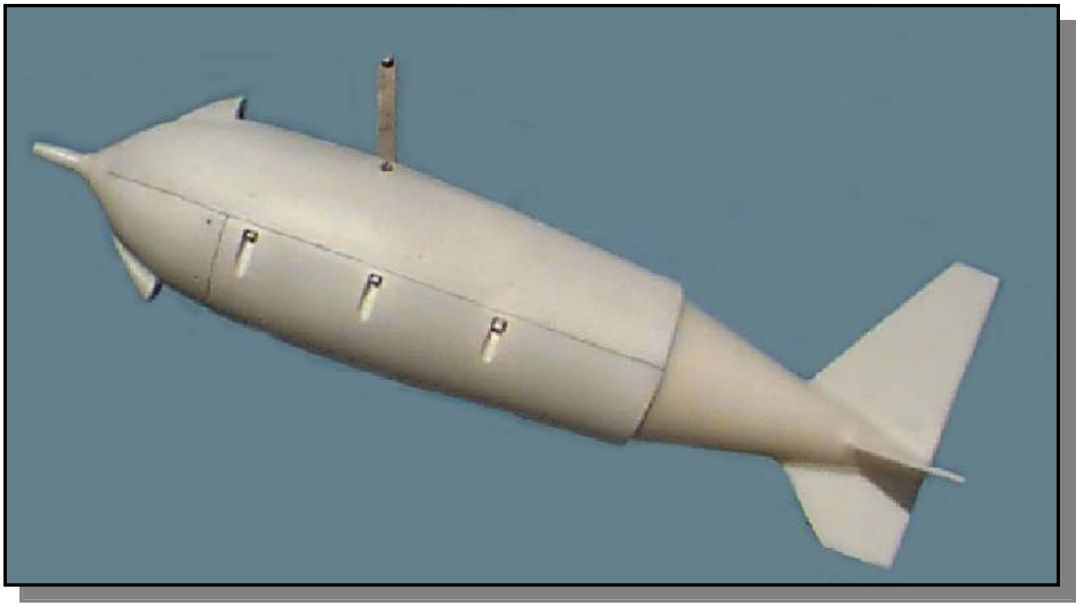
OPERATING INSTRUCTIONS FOR THE US D-96 DEPTH-INTEGRATING COLLAPSIBLE BAG SUSPENDED-SEDIMENT SAMPLER



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Operating Instructions for the US D-96 Depth-Integrating Collapsible Bag Suspended-Sediment Sampler

Characteristics

Description: The US D-96 is a collapsible bag sampler capable of collecting a 3 liter sample. It is 35 inches long, weighs 132 pounds, and has a hollow cavity inside the sampler body. It is fabricated from bronze and aluminum castings with a High Density Polyethylene (HDPE) tail. Figure 1 is a schematic of the sampler. All metal parts are plastic coated with commercially available "PlastiDip." (The use of brand names is this document is for identification purposes only and does not constitute endorsement by the United States Government.) The sampler employs a sliding tray that supports the bag and holds the nozzle holder with nozzle in place. The bag is attached to the nozzle holder with a hook-and-loop strap. The sampler is protected by US Patent No. 6,216,549 B1.

Sampling container: The sampler employs a perfluoroalkoxy (PFA) bag or a polyethylene bag as the sample container.

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.

Operating Limitations

Velocity : The US D-96 sampler will collect acceptable flow-weighted samples in streams with velocities from 2 to 12.5 feet per second (ft/sec). Extreme care should be practiced when deploying the sampler at stream velocities above 10 ft/sec.

Depth: At a maximum transit rate of 0.4 times the stream velocity, the US D-96 sampler is capable of sampling to a depth of 39 ft with a 5/16 in diameter nozzle, 60 ft with a 1/4 in diameter nozzle, and 110 ft with a 3/16 in diameter nozzle.

Unsampled zone: The US D-96 sampler can sample to within 4 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 US D-96 sampler is not subject to the same transit rate limitations as rigid bottle samplers. The minimum transit rate is one at which the sample volume does not exceed 3 liters. Table 1 gives the sampling time for the three 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 60 sec, the minimum transit rate should be such that it takes 30 sec to descend from the surface to the bottom, and 30 sec to return to the surface. If the stream is 30 ft deep, then the transit rate would be 1 ft/sec.

The maximum transit rate is 0.4 times the stream velocity, which is due to the apparent approach angle of the nozzle as it moves vertically in the stream. The transit rate should never exceed 0.4 times the stream velocity.

Operating Instructions

Tetrafluoroethylene (TFE) and plastic nozzles and nozzle holders are available for use with the US D-96. The nozzle holders are stamped "TFE" and "P" to denote the material. Figure 2 denotes the stamped area on the nozzle holder The nozzles are also stamped to denote the material and the diameter. In addition, the plastic nozzles have a red ring for quick identification. Figure 3 shows the stamped area of the nozzles. It should be noted that plastic parts should NOT be used when an acid rinse is used in the sampling/cleaning protocol. Only TFE parts should be used when parts must undergo an acid rinse.

The US D-96 is simple to use when the following steps are followed:

1. Select the appropriate nozzle and screw it into the nozzle holder. See figure 4.

2. Place the nozzle holder in the center of the bag opening as shown in figure 5. "Gather" the open end of the bag around the rear of the nozzle holder between the 2 lugs as depicted in figure 6.

3. Secure the bag by cinching it down between the 2 rear lugs with the hook-and-loop strap as shown in figure 7.

4. Lay the bag and nozzle holder combination on a flat surface. (The top of the shipping box makes an excellent work platform.) Starting at the rear of the bag, use one hand to hold the bag, and the other hand to flatten and push all the air out of the bag through the nozzle as shown in figure 8.

5. Slide the nozzle holder into the nose insert as shown in figure 9 and rotate it 180 degrees as shown in figure 10. It will only go in the nose insert one way. A small 1/16 in diameter hole in the nozzle holder should be visible and pointed up as depicted in figure 11. Make sure the bag does not cover the hole.

6. Lay the bag out flat in the tray as shown in figure 12. Fold the rear of the bag into the tray so that it does not hang past the rear of the tray and get pinched between the tray and the sampler cavity. Insert the slide tray into the sampler cavity as shown in figure 13. The sampler is now ready to use. Refer to table 1 and the transit rate section for appropriate sampling time and transit rate.

7. Once the sample is collected, remove the slide tray, remove the hook-and-loop strap (figure 14), and remove the bag containing the sample (figure 15).

8. 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 for safe transport are available. The bag can be re-used after rinsing.

Two elements in the instructions are critical to insure isokinetic sampling. (1.) As much air as possible must be removed from the bag. (2.) The 1/16 inch diameter "pressure equalization hole" should be pointed up, not covered by the bag, and free from any debris. The hole can easily be cleared with a toothpick. This is extremely important for slow stream velocities in the 2 to 3 ft/sec range. Caution should be used when clearing the hole to insure that it is not enlarged or distorted.

Transport and Storage

The US D-96 is shipped to the user in a custom-built wood box. The sampler should always be transported in the shipping box. The sliding tray must be removed for transport. The box is built with a flat support for the front end of the sampler rest on. A curved cradle is made to support the rear of the sampler. The binding straps must be secured for transport. The sampler is top heavy and can shift in the box if not properly secured, causing damage to the tail fins. It is also advised to store the sampler in the shipping box to prevent damage.

Questions and comments regarding sampler operation should be addressed to:

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Stream Velocity, ft/sec	Nozzle Diameter, inch		
	3/16	1/4	5/16
2.0	277	156	99
2.2	251	141	90
2.4	231	130	83
2.6	213	120	76
2.8	198	111	71
3.0	185	104	66
3.2	173	97	62
3.4	163	91	58
3.6	154	86	55
3.8	146	82	52
4.0	137	77	50
4.2	132	74	47
4.4	126	71	45
4.6	120	68	43
4.8	115	65	41
5.0	111	62	40
5.2	106	60	38
5.4	102	58	37
5.6	99	56	35
5.8	95	54	34
6.0	92	52	33
6.2	89	50	32
6.4	86	49	31
6.6	84	47	30
6.8	81	46	29
7.0	79	44	28
7.2	77	43	28
7.4	75	42	27
7.6	73	41	26
7.8	71	40	25
8.0	69	39	25
8.2	67	38	24
8.4	66	37	24
8.6	64	36	23
8.8	63	35	23
9.0	61	35	22
9.2	60	34	22
9.4	59	33	21
9.6	58	32	21
9.8	56	32	20
10.0	55	31	20
11.0	50	28	18
12.0	46	26	16
13.0	43	24	15

Table 1—Filling time to collect 3 liters, *seconds*

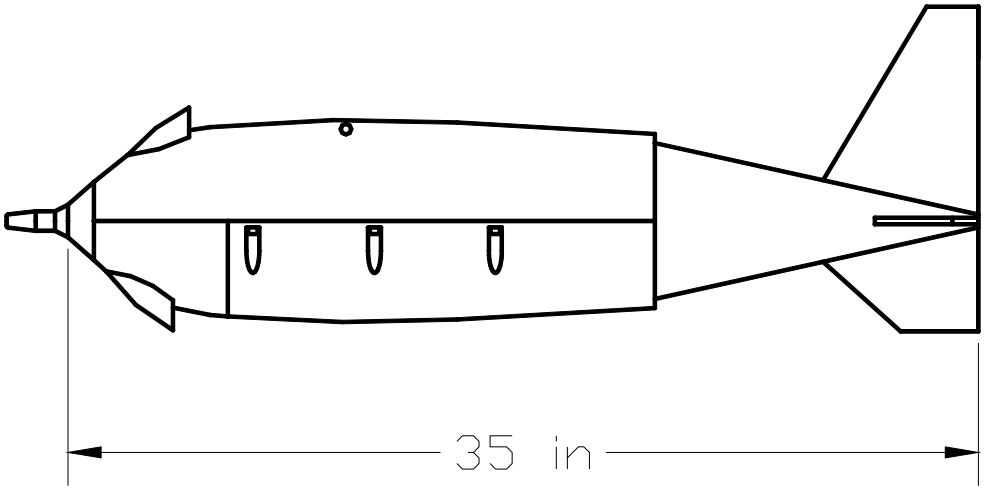

Figure 1-- Schematic

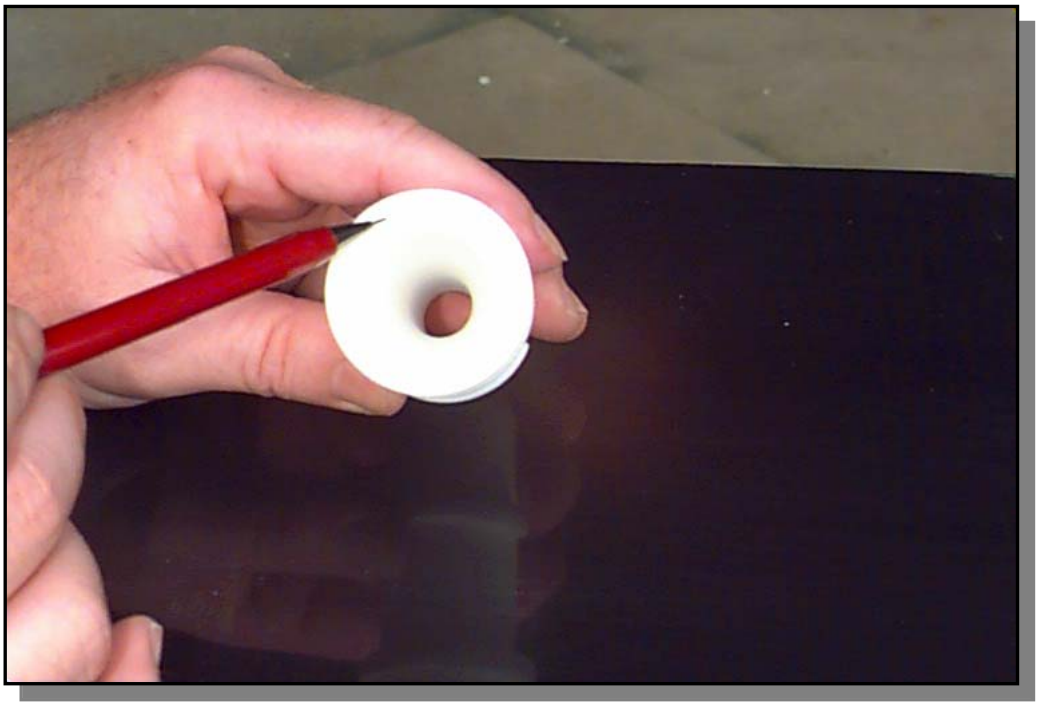

Figure 2-- Stamped area of nozzle holder

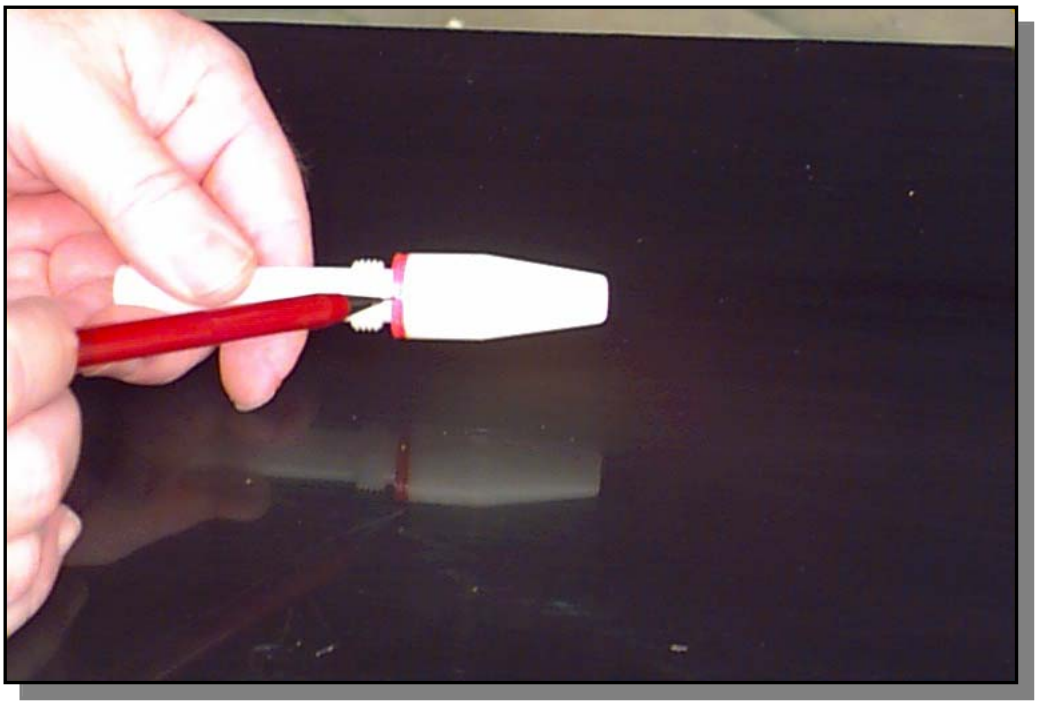

Figure 3-- Stamped area of nozzle

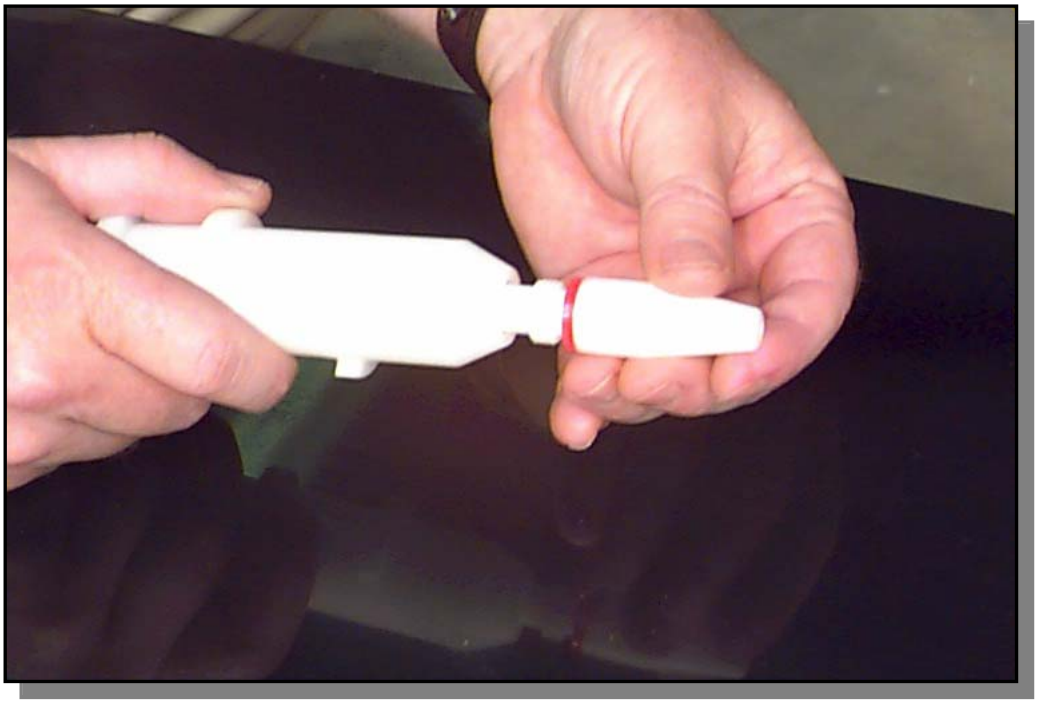

Figure 4-- Insert nozzle into nozzle holder

Figure 5-- Place nozzle holder in center of bag

Figure 6--"Gather " bag between lugs

Figure 7-- Secure with hook-and-loop strap

Figure 8-- Push air out of bag through nozzle

Figure 9-- Insert nozzle holder into nose piece

Figure 10-- Rotate nozzle holder 180 degrees

Figure 11-- Pressure equalization hole

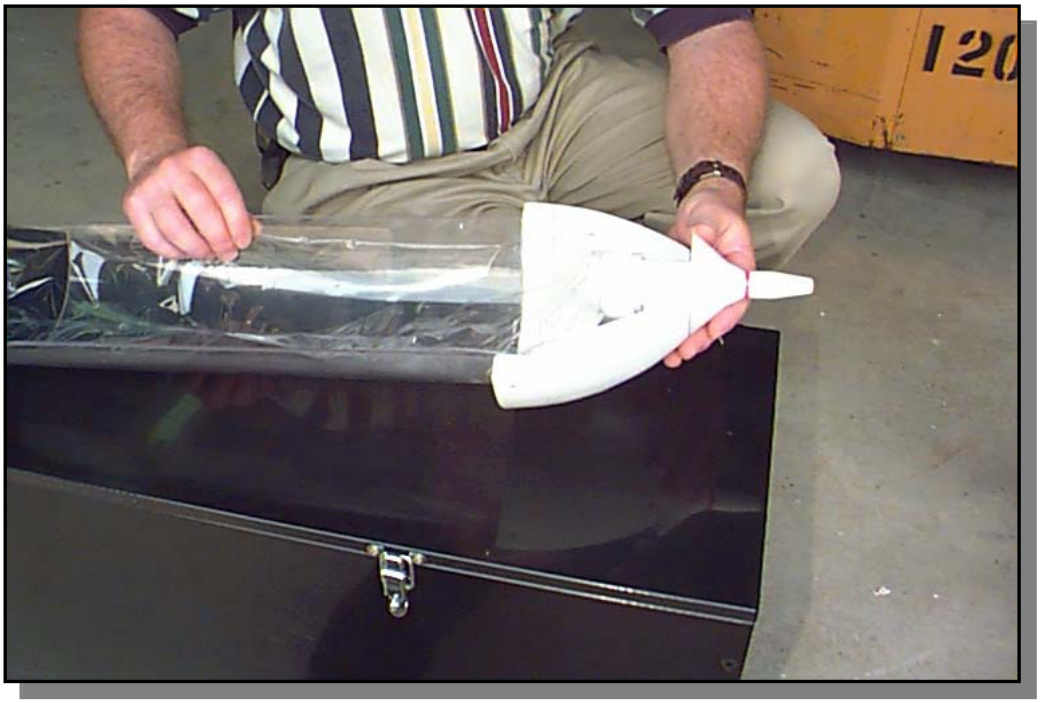

Figure 12-- Lay bag flat in tray

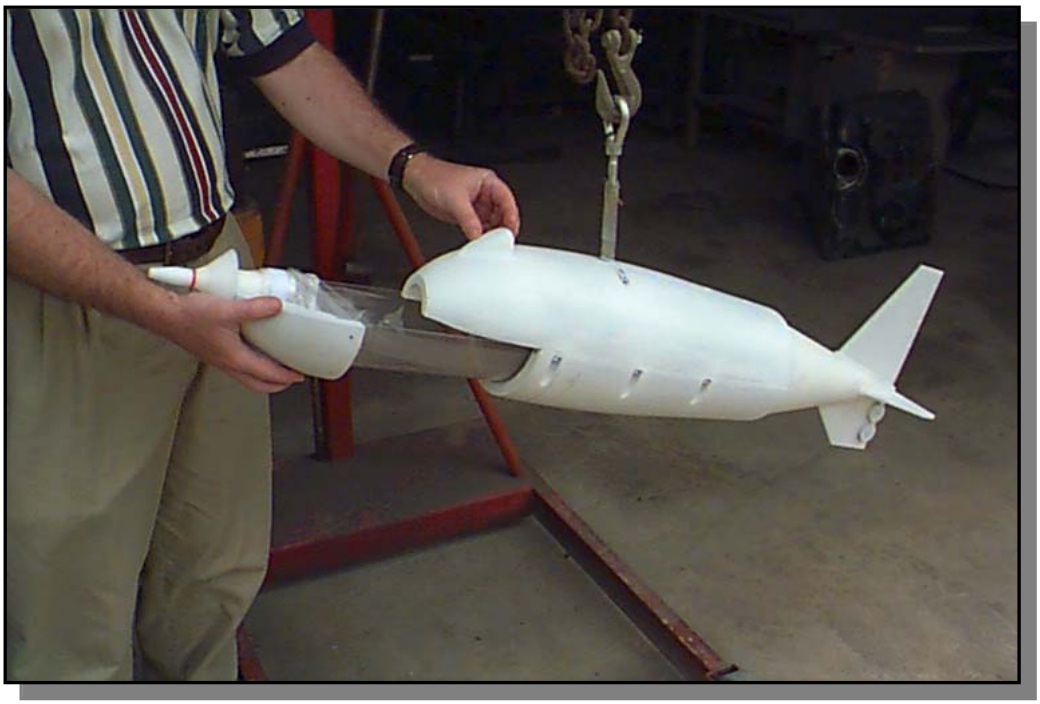

Figure 13-- Place tray in sampler body

Figure 14-- Remove hook-and-loop strap

Figure 15-- Remove bag containing sample