Designation: D7353 – 21

Standard Practice for Sampling of Liquids in Waste Management Activities Using a Peristaltic Pump[1]

This standard is issued under the fixed designation D7353; 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 covers the use of a peristaltic pump for sampling liquids from multiple depths. It is applicable for a wide range of fluids including: high-viscosity fluids, aggressive and corrosive fluids, high-purity solutions, and abrasive fluids. It is especially useful for sampling liquids that require complete isolation from the pump.

1.2 This practice includes the determination of sample depth, pump setup, and collecting a sample to be analyzed.

1.3 This practice is not intended to give detailed instructions for running a peristaltic pump or to recommend which peristaltic pump to purchase. It instructs the field personnel how to connect the pump and collect a sample.

1.4 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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]

D4448 Guide for Sampling Ground-Water Monitoring Wells
D4687 Guide for General Planning of Waste Sampling
D4840 Guide for Sample Chain-of-Custody Procedures
D5681 Terminology for Waste and Waste Management
D5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
D5956 Guide for Sampling Strategies for Heterogeneous Wastes
D6026 Practice for Using Significant Digits in Geotechnical Data
D6044 Guide for Representative Sampling for Management of Waste and Contaminated Media
D6063 Guide for Sampling of Drums and Similar Containers by Field Personnel
D6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities
D6250 Practice for Derivation of Decision Point and Confidence Limit for Statistical Testing of Mean Concentration in Waste Management Decisions (Withdrawn 2018)[3]
D6311 Guide for Generation of Environmental Data Related to Waste Management Activities: Selection and Optimization of Sampling Design
D6634 Guide for Selection of Purging and Sampling Devices for Groundwater Monitoring Wells

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology D5681.

[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.

4. Summary of Practice

4.1 A peristaltic pump is a suction lift pump (see Fig. 1(b)). A length of polytetrafluoroethylene (PTFE) or other suitable tubing such as Silastic tubing is placed in the liquid at any depth up to 7.6 m (25 ft) for water or less depending upon the density of the sample being taken. The other end is connected to the piece of flexible tubing which has been threaded around the rotor of the peristaltic pump (see Fig. 1(a)). A second piece of PTFE or other suitable tubing is connected to the discharge end of the flexible tubing to allow the liquid to be containerized or sampled. One can fill a vacuum-worthy sample container after attaching two tubes to it, one from the top of the pump inlet, and the other from a lower level to the source (see Fig. 1(c)).

5. Significance and Use

5.1 This practice can be used in sampling drums, tanks, and similar containers and in sampling monitoring and waste wells including small-diameter (2.5 cm (1 in.)) wells. The pump can collect samples from multiple depths. The samples can be high-viscosity fluids, aggressive and corrosive fluids, high-purity solutions, and abrasive fluids. The pump can be used to mix samples (see Guide D6063).

5.2 Peristaltic pumps use a vacuum to transport the samples. This vacuum may cause some degassing and loss of volatile organic compounds (VOCs) from the sample. When precise quantitative data for VOCs and dissolved gases are not required, peristaltic pumps may be used.

5.3 The pump is self-priming, runs dry without damage, and is completely isolated from the pumped fluid. A sample can be taken on the intake or discharge side of the pump.

5.4 Some additional advantages of the peristaltic pump are: decontamination of the pump motor is not necessary and the tubing in the pump is disposable and easy to replace. The pumps can be easily started and stopped and can pump fluids at a wide range of pressures and flow rates.

5.5 The place, quality and quantity, frequency, and time of sampling are dependent upon the decisions that are to be made (see Practice D6250), sampling design (see Guide D6311), the sample, the heterogeneity of the samples (see Guide D5956), how representative the sample is (see Guide D6044), and the parameters to be tested as determined by the data quality objectives (DQOs) (see Practice D5792).

6. Sampling Equipment

6.1 It is recommended that two peristaltic pumps be taken to the site with two pump-specific clamps per unit.

NOTE 1—There are many peristaltic pumps on the market from several manufacturers. Consult with the manufacturers to determine the capabilities of each pump for your application.

6.2 Two fully charged batteries (or other applicable batteries or AC/DC converter as required).

6.3 New medical-grade rubber/silicone tubing (Dow-Corning Silastic or equivalent). In corrosive situations, a length of PTFE tubing is used.

6.4 Applicable tubing couplers for discharge and intake, as needed.

6.5 Tape measure or water level instrument.

6.6 Waste container.

6.7 Plastic, glass, or other nonreactive containers should be used as specified by the site sampling plan (see Guide D4687).

7. General Sample Collecltion

7.1 Review the work or sampling plan.

7.2 Check to make sure that the supply of sample containers, labels, ice chest, stopwatch or timing device, composite collection container if required, and sampling equipment in place are adequate and correct. There should be sampling forms, or log books, or equivalent for recording field information such as date, time the sample was taken, sampler's name, physical description of the sampling location, and any other information which might impact the validity of the sample. The log books, sampling forms, and bottle labels should be signed or initialed.

7.3 Provision should be made for split samples and field quality control samples, such as trip blanks, equipment blanks, and field spikes.

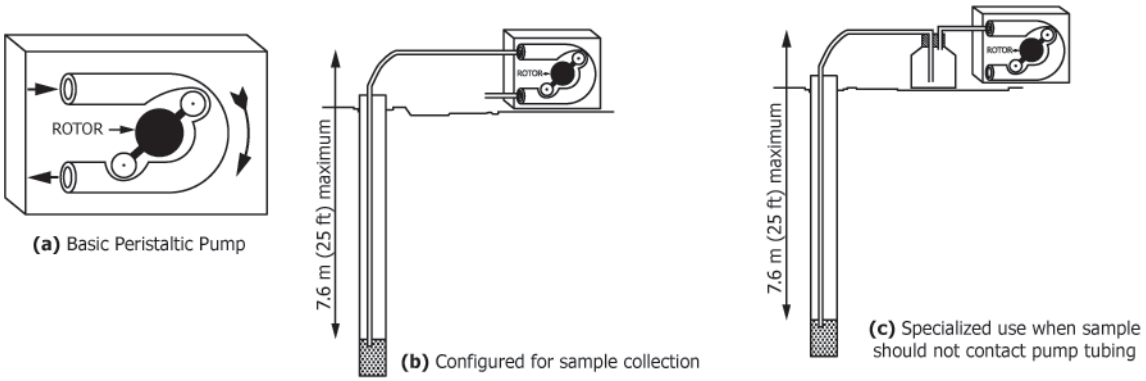

FIG. 1 Peristaltic Pump

8. Pre-Sampling Testing

8.1 Remove the pump cover plate. Slide the tubing through the clamps, position the clamps in their seats, and gently rotate the pump mast to engage the tubing in the pump housing. With the pump mast at the 6:00/12:00 position, the un-pinched tubing should touch the walls of the pump housing (Fig. 1(a)). A little slack is desirable.

8.2 Tighten each pump clamp and replace the pump cover plate.

8.3 Install the battery and hook up the power lead.

8.4 Insert one end of the tubing into the liquid and the other end into a waste container. The arrow on the pump points to the discharge tube.

8.5 Activate the pump.

8.5.1 Observe the flow of the liquid through the tubing and into the waste container.

8.5.1.1 The system may be checked without liquid by placing a finger over the intake of the sampling system and checking for vacuum.

8.5.2 Vary the pump speeds through the full range.

NOTE 2—It is normal for the pump to be a little sluggish at slow speeds.

8.6 Turn the pump off and switch the tube ends so the discharge tubing end is now the intake tubing end and the discharge tubing end is the intake.

8.6.1 Turn the pump direction switch to reverse the pump mast.

8.7 Repeat 8.5.

8.8 Record the following data in the field log book:

8.8.1 Date and time; pump type, manufacturer, and serial number; battery tracking number, type, and manufacturer; lot number of the tubing; and results of the test.

9. General Peristaltic Sampling Setups

9.1 Fig. 1(b) demonstrates sampling directly from the exit tube after the pump.

9.2 Fig. 1(c) demonstrates sampling by attaching a sample bottle to the sampling tube from the sample source and a second tube to the intake side of the pump. The sample intake tube reaches almost to the bottom of the sample container while the bottle exit tube reaches just below the bottle cover. The exit tube is placed in the waste container. The pump does not require an air purge between samples since no liquids are in contact with the pump.

9.2.1 If a new sample source is to be sampled, the sampling tube should be replaced or flushed according to the sampling plan.

10. Procedure for Sampling from Wells

10.1 Review the well construction data to determine the screen size, type, and depth.

10.2 Prepare the labels, sample bottles, waste containers, and coolers.

10.3 Collect a field blank by pumping de-ionized water or equivalent through the new tubing. The tubing should have the same lot number as the tubing used to collect the samples.

10.4 Determine the liquid level using a level meter (water level or oil/water interface meter). **Warning**—Peristaltic pumps are not recommended for sampling below 7.6 m (25 ft) from the top of the well (see Guide D6634 for sampling devices and Guide D4448 for guidance in sampling ground water monitoring wells).

10.5 *Taking the Samples:*

10.5.1 Lower the intake tubing end to the pre-determined depth to be sampled (Fig. 1(b)).

10.5.2 Start the pump and purge the system as specified in the sampling plan.

10.5.3 Turn off the pump and lower the exit tube into the sample container.

10.5.4 Turn on the pump.

10.5.5 Fill the labeled sample bottle or bottles to the desired volume, and apply the cap and custody tape if required (see Guide D4840).

10.6 Air-purge the tubing by reversing the pump direction with the exit side of the pump clear of any liquids before sampling the next level. The pump and sampling tube must be clear of any liquid.

10.7 Reverse the pump again and lower the intake tube to the next level if required.

10.8 Repeat the steps in 10.5.

10.9 Record the information in the field log book and preserve the samples.

10.10 If samples are taken on the suction side of the pump according to 9.2 and Fig. 1(c), pump reversal and air purging will not be required before moving to a new sample level.

11. Procedure for Sampling from Tanks

11.1 Determine the physical dimensions of each tank to be sampled (height, diameter, length, liquid level or depth, and position/height of pump access point).

11.2 Prepare the intake tubing for installation to the pump by marking depth levels as specified in the sampling plan.

11.3 Determine the distance to the top of the liquid and record the data in the field log book.

11.4 Prepare the sample containers according to the sampling plan. Each bottle should have a label which can be placed on the bottle before or at the time of sampling (see Guide D4840).

11.4.1 Aliquots shall be taken at the pre-designated depths as specified within the sampling plan. The data quality objectives will specify whether the samples shall be handled as discrete or composite samples.

11.4.2 Replicates are prepared by repeating the entire process at each of the specified intervals.

NOTE 3—Vertical tanks and horizontal tanks may need to be sampled differently if volumes at a given level need to be considered. In horizontal cylindrical tanks evenly spaced depth intervals do not correspond with equal volumes. If a volume-to-depth relationship is to be maintained, more sample volume needs to be collected in the middle than at the top or