45 Dual Tube System. After the collection of continuous soil cores to the desired depth, prepacked screens can be inserted to the bottom of the outer casing on the leading end of a PVC riser string. The well is finished, complete with grout barrier, bentonite well seal, and a high-solids bentonite slurry/neat cement grout, during retrieval of the outer casing.

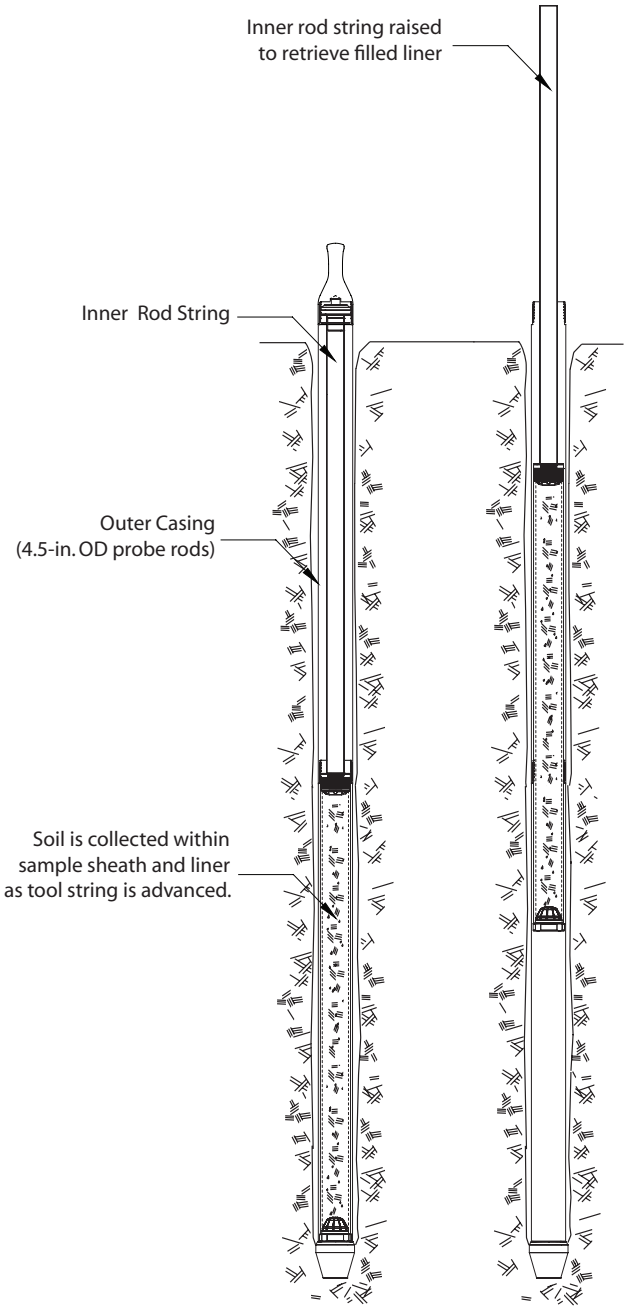


Figure 2.1
Outer casing driven with sample sheath and liner.

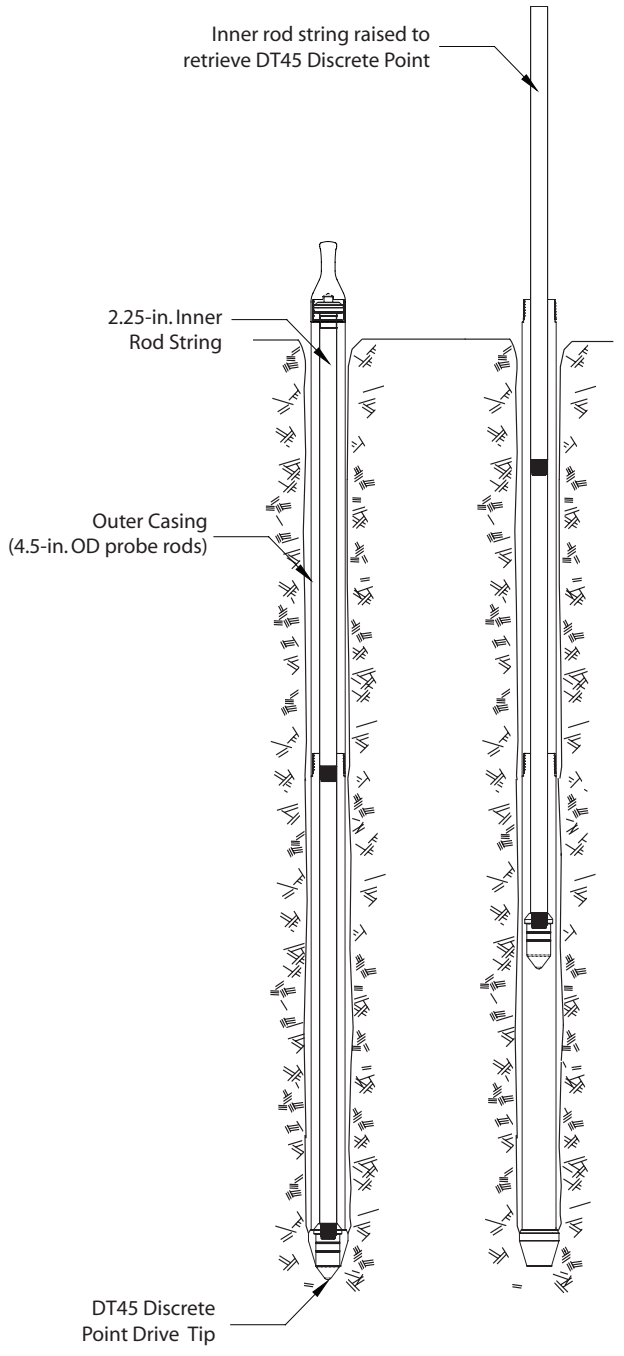


Figure 2.2
Outer casing driven with DT45 Discrete Point.*

3.0 Tools and Equipment

The following equipment is required to operate the DT45 Dual Tube Sampling System. Refer to Figure 3.1 for identification of the specified parts.

DT45 Sampler Parts*	Quantity	Part Number
DT45 Drive Head, 2.25-in. box	-1-	32335
DT45 Drive Head, 1.25-in. box	-1-	30289
DT45 Buffering Drive Cap, 2.25-inch rod	-1-	32694
DT45 Buffering Drive Cap, 1.25-inch rod	-1-	32693
DT45 Centering Drive Cap, 2.25-in. rods	-1-	32381
DT45 Centering Drive Cap, 1.25-in. rods	-1-	32381
DT45 Sample Sheath, 72-in. length	-1-	30252
DT45 Sample Sheath, 60-in. length	-1-	30250
DT45 Sample Sheath, 48-in. length	-1-	30248
DT45 Sample Sheath, 1-m length	-1-	34081
DT45 Cutting Shoe	-1-	30450
DT45 Expendable Cutting Shoe Holder	-1-	32940
DT45 Expendable Cutting Shoe	-1-	34887
DT45 Discrete Point, 2.25-in. rod	-1-	34086
Replacement O-rings for DT45 Discrete Point, Pkg. of 25	Variable	22313
DT45 Liner Retainer	-1-	32349
DT45 Liner Retainer Wrench	-1-	30302

DT45 Liners and Accessories	Quantity	Part Number
DT45 Liner Spacer PETG, pkg. of 36	Variable	32526
DT45 Liner Spacer Connector	-1-	30436
DT45 PETG Liner, 72-in. length, box of 18	Variable	32564
DT45 PETG Liner, 60-in. length, box of 18	Variable	30527
DT45 PETG Liner, 48-in. length, box of 18	Variable	32700
DT45 PETG Liner, 1-m length, box of 18	Variable	34080
DT45 Core Catcher	-1-	34454
DT45 Liner Cutter	-1-	34340
Universal Liner Holder	-1-	22734

Probe Rods and Accessories*	Quantity	Part Number
GH60 Threadless Drive Cap, 4.5-in. rods	-1-	26622
Pull Cap, 4.5-in. rods	-1-	37343
Swivel Pull Cap, 4.5-in. rods	-1-	29502
Rod Grip Handle Assembly GH60 Series, 4.5-in. rods	-1-	31909
Probe Rod, 4.5-in. OD x 60-in. length	Variable	28887
Probe Rod, 4.5-in. OD x 48-in. length	Variable	25404
Probe Rod, 4.5-in. OD x 1-m length	Variable	34008
Probe Rod, 4.5-in. OD x 24-in. length	-1-	31865
Pull Cap, 1.25-in. rods	-1-	AT1204
Probe Rod, 2.25-in. OD x 60-in. length**	Variable	25301
Probe Rod, 2.25-in. OD x 48-in. length**	Variable	25300
Probe Rod, 2.25-in. OD x 1-m length**	Variable	25352
Probe Rod, 1.25-in. OD x 60-in. length	Variable	AT1260
Probe Rod, 1.25-in. OD x 48-in. length	Variable	AT1248
Probe Rod, 1.25-in. OD x 1-m length	Variable	AT1239
1.25-in. Leaf Puller	-1-	31499
2.25-in. Leaf Puller	-1-	32952

Optional Accessories	Quantity	Part Number
DT45 Adapter for Hydraulic Liner Extruder	-1-	32942
DT45 Plunger for Hydraulic Liner Extruder	-1-	31611
Rod Grip Handle, GH60 Hammer, 4.5-in. rods	-1-	31909
Rod Wiper Donuts, 4.5-in. Rods	-1-	29976
Rod Wiper Weldment	-1-	23633

* Select DT45 Sample Sheath and liner lengths to match length of probe rods.

** 1.25-inch OD probe rods may be substituted for 2.25-inch probe rods.

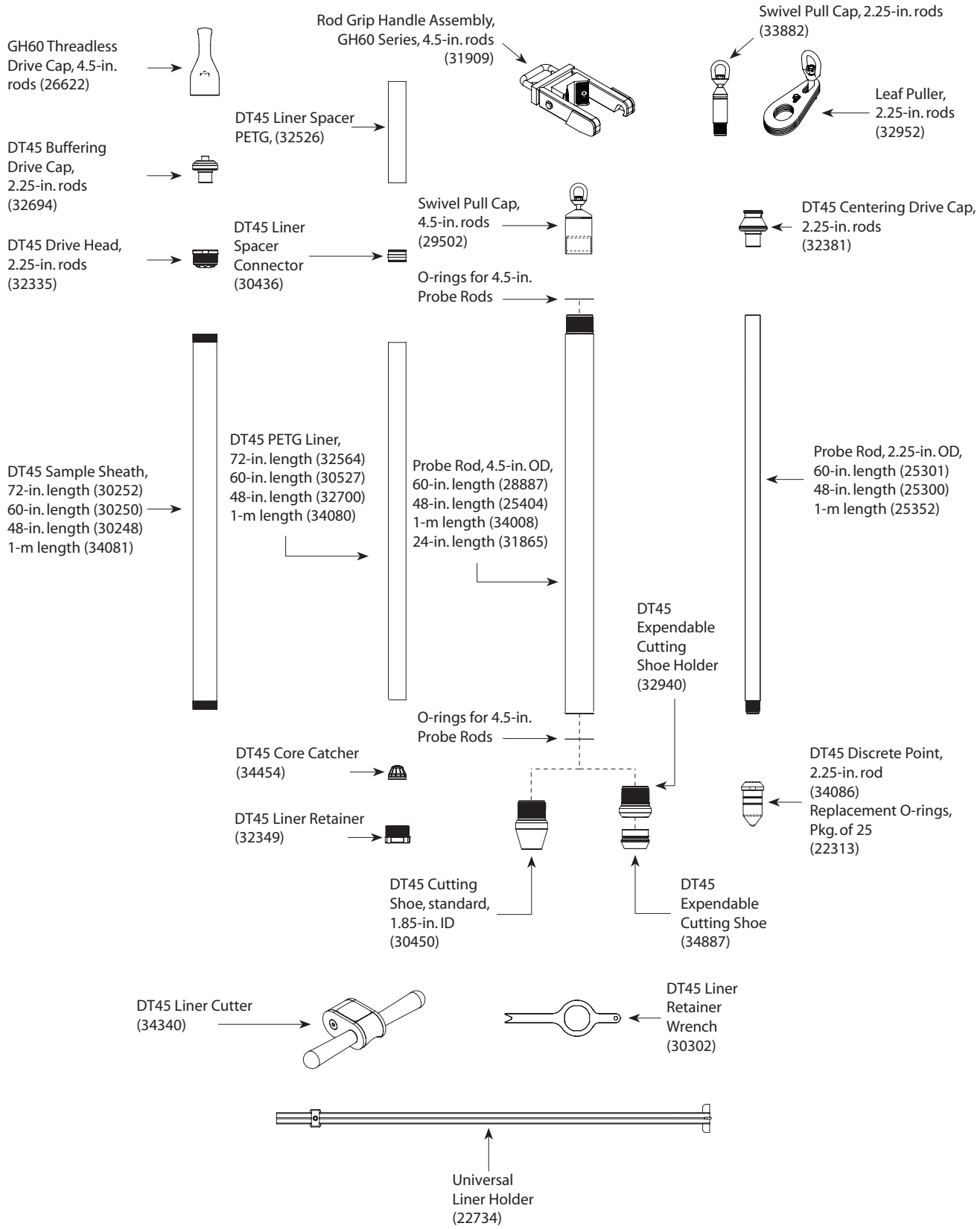


Figure 3.1
DT45 parts and accessories using 2.25-inch inner rods.

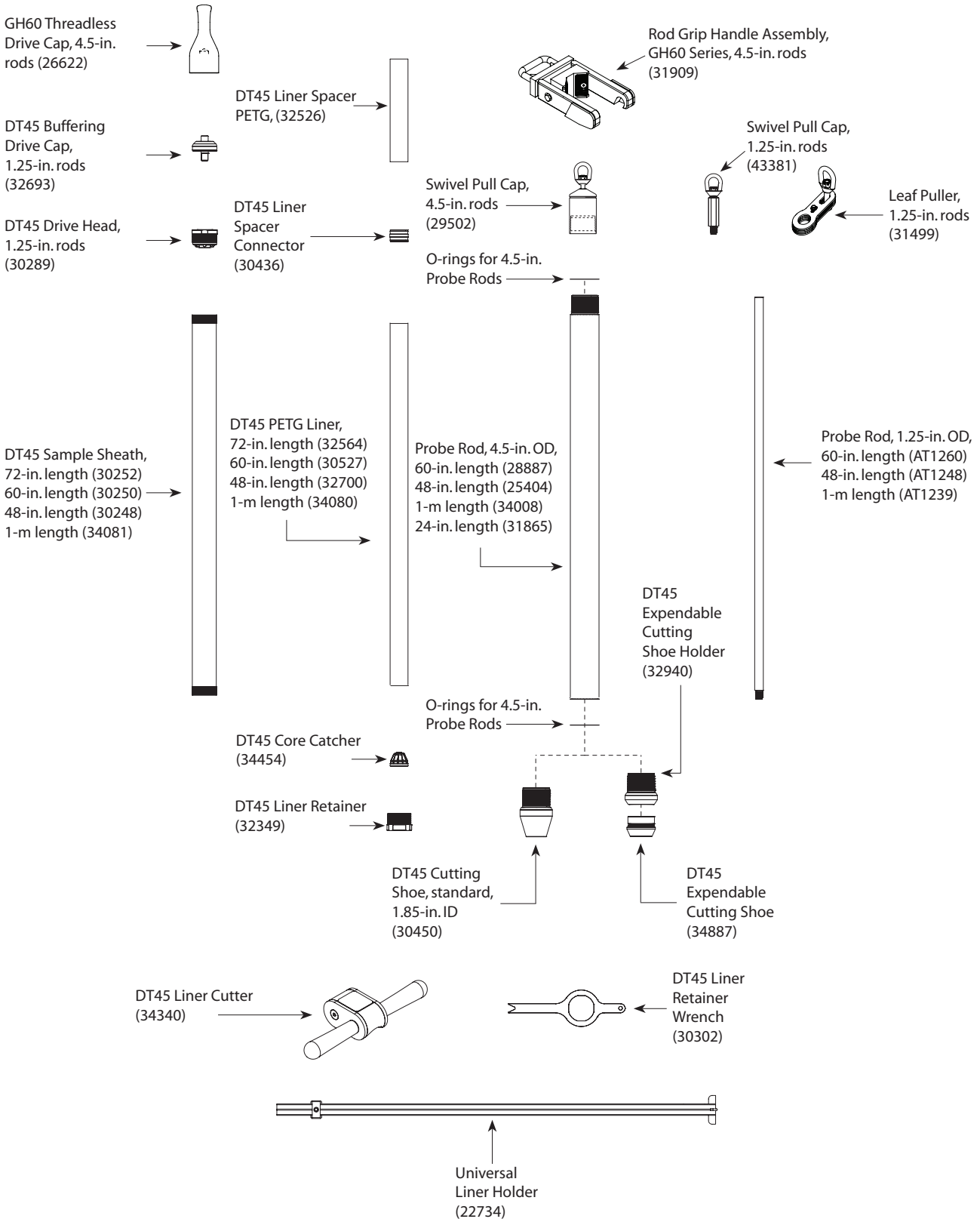


Figure 3.2
DT45 parts and accessories using 1.25-inch inner rods.

3.1 Tool Options

This section identifies the specific tool options available for use with the DT45 Dual Tube System. Refer to Figure 3.1 and Figure 3.2 for illustrations of the specified parts.

Probe Rods

Standard Geoprobe® 4.5-inch (114-mm) OD probe rods are utilized for the outer casing of the DT45 Sampling System. Nominal rod lengths include 1 meter, 48 inches, and 60 inches. The specific length of rods may be selected by the operator and will determine the length of tooling for the rest of the DT45 system.

2.25-inch probe rods

2.25-inch probe rods (2.25-inch / 57-mm OD) are recommended for the inner rod string of the DT45 system when utilizing an outer casing of 48- or 60-inch long rods. Choose the rod length that matches the length of rods used for the outer casing (48-inch inner rods with 48-inch outer casing, etc.). The DT45 Discrete Point (34086) can only be used with 2.25-inch inner rods.

1.25-inch probe rods

1.25-inch probe rods (1.25-inch / 32-mm OD) can be used for the inner rod string of the DT45 system when utilizing an outer casing of 48- or 60-inch long rods. Choose the rod length that matches the length of rods used for the outer casing (48-inch inner rods with 48-inch outer casing, etc.). 1.25-inch probe rods must not be used with the DT45 Discrete Point (34086).

Sample Sheaths

A steel sample sheath supports the weight of the inner rods to protect the sample liner from damage while advancing the DT45 tool string. The liner is placed within the sample sheath and secured with a drive head at the top of the tube and a liner retainer at the bottom. The assembled tube with liner is inserted to the bottom of the outer casing on the leading end of the inner rod string. After advancing the entire tool string one sample interval, the inner rods and sample sheath are retrieved to recover the soil core.

Sample sheaths are available in nominal lengths of 1 meter, 48 inches, 60 inches, and 72 inches. Sample sheath length is generally matched to the length of the probe rods selected for the outer casing. However, a DT45 Liner Spacer PETG (32526) and DT45 Liner Spacer Connector (30436) allow use of 48-inch liners with a 60-inch sample sheath (30250) and 60-inch liners with a 72-inch sample sheath (30252).

Sample Liners

Sample liners are made of a heavy-duty clear PETG for convenient inspection of the soil sample. Liners are available as a simple, open tube. A core catcher can be inserted into the liner. Utilize the core catchers when sampling flowing sands, noncohesive soils, extremely dry soils, or any other materials that fall from the liner during retrieval.

Nominal liner lengths include 1 meter, 48 inches, 60 inches and 70 inches with an OD of 3.0 inches (76 mm). Under "normal" sampling conditions, liner length should correspond to the length of probe rods used for the outer casing. Certain sampling conditions can cause over-filled liners which may lead to problems removing the liner and soil core from the sample sheath. For these special conditions, utilize a Liner Spacer PETG (32526) and DT45 Liner Spacer Connector (30436) to provide additional room above the liner for the excess soil (Fig. 3.2). The Liner Spacer PETG and Liner Spacer Connector must be used with either a 48-inch liner in a 60-inch sample sheath (30250) or a 60-inch liner in a 72-inch sample sheath (30252). With the tool string only advanced the length of the liner, the Liner Spacer PETG remains free to accept excess soil that may otherwise overfill the liner.

Cutting Shoes

Two cutting shoes are available for use with the DT45 Dual Tube System (Fig. 3.3). The standard DT45 Cutting Shoe (30450) threads into the leading end of the 4.5-inch probe rods and is recovered after sampling. Dimensions for the standard cutting shoe are 3 inches (76 mm) ID and 5 inches (127 mm) OD.

The DT45 sampling system may also employ an expendable cutting shoe (Fig. 3.3). In this arrangement, a DT45 Expendable Cutting Shoe Holder (32940) is threaded into the leading end of the outer casing. A DT45 Expendable Cutting Shoe (34887) is then inserted into the holder. Upon completion of soil sampling, the outer casing is withdrawn slightly. The expendable cutting shoe is knocked from the holder, leaving an open casing through which a prepacked screen monitoring well may be installed. The expendable cutting shoe has an ID of 3 inches (76 mm). The expendable cutting shoe holder has dimensions of 3.75 in. (95 mm) ID and 5 inches (127 mm) OD.

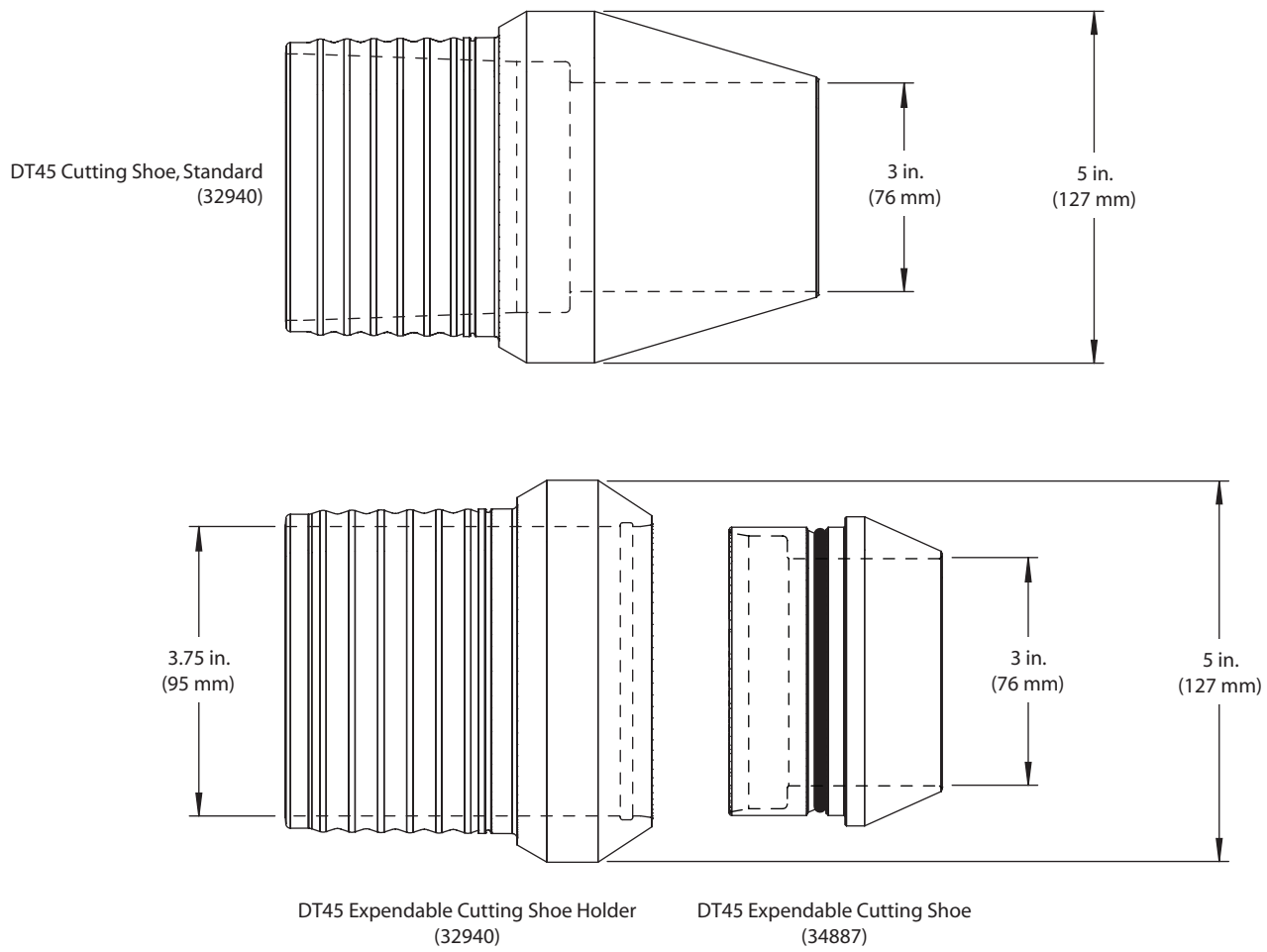


Figure 3.3
Cutting shoe options for the DT45 Dual Tube Sampling System.

4.0 Operation

4.1 Decontamination

Before and after each use, thoroughly clean all parts of the soil sampling system according to project requirements. Parts should also be inspected for wear or damage at this time. During sampling, a clean new liner is used for each soil core.

4.2 Operational Overview

The DT45 Soil Sampling System is designed to collect continuous soil cores. Sampling may begin either from ground surface or a predetermined depth below ground. Once sampling begins, consecutive soil cores are removed as the outer casing is advanced to greater depths

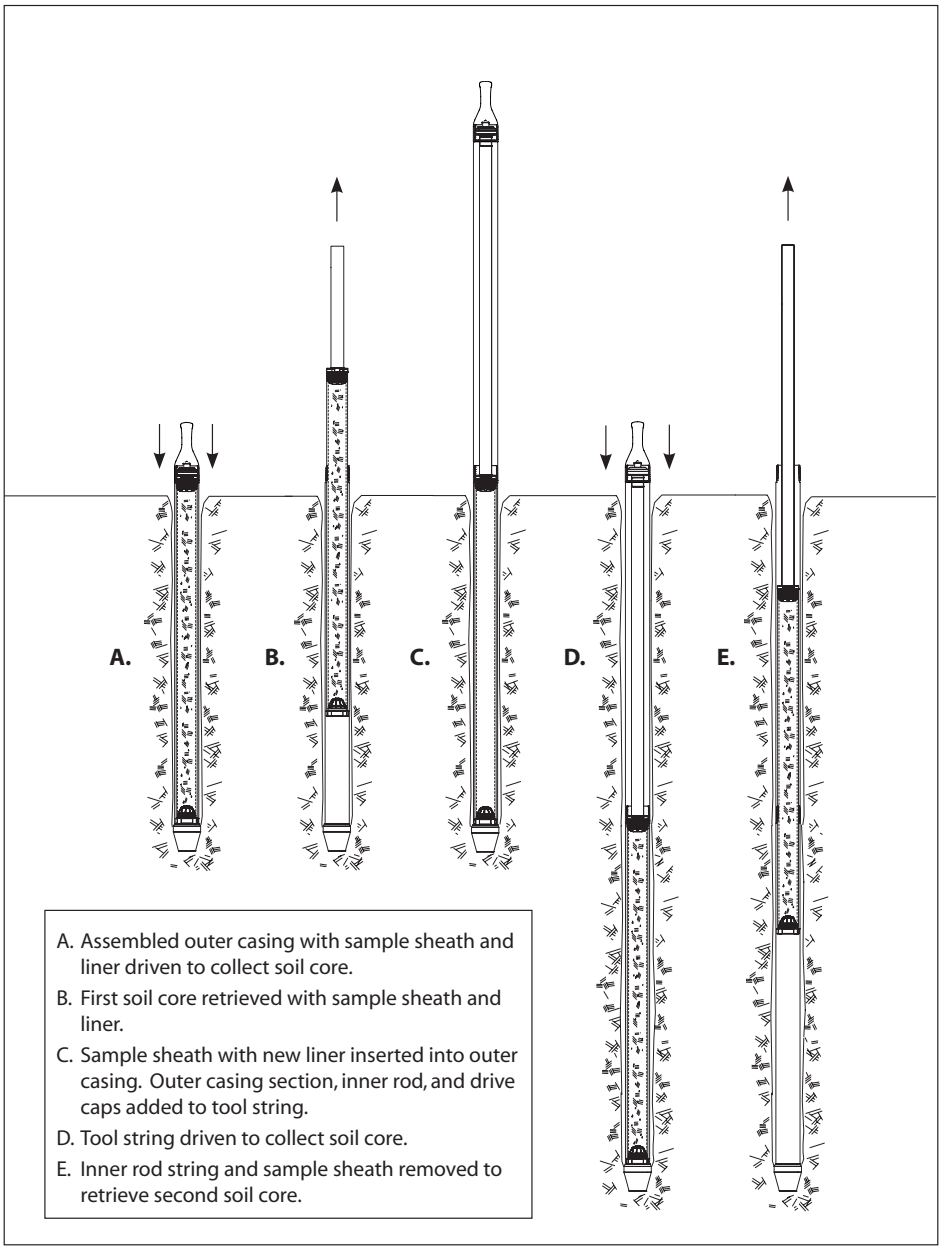


Figure 4.1
Continuous core sampling from ground surface with the DT45 system.

When sampling is to begin at the ground surface, the first soil core is generally collected using a liner with core catcher to maximize sample recovery (Fig. 4.1-A). This is especially true when the first core is composed of dry, loose soil. Upon retrieval of the first liner and soil core (Fig. 4.1-B), a new liner is loaded into the sample sheath and inserted to the bottom of the outer casing on the end of an inner rod. A section of outer casing is added to the tool string (Fig. 4.1-C) and the entire tool string is driven to fill the liner with soil (Fig. 4.1-D). The sample sheath and filled liner are removed from the outer casing to retrieve the second soil core (Fig. 4.1-E). A new liner is placed in the sample sheath and the process is repeated for the entire sampling interval.

When the sampling interval begins at some depth below ground surface using 2.25-inch probe rods, a DT45 Discrete Point is installed in the outer casing and the entire assembly is driven from ground surface directly through undisturbed soil (Fig. 4.2-A). This enables the operator to reach the top of the sampling interval without stopping to remove unwanted soil cores. Once the interval is reached, the DT45 Discrete Point is removed (Fig 4.2-B) and sampling continues as described in the preceding paragraphs (Fig. 4.2-C, Fig. 4.2-D, and Fig. 4.2-E).

Specific instructions for assembly and operation of the DT45 Sampling System are given in the following sections.

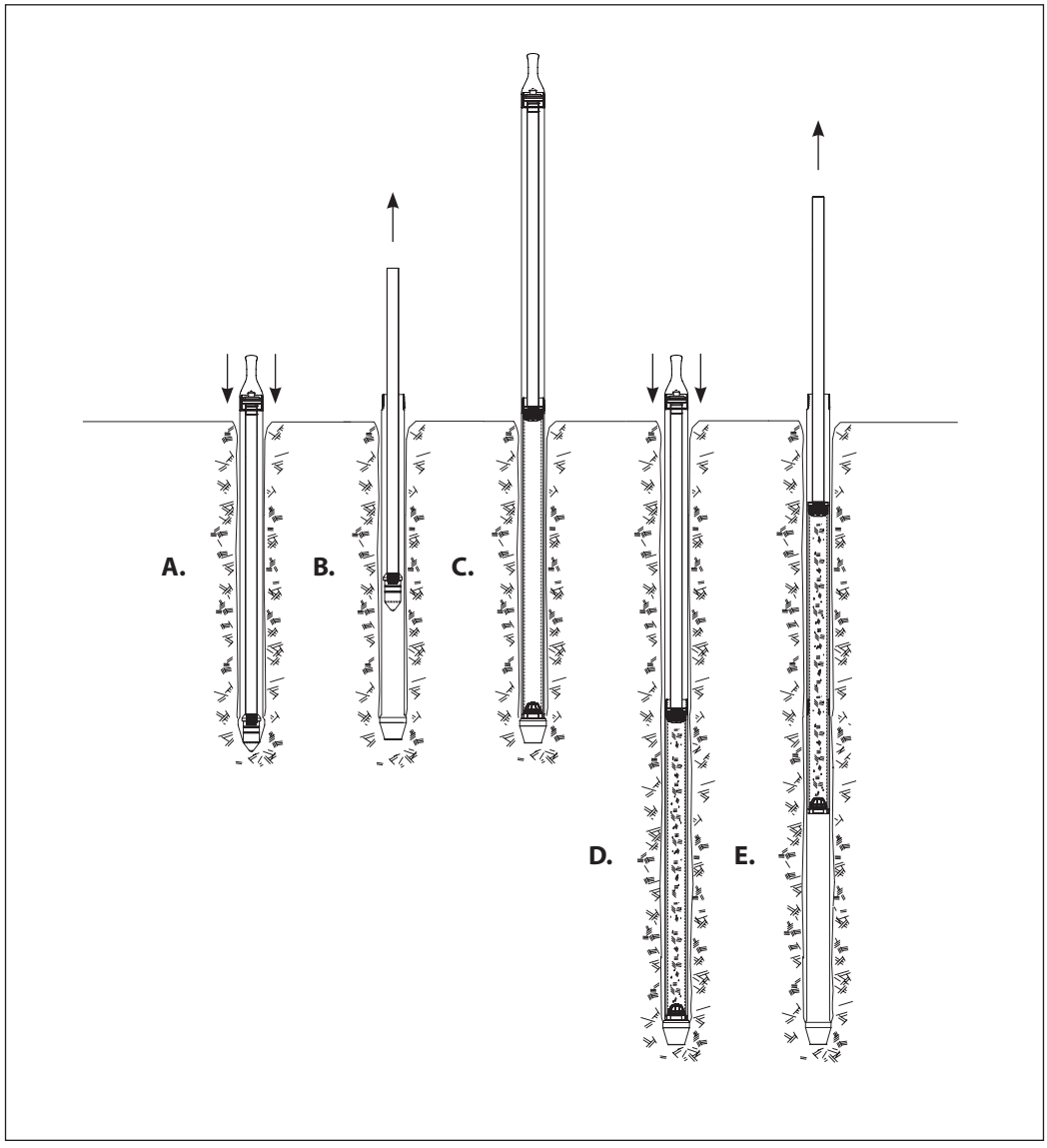


Figure 4.2
Using a DT45 Discrete Point to advance the DT45 outer casing through undisturbed soil before collecing soil cores.

4.3 Assembling and Driving the Outer Casing Using a DT45 Discrete Point

A DT45 Discrete Point (34086) , Figure 4.3, enables the operator to advance the outer casing to the bottom of a pre-cored hole or through undisturbed soil to reach the top of the sampling interval. The outer casing is assembled first, followed by the 2.25-inch probe rod system with a DT45 Discrete Point. Step-by-step instructions are listed below.

1a. When using a DT45 Cutting Shoe (30450), install an O-ring for 4.25-inch probe rods in the O-ring groove as shown in Figure 4.4.

1b. If using an expendable cutting shoe, install an O-ring for 4.25-inch probe rods in the O-ring groove on the DT45 Expendable Cutting Shoe Holder (32940) as indicated in Figure 4.4. An O-ring is supplied with each DT45 Expendable Cutting Shoe (34887). Install this O-ring on the cutting shoe (Fig. 4.4) and then insert the cutting shoe into the holder.

2. Thread the DT45 Cutting Shoe or DT45 Expendable Point Holder onto the leading end of a 4.5-inch OD Probe Rod. Completely tighten the cutting shoe or cutting shoe holder using a pipe wrench.

3. Install an O-ring (22313) in both grooves of the DT45 Discrete Point (34086) as shown in Figure 4.3.

4. Thread the DT45 Discrete Point onto the male end of a 2.25-inch probe rod.

5. Lubricate the O-rings on the solid drive point with a small amount of deionized water. Insert the point and probe rod into the outer casing until the point partially extends from the bottom of the cutting shoe.

6. Place a Centering Drive Cap (32381) on top (female end) of the 2.25-inch probe rod and a Threadless Drive Cap (26622) onto the 4.5-inch probe rod (outer casing) as shown in Figure 4.5.

7. Raise the probe unit hammer assembly to its highest position by fully extending the probe cylinder.

8. Position the assembled outer casing section directly under the hammer with the cutting shoe centered between the toes of the probe foot. The assembled outer casing section should now be parallel to the probe derrick. Step back from the unit and visually check sampler alignment. A magnetic level can be placed on the assembly to check level.

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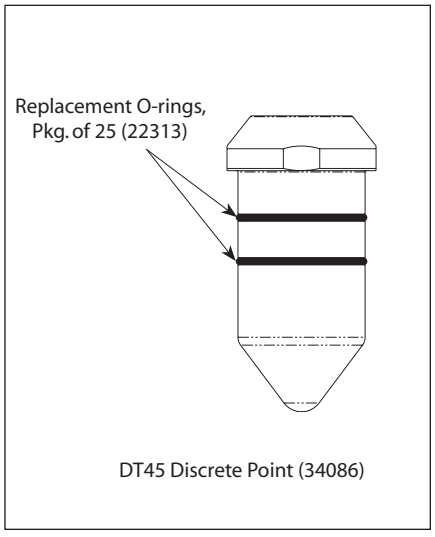

Figure 4.3
Solid Drive Point utilizes two O-rings

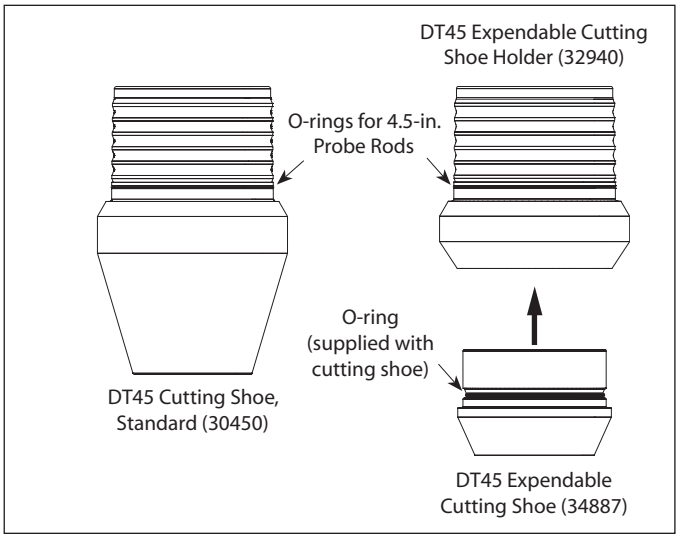

Figure 4.4
DT45 Cutting Shoes

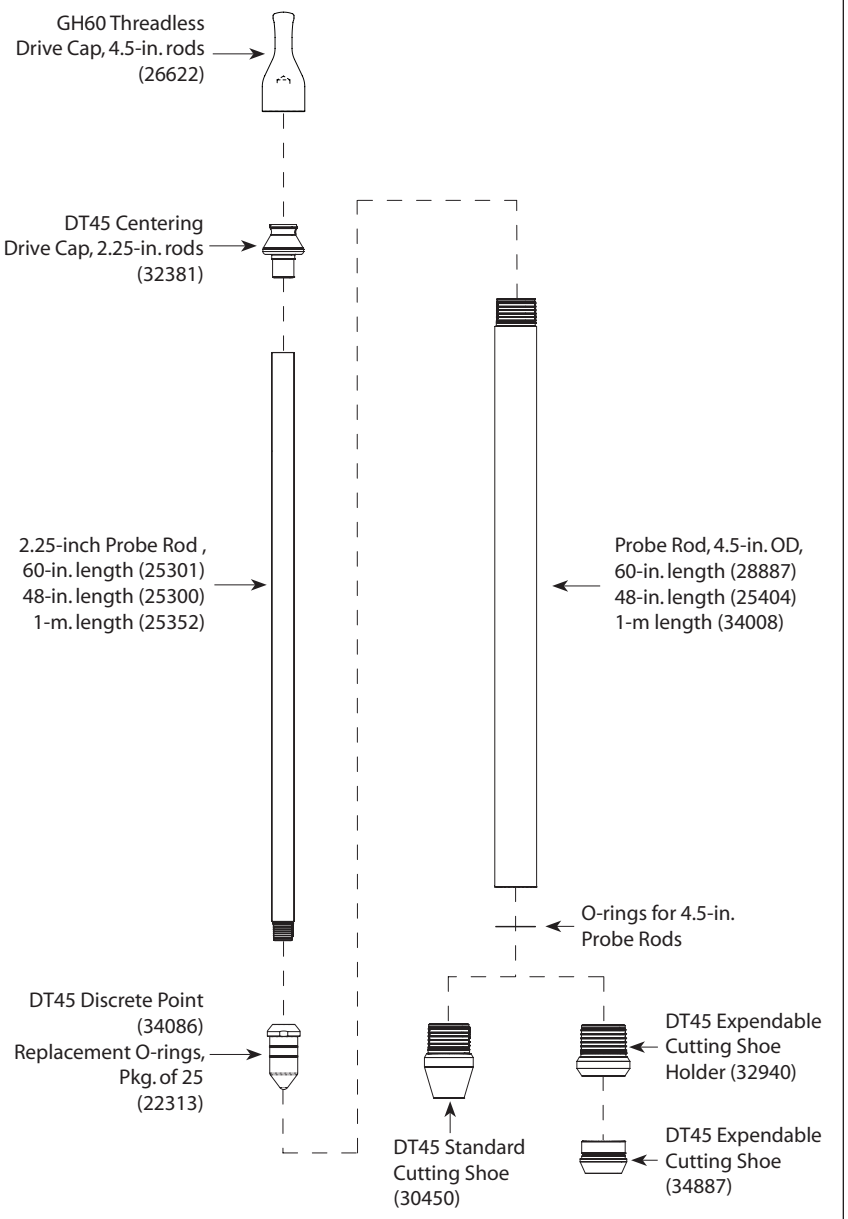

Figure 4.5
Assembly Using the DT45 Discrete Point

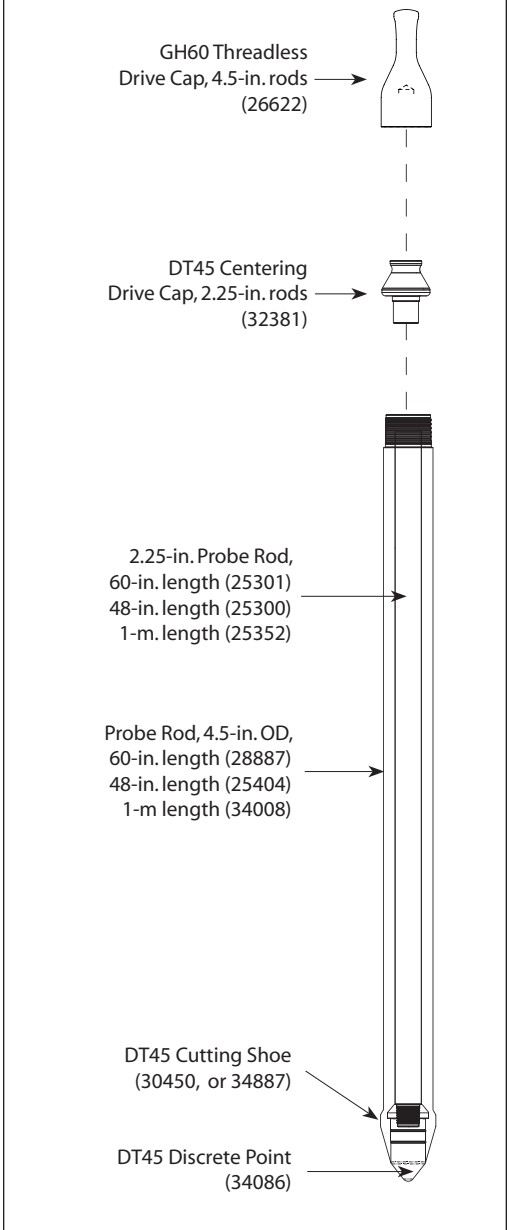

Figure 4.6
Completed Assembly

9. Apply static weight and hammer percussion to advance the assembled outer casing until the drive head reaches the ground surface.

NOTE: Activate hammer percussion whenever collecting soil. Percussion helps shear the soil at the leading end of the sampler so that it moves into the sample sheath for increased recovery.

10. Raise the hammer assembly a few feet and retract the unit to provide access to the top of the outer casing.

11. Remove the centering drive cap and 4.5-inch drive cap.

12. Add additional 2.25-inch probe rods to the inner rod string and 4.5-in. probe rods (with O-rings) to the outer casing and advance until the sampling interval is reached. At this point, the inner rods can be removed and an assembled sample sheath can be added (See Section 4.4).

4.4 Assembling the Sample Sheath

The sample sheath is used to support the weight of the 2.25-inch probe rods and to protect the liner from damage while advancing the DT45 tool string. The process of assembling the tube to collect soil samples is given below.

1. Slide the core catcher into the leading end of the liner (Fig. 4.7).
2. Slide the liner retainer over the core catcher (and liner) (Fig. 4.8).
3. Place the liner into either end of the sample sheath with the liner retainer and core catcher (Fig. 4.9).
4. Thread the liner retainer onto the sample sheath. If the tools are clean, it should easily thread on easily by hand (Fig. 4.10).
5. On the opposite end of the tube, thread on the DT45 Drive Head. The drive head will connect the tube to the 2.25-inch probe rods (Fig. 4.11).

The sample sheath is now ready for soil core collection.

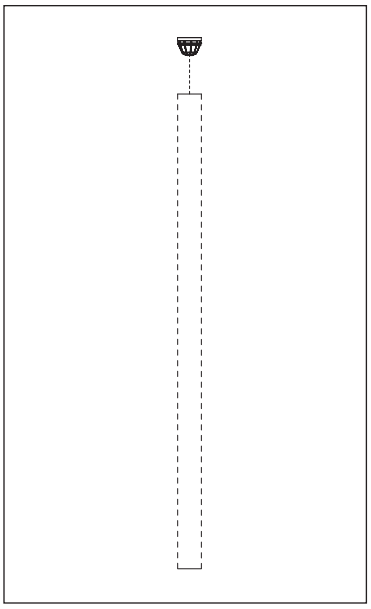

Figure 4.7. The core catcher is placed on the end of the liner.

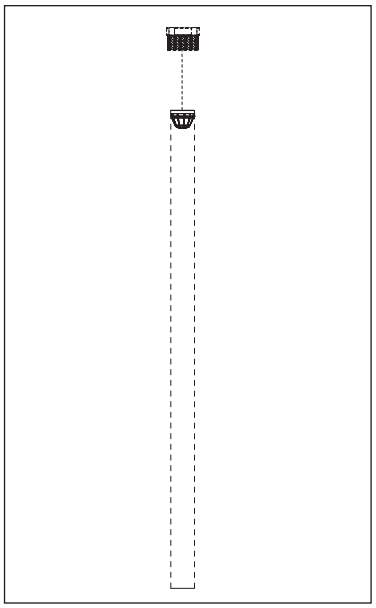

Figure 4.8. The liner retainer is placed over the core catcher and liner.

Figure 4.9. Liner, core catcher, and liner retainer are slid into sample sheath.

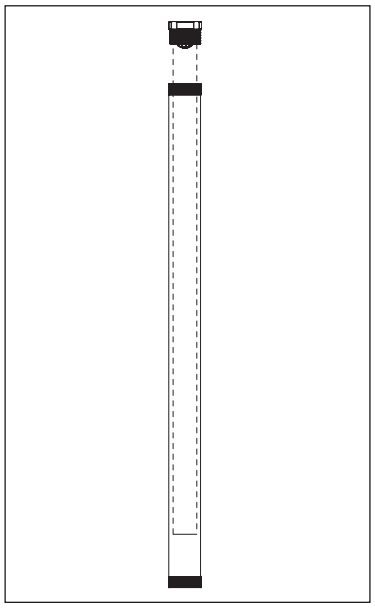

Figure 4.10. Liner, core catcher, and liner retainer are slid into sample sheath.

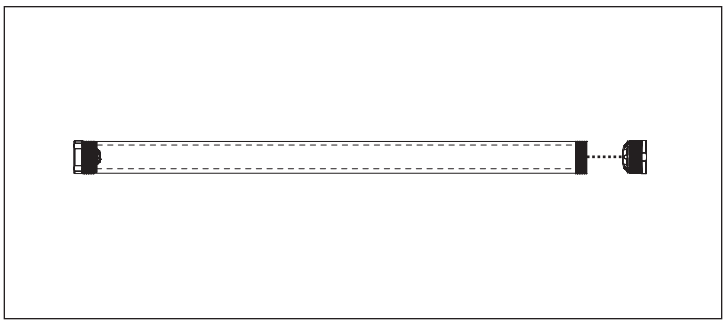

Figure 4.11. Drive head is threaded onto the opposite end of the sample sheath.

4.5 Soil Core Collection

This section describes collection of continuous soil core samples from within the sealed outer casing of the DT45 Dual Tube Sampling System. The procedure is written for a sampling series that begins at the ground surface and utilizes 2.25-inch inner rods. Refer to Figure 4.12 for an illustration of the assembled sampler. Figure 3.2 illustrates the corresponding parts if 1.25-inch inner rods are to be used.

1a. When using a DT45 Cutting Shoe (30450), install an O-ring for 4.25-inch probe rods in the O-ring groove as shown in Figure 4.4.

1b. If using an expendable cutting shoe, install an O-ring for 4.25-inch probe rods in the O-ring groove on the DT45 Expendable Cutting Shoe Holder (32940) as indicated in Figure 4.4. An O-ring is supplied with each DT45 Expendable Cutting Shoe (34887). Install this O-ring on the cutting shoe (Fig. 4.4) and then insert the cutting shoe into the holder.

2. Thread the DT45 Cutting Shoe or DT45 Expendable Point Holder onto the leading end of a 4.5-inch OD Probe Rod. Completely tighten the cutting shoe or cutting shoe holder using a pipe wrench. (Fig. 4.13)

3. Insert the sample sheath assembly (see Section 4.4) into the 4.5-inch OD probe rod.

4. Place a DT45 Buffering Drive Cap (32694) on top of the DT45 Drive Head and a GH60 Threadless Drive Cap (26622) onto the 4.5-inch probe rod (Fig. 4.12).

5. Raise the hydraulic hammer to its highest position by fully extending the probe cylinder.

6. Position the DT45 Sampler directly under the hammer with the cutting shoe centered between the toes of the probe foot (Fig. 4.14). The sampler should now be parallel to the probe derrick. Step back from the unit and visually check sampler alignment. A magnetic level can be placed on the assembly to check level.

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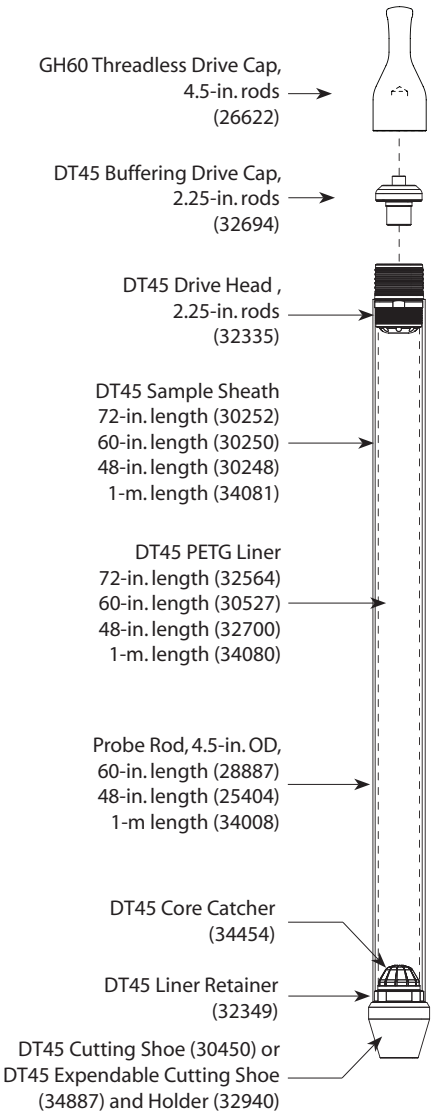

Figure 4.12
Assembled DT45 Sampler

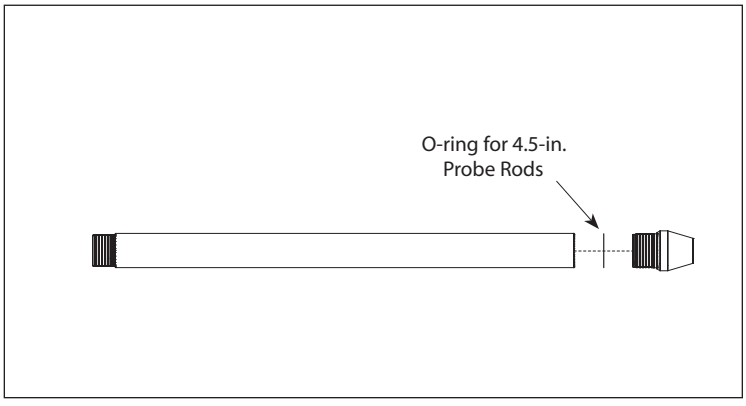

Figure 4.13. The cutting shoe is threaded onto the 4.5-inch probe rod.

Figure 4.14. DT45 Sampler is centered before initial push.

Figure 4.15. Advancing the DT45 Sampler

Figure 4.16. Remove drive cap to provide access to inner tool string.

Figure 4.17. The adjustable rod clamp and leaf puller can be used when retrieving the sample.

Figure 4.18. Inner rods and sample sheath are retrieved.

7. Apply static weight and hammer percussion to advance the sampler unit until the drive head reaches the ground surface. (Fig. 4.15)

   NOTE: Activate hammer percussion whenever collecting soil. Percussion helps shear the soil at the leading end of the sampler so that it moves into the sample sheath for increased recovery.

8. Raise the hammer assembly a few feet and retract the unit to provide access to the top of the sampler. (Fig. 4.16)

9. Remove the drive cap and thread an additional 2.25-inch probe rod onto the center string. Place the adjustable rod clamp on the top of the 4.5-inch rods to keep the center rods from falling when they are removed, and the leaf puller on the winch to remove the inner string of rods and sampler (Fig. 4.17).

10. Pull up the inner rod string along with the sample sheath (Fig. 4.18).

    To sample consecutive soil cores, advance a clean sample sheath and liner down the previously opened hole to the top of the next sampling interval. Add center rods as the sample sheath is lowered into the opened hole. An additional inner rod and 4.5-inch probe rod should be added. Drive the tool string the length of the sampler to collect the next soil core. Proceed to Section 4.6 for instructions on recovering the soil core from the sample sheath.

4.6 Removing Filled Liner from the Sample Sheath

Place the sample sheath into the vise. The liner retainer wrench can be used to remove the DT45 Liner Retainer and liner from the sample sheath. If possible, the retainer can be removed by hand (Fig. 4.19). The wrench can be used to gently knock off the retainer if necessary (Fig. 4.20). With the retainer and core catcher removed, the core can be withdrawn from the sample sheath. (Fig. 4.21) A Hydraulic Liner Extruder is also available for mounting on your machine to remove liners.

Figure 4.19. Remove the liner retainer with liner retainer wrench.

Figure 4.20. The wrench can be used to gently knock off the retainer.

Figure 4.21. Remove liner retainer and core catcher.

4.7 Removing a Section of Liner with a DT45 Liner Cutter

The liner and core can be placed on the liner holder. Use the DT45 Liner Cutter to safely expose the sample. Using both hands, smoothly pull the cutter through the liner. (Fig. 4.22) The slit liner can be removed and the core is exposed (Fig. 4.23).

Figure 4.22. Use the DT45 Liner Cutter to safely expose the sample.

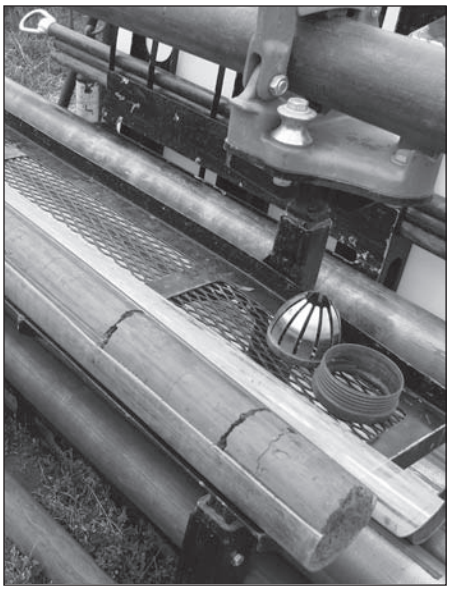

Figure 4.23. Slit liner exposing the sample.

4.8 Dual Tube Soil Sampling Tips

Saturated sands are the most difficult formations to sample with the DT45 system. Saturated conditions place positive pressure on the soil outside of the outer casing. When sampling in noncohesive formations (e.g. sands) below the water table, it may be necessary to add water to the outer casing to prevent formation heave. Adding water to the probe rods puts a positive head on the system and may keep formation material from flowing into the rods as the liner and soil sample are retracted. If a small amount of formation material is still drawn into the outer casing as the soil core is retrieved, the material may be displaced by slightly raising the outer casing while lowering the next new liner to depth. Water must be maintained within the outer casing during this process to overcome the hydraulic head imparted by the formation fluid. When retrieving, pull back the sample slowly.

DT45 core catchers will help considerably with sample recovery in non-cohesive soils and other materials that do not fill the liner diameter. Core catchers are not recommended for cohesive or expansive soils as the core catchers may actually inhibit soil movement into the liner. Also, using a shorter sample interval may improve sample recovery by minimizing wall friction as the material is sampled.

Certain soils have a tendency to exhibit plastic flow or extrusion characteristics. Allowing additional space for these materials will increase the speed of sampling because less time is spent cleaning overfilled sample sheaths. This will also yield a more representative sample. Using a tube that is a foot or two longer than the sampling interval or using a shorter sample interval (under driving) can create a buffer zone. The DT45 Liner Spacer PETG and Spacer Head were designed for these situations.

Some clay materials will extrude during sampling. Under these conditions, using a shorter sample interval may improve sample recovery by minimizing the wall friction as the material is sampled.

It may be helpful to mark the first 2.25-inch probe rod attached to the tube as an indicator that the tube is next in line.

4.9 Outer Casing Retrieval

The outer casing of the DT45 Dual Tube System may be retrieved in one of three ways:

1. Casing pulled then probe hole sealed from ground surface with granular bentonite.

The outer casing may be pulled from the ground with the probe machine and a Rod Grip Handle Assembly GH60 Series (31909) or the Flange Pull Rod (35309) for the GH80 series hammer, if the probe hole is to be sealed with granular bentonite from the ground surface. This method is used for shallow probe holes in stable formations only. Such conditions allow the entire probe hole to be sealed with granular bentonite.

2. Casing pulled with probe hole sealed from bottom-up during retrieval.

Bottom-up grouting should be performed during casing retrieval in unstable formations where side slough is probable. Such conditions create void spaces in the probe hole if granular bentonite is installed from the ground surface.

A Geoprobe® grout machine is used to deliver a sealing material (high-solids bentonite slurry or neat cement grout) to the bottom of the outer casing through flexible tubing. The grout mix is pumped through the tubing to seal the void remaining as the outer casing is retrieved. This is an advantage of the DT45 Dual Tube Sampling System as other soil samplers require a second set of tools to deliver grout to the bottom of the probe hole. Contact Geoprobe Systems® for more information on bottom-up grouting with the Geoprobe® grout machines.

3. Casing pulled with Geoprobe® Prepacked Screen Well installed during retrieval.

The final option is to install a 3.4-inch OD Geoprobe® Prepacked Screen Monitoring Well in the probe hole during retrieval of the outer casing. A DT45 Expendable Cutting Shoe Holder (32940) and a DT45 Expendable Cutting Shoe (34887) allow the operator to collect continuous soil cores as the outer casing is driven to depth.

When sampling is complete, the outer rods are raised and the expendable cutting shoe is removed from the leading rod. This leaves an open casing through which a set of prepacked screens is lowered on the leading end of a PVC riser string. (Fig. 4.24) The well is finished, complete with grout barrier, bentonite well seal, and a high-solids bentonite slurry/neat cement grout, during retrieval of the outer casing.

Refer to Geoprobe® 2.0-in. x 3.4-in. Prepacked Screen Monitoring Wells Standard Operating Procedure (Geoprobe® Technical Bulletin No. MK3172) for specific information on well installation.

Figure 4.24. A Geoprobe® 2.0-in. Prepacked Screen Monitoring Well can be installed using the DT45 Soil Sampler.

5.0 References

Geoprobe Systems®, 2003. *Tools Catalog, V. 6.*

Geoprobe Systems®, 2005. *Standard Operating Procedure. Geoprobe@ Pneumatic Slug Test Kit. Technical Bulletin No. 19344.*

Geoprobe Systems®, 2006. *Direct Push Installation of Devices for Active Soil Gas Sampling and Monitoring. Technical Bulletin No. MK3098.*

Geoprobe Systems®, 2010. *Standard Operating Procedure. 2.0-in. x 3.4-in. OD Prepacked Screen Monitoring Wells. Geoprobe® Technical Bulletin Number MK3172.*

Equipment and tool specifications, including weights, dimensions, materials, and operating specifications included in this brochure are subject to change without notice. Where specifications are critical to your application, please consult Geoprobe Systems®.

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