Designation: D6699 – 16

Standard Practice for Sampling Liquids Using Bailers[1]

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1. Scope

1.1 This practice covers the procedure for sampling stratified or un-stratified waters and liquid waste using bailers.

1.2 Three specific bailers are discussed in this practice. The bailers are the single and double check valve and differential pressure.

1.3 This standard does not cover all of the bailing devices available to the user. The bailers chosen for this practice are typical of those commercially available.

1.4 This practice should be used in conjunction with Guide D4687, Practice D5088, and Practice D5283.

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]

D4448 Guide for Sampling Ground-Water Monitoring Wells
D4687 Guide for General Planning of Waste Sampling
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
D5681 Terminology for Waste and Waste Management
D5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
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
D6517 Guide for Field Preservation of Groundwater Samples
D6564 Guide for Field Filtration of Groundwater Samples
D6634 Guide for Selection of Purging and Sampling Devices for Groundwater Monitoring Wells
D6771 Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations (Withdrawn 2011)[3]
D7929 Guide for Selection of Passive Techniques for Sampling Groundwater Monitoring Wells

2.2 *EPA Standard:*

EPA SW 846 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

3. Terminology

3.1 See Terminology D5681.

4. Summary of Practice

4.1 A clean bailer is lowered into the liquid to be sampled using a suspension line (see Fig. 1). The bailer chamber is allowed to fill with the sample. The check valve or valves on bailers close when the bailer stops. The bailer is raised to the surface where the sample is discharged into a clean sample container.

5. Significance and Use

5.1 A bailer is a device for obtaining a sample from stratified or un-stratified waters and liquid wastes. The most common use of a bailer is for sampling ground water from single-screened wells (Fig. 1) and well clusters (see Guide D4448).

5.2 This practice is applicable to sampling water and liquid wastes. The sampling procedure will depend on sampling plan and the data quality objectives (DQOs) (Practice D5792).

5.3 Bailers may be used to sample waters and liquid wastes in underground and above ground tanks and surface impoundments. However, the design of the unit and associated piping should be well understood so that the bailer can access the

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

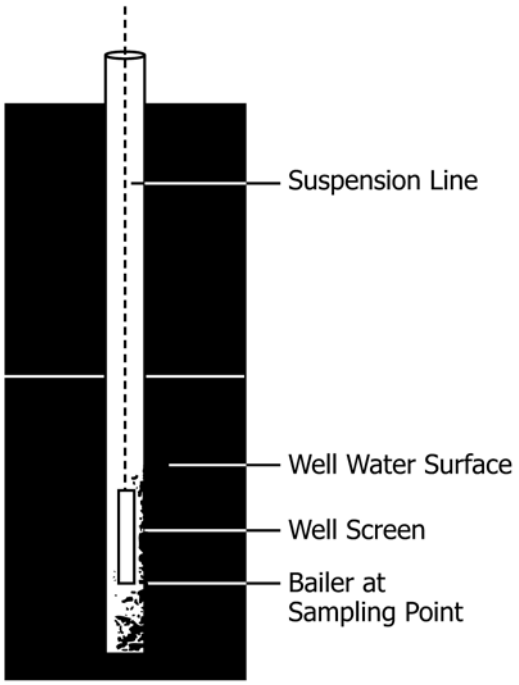

FIG. 1 Bailer Sampling a Screened Well

desired compartment and depth. Any stratification of the liquid should be identified prior to sampling.

NOTE 1—Viscous liquids and suspended solids may interfere with a bailer's designed operation.

5.4 Bailers do not subject the sample to pressure extremes. Bailing does disturb the water column and may cause changes to the parameters to be measured (for example, turbidity, gases, etc.).

5.5 The use of bailers in low flow wells for purging can result in increased agitation and turbidity in the sample and can introduce errors into the sample if the water surface level is drawn down below the top of the screen. In such cases, alternate methods of sampling such as Passive Sampling (Guide D7929) or Low Flow Sampling (Practice D6771) should be considered.

6. Sampling Equipment

6.1 Bailers are versatile devices constructed in different sizes and from a variety of materials. Some bailers are designed using a threaded section that allows the user to change the volume of the bailer by connecting additional sections. When sampling for volatile organic compounds (VOCs) in liquids, specialized bailers that have a sample control or a draft valve near the bottom of the bailer are used. The control valve allows a sample to be drained from the bailer with minimal loss of volatile compounds.

6.2 Three general types of bailers are a single check valve bailer, a double check valve bailer, and a differential pressure bailer (hydrostatic pressure allows the bailer to fill through the lower tube and release displaced air through the upper tube). Advantages and limitations of bailers are found in Guides D6232 and D6634. A description of the equipment and the advantages and limitations of bailers in general and specific limitations of the single and double check valve bailers and the differential pressure bailer are as follows:

TABLE 1 General Advantages and Limitations of Bailers

Advantages	Limitations
Simple to use	Time consuming to use
Some have a low initial cost	Valves may leak
Can be made almost any size	Tend to expose sample to the atmosphere
Can be constructed of a variety of materials	May result in sample contamination
No external power source needed	Bailers are not suitable for sampling thin surface layers like thin layers of light non-aqueous phase liquids
	In low flow wells, errors can be introduced if the surface level is drawn down below the top of the screen or the sample waters are agitated the sample waters excessively
	May result in loss of VOCs when discharging sample

6.2.1 *General Description and Advantages and Limitations of Bailers:*

6.2.1.1 Bailers are available commercially in different lengths, volumes, and check valve density and sample release arrangements. They are typically constructed of PTFE, polyvinyl chloride (PVC), stainless steel, and polyethylene (single use disposable bailer).

6.2.1.2 General advantages and limitations of bailers are listed in Table 1.

6.2.2 *Single Valve Bailer* (Fig. 2)*:*

6.2.2.1 A single check valve bailer is a length of tubing with a check valve in the bottom. The bottom valve allows the bailer to fill and retain the sample.

6.2.2.2 The bottom-emptying bailers with controlled flow valves (Fig. 3) are used for collecting samples for volatile organic analyses.

6.2.2.3 *Advantages*—Low initial cost, and it is mechanically simple.

6.2.2.4 *Limitations*—Applicable to surface sampling only, disturbs the sample, and exposes the samples to the atmosphere.

6.2.3 *Double Valve Bailers* (Fig. 4)*:*

6.2.3.1 A double check valve bailer has an additional check valve at the top of the body that allows sampling at a specific depth. As the bailer is lowered through the liquid column, the liquid flows through the bailer until the sampling level is reached. At the sampling point, the two check valves close to contain the sample. Because the difference between each ball and check valve seat is the same, both check valves close simultaneously upon retrieval. The valve from the valve seat is maintained by a pin that blocks vertical movement of the check ball. A drainage pin is placed into the bottom of the bailer to drain the sample directly into a sample bottle.

6.2.3.2 *Advantage*—It can sample at any point in a liquid column.

6.2.3.3 *Limitation*—It can become contaminated with the overlaying material as the sampler approaches the targeted sampling point.

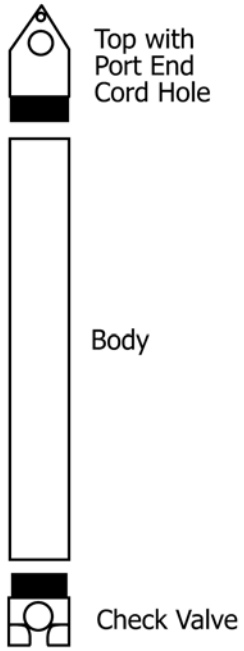

FIG. 2 Single Valve Bailer

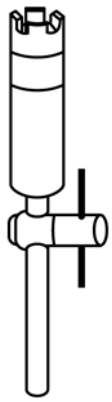

FIG. 3 Bailer Emptying Device

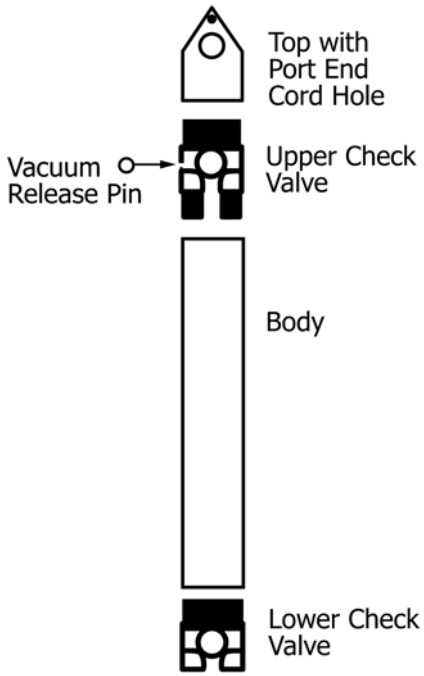

FIG. 4 Double Valve Bailer

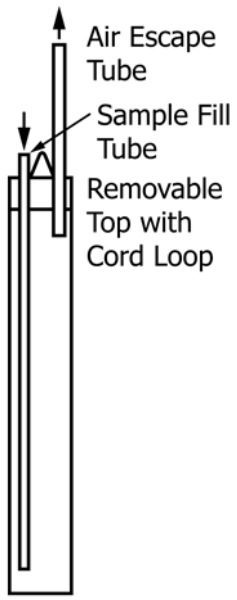

FIG. 5 Differential Pressure Bailer

6.2.4 *Differential Pressure Bailer* (Fig. 5)*:*

6.2.4.1 The differential pressure bailer is a canister with two small diameter tubes of different heights built into the removable top. It is usually made from stainless steel to provide sufficient weight to allow it to be lowered rapidly to the desired sampling depth. Once the bailer is stopped, hydrostatic pressure allows the bailer to fill through the lower tube at the same time as air is displaced through the upper tube.

6.2.4.2 *Advantages*—There is a minimal cross contamination from the matrix so samples are more likely to be representative at depth. They are good for sampling for VOCs because they minimize contact with air.

6.2.4.3 *Limitations*—Difficulty of cleaning the equipment, high cost due to the complexity of the device, relative small sample size compared to other bailers, the required rapid lowering of the bailer may disturb the sample matrix, and cross contamination from potential leakage of the upper liquid layers into the bailer during descent.

6.3 Figs. 6 and 3 show devices used to drain samples from the bailers. These devices are hollow tubes pushed into the bottom of the bailer raising the check valve and allowing the sample to drain into the sample container. The device in Fig. 6 regulates sample flow by controlling how high the check valve is raised. The Fig. 3 emptying device controls sample flow using a separate valve.

6.4 Suspension line for raising and lowering bailer must be constructed of a non-contaminating material, inert to the sample matrix, adequately cleaned, and dedicated to the point source to prevent cross contamination.

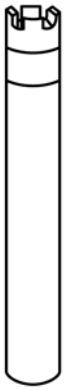

FIG. 6 Bailer Emptying Device

7. Pre-Sampling

7.1 A sampling plan must be in place.

7.2 The depth at which the sample is taken must be known. The depth is measured from a reference point (datum) on a well casing, tank sampling port or manhole, stream gage or other measuring device for rivers and ponds. Whenever possible, the reference point should be surveyed.

7.3 The distance from the reference point to the top of the liquid should be measured and recorded. If there is an interface to be sampled, the top and bottom of the interface needs to be determined.

7.4 The sampling plan should consider special sample handling like preservation (see Guide D6517 for preservation of ground-water samples and SW 846 for RCRA samples), filtration, if required (see Guide D6564 for field filtration of ground-water), and field compositing (see Guide D6051).

7.5 Confirm that adequate sample labels, security seals, appropriate storage containers, field logbooks, iced coolers if required, chain-of-custody forms, and the like, are available.

8. General Procedure for Using Bailers

8.1 The sampler and suspension line is to be clean and free from other contaminating materials that could be carried into the hole.

8.2 A pail or other suitable container should be used for storage, payout, and retrieval of the suspension line.

8.3 The suspension line should be measured and marked to the depth required for the desired sample. The measurement to the point where the sample is taken must be from the reference point.

NOTE 2—It is extremely important to secure the end of the suspension line to a fixed object prior to lowering the bailer into a well or unit so that it may not be accidentally lost during the sampling event.

8.4 The surface around the sampling site should be clean as possible.

NOTE 3—A polyethylene sheet can be an effective method to protect both the sampling equipment and the area surrounding the well from contamination from sampling spills.

8.5 The bailer is attached to the suspension line and lowered into the liquid to be sampled.

8.6 The bailer is raised to the surface, the outside wiped, and its contents emptied into labeled sample containers and stored.

NOTE 4—It is advisable to use a disposable wipe or equivalent to clean the suspension line and bailer during the retrieval process when sampling a material known to be hazardous.

9. Bailer Procedures by Type

9.1 *Single Check Valve Bailer (Top-Emptying and Bottom-Emptying) Procedure:*

9.1.1 Attach the suspension line to a clean bailer and gently lower the bailer to the desired depth usually just below the surface. The sample will enter the chamber through the bottom upon reaching the sampling surface.

9.1.1.1 The lowering rate should minimize disturbance to the medium to be sampled.

9.1.1.2 The check ball will seat when the bailer stops its downward movement and will remain closed as long as there is no downward movement during retrieval.

9.1.2 Retrieval of the bailer must be slow and continuous.

9.1.2.1 As the bailer is being retrieved, the suspension line is wiped.

9.1.3 The outside of the bailer is wiped.

9.1.4 Transfer the bailer contents into a clean labeled sample container by pouring the contents slowly from the top of the bailer or from the bottom using bailer emptying devices such as those found in Figs. 6 and 3.

NOTE 5—If the bailer is being emptied from the top, rapid emptying may cause the check valve to accidentally release, spilling the contents.

9.1.4.1 Bottom-emptying bailers using controlled flow valves are used to collect samples for volatile organic analyses (VOA). The sample is discharged from the bottom through a controlled flow valve into the VOA vial.

9.2 *Double Check Valve Procedure:*

9.2.1 Attach the suspension line to the bailer.

9.2.2 Lower the bailer to the predetermined sampling depth at a steady rate that will minimize the disturbance to the liquid to be sampled.

9.2.3 Slowly and continuously raise the bailer, cleaning the suspension line as it is being retrieved.

9.2.4 Wipe the outside of the bailer, prior to removing the sample.

9.2.5 Insert the vacuum release pin (see Fig. 4) and attach the bottom emptying device or drainage pin. Discharge the sample into a labeled sample container.

9.3 *Differential Pressure Bailer Procedure:*

9.3.1 The suspension line is attached to the bailer and the bailer is allowed to sink quickly to the desired depth.

9.3.2 The bailer should remain at depth until it is filled.

NOTE 6—The length of time to fill depends upon the sample matrix (usually less than a minute).

9.3.3 Retrieve the bailer while wiping the suspension line.

9.3.4 The outside of the bailer is wiped.

9.3.5 Wipe the outside of the bailer, prior to removing the sample.

10. Post Sampling

10.1 Check the following: sample bottles for the correct labeling, chain-of-custody for completeness. If required, sample container for adequate cooling and completeness of the field logs (see Practice D5283).

10.2 Decontaminate the equipment in accordance with Practice D5088.

NOTE 7—The differential pressure bailer requires additional care to ensure that all parts of the device, including the air escape and sample entry tubes, are clean.

10.3 Dispose of non-reusable equipment properly.

11. Keywords

11.1 bailer; ground water; liquid sampling; sampling waste