

**OPERATOR'S MANUAL FOR THE US DH-2
DEPTH-INTEGRATING COLLAPSIBLE-BAG
SUSPENDED-SEDIMENT/WATER-QUALITY SAMPLER**



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FEDERAL INTERAGENCY SEDIMENTATION PROJECT

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Operator's Manual for the US DH-2 Depth-Integrating Collapsible Bag Suspended-Sediment/Water-Quality Sampler

Characteristics

Description: The US DH-2 is a hand-line depth-integrating collapsible-bag suspended-sediment and water-quality sampler capable of collecting a 1-liter sample. It is 20 inches long, weighs 30 pounds, and has a hollow cavity inside the sampler body. It is fabricated from a bronze casting with a plastic nose-piece and a High Density Polyethylene (HDPE) tail. Figure 1 is a photograph of the sampler. The bronze casting is plastic coated with commercially available "PlastiDip." (The use of brand names in this document is for identification purposes only and does not constitute endorsement by the United States Government.) The cavity in the bronze body is plastic lined. The plastic nose-piece holds the nozzle and nozzle holder in place and "snaps" into the sampler body with slight hand pressure. The collapsible bag is attached to the rear of the nozzle holder with a hook-and-loop strap. The US DH-2 meets protocols for water-quality sampling as outlined in the USGS National Field Manual for the Collection of Water-Quality Data.

Sampling container: The US DH-2 has a hollow cavity in the sampler body that houses the collapsible bag. A perfluoroalkoxy (PFA) bag or a polyethylene bag can be used. The lay-flat bags are 6 in by 14 in by 0.002 in wall thickness.

Sampler function: When the sampler is submerged with the nozzle pointed into the flow, the water-sediment mixture flows through the nozzle into the bag at a rate that is the same or nearly the same as the ambient stream velocity, within a certain acceptable velocity range. An acceptable velocity range is one at which a representative flow-weighted sample is collected at a sampler inflow efficiency between 90% and 110%. Inflow efficiency is defined as the ratio of the sample velocity in the nozzle to the ambient stream velocity. An inflow efficiency of 100% is referred to as isokinetic.

Nozzles: Tetrafluoroethylene (TFE) and plastic nozzles and nozzle holders are available for use with the US DH-2. The nozzles are stamped "TFE" or "P" to denote the material and "3/16", "1/4" or "5/16" to denote the internal diameter. In addition, plastic nozzles and nozzle holders have a red ring for quick identification. Figure 2 shows the stamped area of the nozzles. Caution: plastic parts should NOT be used when an acid rinse is used in the sampling/cleaning protocol. Do not acid rinse plastic parts. Acid deteriorates the plastic and compromises the integrity of the nozzle. Only TFE parts should be used when parts must undergo an acid rinse.

Operating Limitations

Velocity : The US DH-2 sampler will collect representative flow-weighted samples in streams with velocities from 2 to 6 feet per second (ft/sec).

Depth: At a maximum transit rate of 0.4 times the stream velocity, the US DH-2 sampler is capable of sampling to a depth of 13 ft with a 5/16 in diameter nozzle, 20 ft with a 1/4 in diameter nozzle, and 35 ft with a 3/16 in diameter nozzle.

Unsampled zone: The US DH-2 sampler can sample to within 3.5 inches of the streambed. This unsampled zone is the distance between the nozzle and the bottom of the sampler.

Transit rate: The transit rate is the speed of lowering and raising the sampler in the sampling vertical. The minimum transit rate is one at which the sample volume does not exceed 1 liter. The table gives the sampling time to collect 1 liter of sample for the three internal diameter nozzles at varying stream velocities. The minimum transit rate can be calculated using the sampling time from the table and the total distance to be transited. For example, if the total sampling time is 30 sec, the minimum transit rate should be such that it takes 15 sec to descend from the surface to the bottom, and 15 sec to return to the surface. If the stream is 15 ft deep, then the transit rate would be 1 ft/sec.

The maximum transit rate is 0.4 times the mean stream velocity. This limitation is based on the apparent approach angle of the flow into the nozzle that results from the vertical movement of the sampler through the water column.

Operating Instructions

The US DH-2 is simple to use when the following steps are followed:

1. Select the appropriate nozzle and nozzle holder. Select a bag and place the bag opening over the rear of the nozzle holder. “Gather” the bag around the rear of the nozzle holder as shown in figure 3.
2. Secure the bag by cinching it down with the hook-and-loop strap as shown in figure 4.
3. Slide the nozzle holder into the back of the nose-piece. Align the lug on the nozzle holder with the slot in the nose. See figure 5.
4. Insert the nozzle through the hole in the front of the nose-piece and screw it into the nozzle holder. Hand tighten only. See figure 6.
5. Lay the nose-piece with nozzle, nozzle holder, and bag on a flat surface. Starting at the rear of the bag, use one hand to hold the bag, and the other hand to flatten and push the air out of the bag through the nozzle as shown in figure 7.
6. Fold the bag in half along the longitudinal centerline as shown in figure 8 and push the air out of the bag as depicted in figure 9.
7. Insert the bag into the sampler cavity as seen in figure 10. Place the bottom of the nose-piece into the bottom of the sampler cavity (figure 11) and snap it into place as shown in

figure 12. The sampler is ready for use. Refer to the table and the transit rate section for appropriate sampling time and transit rate.

8. Once the sample is collected, remove the nose-piece by grabbing it at the sample body indentations (figure 13) and popping it out (figure 14). Make sure to support the bag with sample as it is removed from the sampler.
9. Do not pour the sample back through the nozzle. The sample may be transferred to another container, processed on site, or transported back to the lab in the bag if means of safe transport are available. Plastic bags should be discarded after use. PFA bag should be cleaned and rinsed thoroughly before re-use to avoid sample contamination.
10. The tightness of fit of the nose-piece in the sampler body can be adjusted by removing the O-ring and adding or removing Teflon plumber's tape in the groove and replacing the O-ring.

For further information on how to properly collect sediment and water-quality samples see: Field Methods for Measurement of Fluvial Sediment: U.S. Geological Survey Techniques of Water Resources Investigations, book 3 chapter C2, available at <http://water.usgs.gov/pubs/twri/twri3-c2> and National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, Selection of Equipment for Water Sampling, book 9, chap. A2, available at: <http://water.usgs.gov/owq/FieldManualT>

Transport and Storage

The US DH-2 is shipped to the user in a custom box. The sampler should always be transported in the shipping box. It is also advised to store the sampler in the shipping box to prevent damage. The box should be left open to completely evaporate any residual moisture before long-term storage.

Questions and comments regarding sampler operation should be addressed to:

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Table-- Filling time to collect 1 liter, *seconds*

Stream Velocity, ft/sec	Nozzle Dia., 3/16 in	Nozzle Dia., 1/4 in	Nozzle Dia., 5/16 in
2.0	92	52	33
2.2	84	47	30
2.4	77	43	28
2.6	71	40	25
2.8	66	37	24
3.0	62	35	23
3.2	58	32	21
3.4	54	30	19
3.6	51	29	18
3.8	49	27	17
4.0	46	26	17
4.2	44	25	16
4.4	42	24	15
4.6	40	23	14
4.8	38	22	14
5.0	37	21	13
5.2	35	20	13
5.4	34	19	12
5.6	33	19	12
5.8	32	18	11
6.0	31	17	11



Figure 1-- US DH-2 sampler

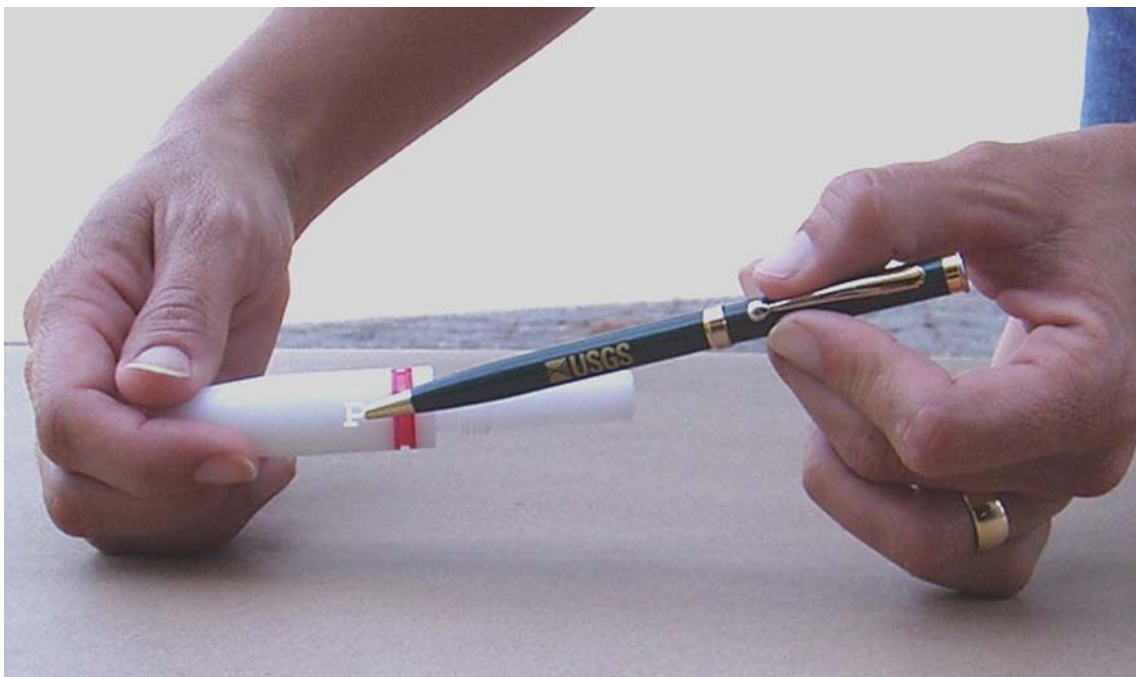


Figure 2-- Indication of nozzle material (P: plastic)



Figure 3-- “Gather” the bag opening around the nozzle holder



Figure 4-- Secure bag with hook-and-loop strap



Figure 5-- Insert nozzle holder into nose-piece



Figure 6-- Screw nozzle into nozzle holder



Figure 7-- Lay the bag flat and push the air out



Figure 8-- Fold the bag along the longitudinal centerline



Figure 9-- Push the air out of the folded bag



Figure 10-- Slide the bag into the sampler cavity



Figure 11-- Insert the bottom of the nose-piece into bottom of sampler cavity



Figure 12-- Snap the nose-piece into the sampler cavity



Figure 13-- To remove sample, grab nose-piece at sampler body indentions



Figure 14-- Pop the nose-piece from sampler body and remove sample