DIY-DiP-FAST Kit

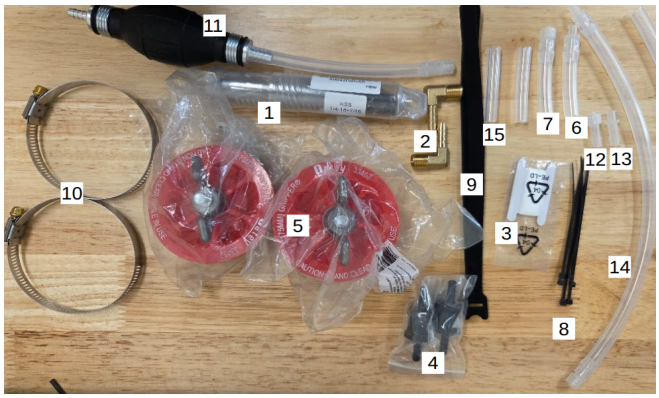
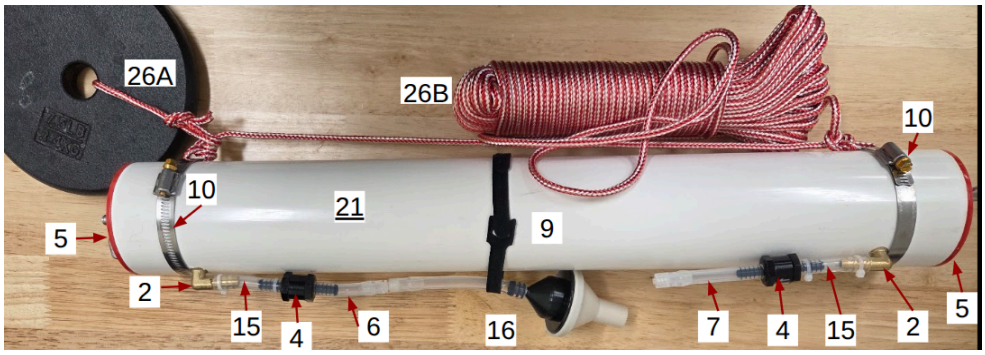




Table A: DIY-DiP-FAST Kit contents			
Part id	**Description**	**Purpose**	**Quantity**
1	¼” NPT tap drill (7/16”) and Tap	Drilling and tapping holes for Part 2	1
2	¼” NPT to ¼” Barb Right Angle	Inlets and outlet fittings	2
3	Teflon tape	Sealing for part 4	1 roll
4	In-line check valve	Inlet and outlet check valves	2
5	Gripper 3 in. Plastic Mechanical Test Plug	Endcaps for tubes	2
6	¼” Silicone Tube Inlet Adapter	Inlet adapter tube with inlet luer	1
7	¼” Silicone Tube Outlet Adapter	Outlet adapter tube with outlet luer	1
8	4” zip ties	Tightening tubes on barbs	10
9	Velcro straps	Stabilizing filters	4
10	4” Hose clamp	Rope/weight attachments	2
11	Pump bulb with luer lock adapter for outlet	Vacuum and negative control testing	1
12	Spare luer to ¼” tube adapter M	Spare for ¼” tube to attach to outlet luer	1
13	Spare luer to ¼” tube adapter F	Spare for ¼” tube to attach to outlet luer	1
14	Luer M to Luer F 12” tube	Negative control	1
15	2” long ¼” tube	Barb right angle -> inline check valve	2

Table B: Filter Kit			
Part id	**Description**	**Purpose**	**Quantity**
16	Smith-root reusable filter housing with ¼” NPT to ¼” Barb adapter	Reusable filter holder loaded w/ drain disk and 1.2 um pore PES filter.	1
17	Drain disks (purple dot)	Drain disk refills (improve flow)	4
18	Filter papers: PES 1.2 um pore (yellow dot)	Filter refills (catch eDNA inside filter holder)	4
19	Tweezers	Place/remove filters from filter holder	1
20	Tube for Smith-root filter holder	Negative control testing	1

Table C: Not Included/what you’ll need			
Part id	**Description**	**Purpose**	**Quantity**
21	PVC Tube: 3 in x 2 ft (or local equivalent)	Tube for DiP-FAST	1
22	Hand Drill	Drilling holes	1
23	Adjustable wrench	Tightening fittings in holes	1
24	Smaller drill bit (⅜” or 9mm works well)	Pre-drilling hole prior to using (1) 7/16” bit	1
25	Tap Wrench (optional)	Tapping hole using provided tap drill	1
26A/B	Weight and Rope	Deploying sampler	1 each



DIY-DiP-FAST Kit
Building Your DIY-DiP-FAST

Step 1: Drill the holes

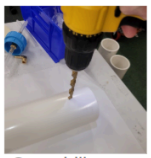
1) Mark points on tube (21) approximately 2 inches (5 cm) from each end of the tube.

2) Using a smaller drill bit (24) (I used 3/8"), do an initial drill of each hole as straight as you can.

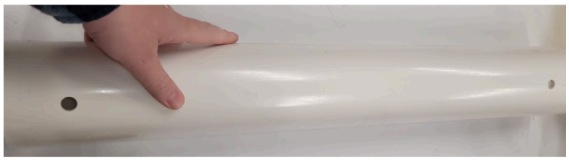
3) Using the 7/16" drill bit (1), carefully drill out both holes to the tap drill size. **Safety note:** wear safety glasses & tie back long hair when operating power tools



Mark hole positions approximately 2 inches (5 cm) from each end



Step drill, ending with 7/16" bit



Two holes are now drilled near the ends of your DiP-FAST DIY.

Step 2: Tap holes with 1/4-18 NPT tap

1) In one of the holes, hand-screw the 1/4 NPT tap drill (1) in until you are unable to further advance it.
2) Using a tap drill or wrench, screw tap drill into hole until about 1/3 advanced along its length. NOTE: Do not fully advance the tap through the hole.
3) Repeat on second hole.



Insert tap drill | Tap Holes with tap | Tapped Holes

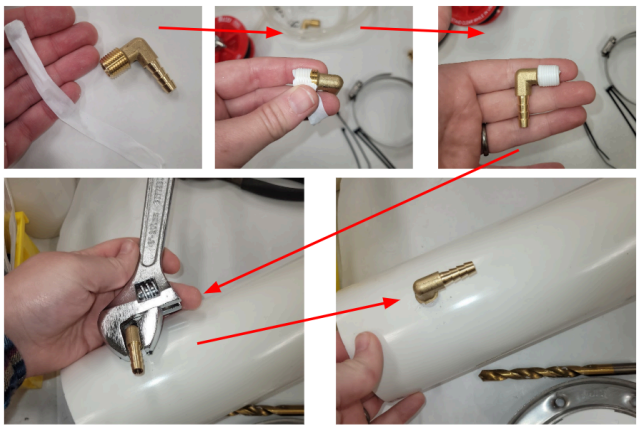
Step 3: Prepare and insert the fittings

1) Wrap teflon tape (3) around the thread on the brass 1/4" NPT to 1/4" barb fitting (2) until it is tight and wrapped several times

2) Screw fitting into one of the holes. Hand thread until you are not able to advance it further.

3) Using a wrench, tighten fitting until it is fully tight and facing along the tube.

4) Repeat with other hole/fitting.

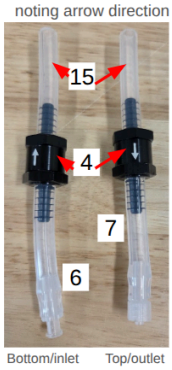


Step 4: Add tubing and check valves

1) Connect inlet assembly (6 -> 4 -> 15) and outlet assembly (15 -> 4 -> 7)

2) Install inlet and outlet assemblies and zip tie in place.
Note: Make sure the inlet check valve has the arrow pointing towards the brass fitting, and the outlet has the arrow pointing away from the brass fitting

Connect in/outlet valve assemblies noting arrow direction



Bottom/inlet Top/outlet

Install outlet assembly



Install inlet assembly



Step 5: Install test plugs Place a test plug in each end and tighten wing nut until firmly held in place in tube.





DIY-DiP-FAST Kit

Lab Test and Negative control

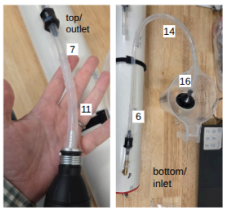
1) Attach hand pump (11) to outlet tube (7) using luer lock

2) Attach negative control tube (14) to inlet tube (6)

3) Attach Filter holder (16) to inlet of negative control tube (14)

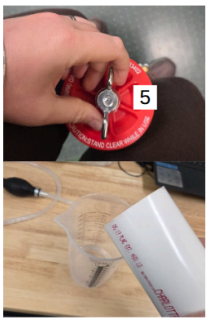
4) Place end of filter holder (14) in water; pump hand pump until water begins to flow. If water flows, your system seals; pump desired amount of water for negative control.

5) Recover sample: Stand on end, remove top plug (5) and pour out water. Remove the filter holder. Remove filter and process.

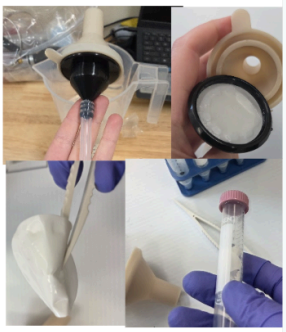


Attach bulb and filter


Take Sample

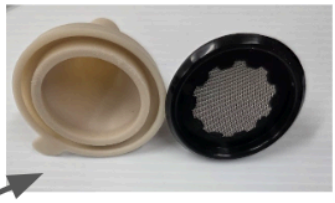


Remove top plug and pour water sample


Remove filter & process as desired

Filter holder sterilization




1) Open filter holder; remove filter paper if required.


2) Soak all parts in 10% bleach solution.


3) Rinse all parts with fresh water (deionized is best)


4) Allow to dry before re-assembling.

Loading Drain disks and filters in filter holders

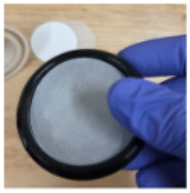


1. Open filter holder, remove drain disk and filter from packaging





2. Identify drain disk (17A) and filter membrane (18A), separate from stiffener (17B/18B).


3. Load drain disk


4. Load Filter


5. Close filter holder.

Field Testing: System Prep

1) Attach hose clamp near top of tube, tie rope to hose clamp leaving a 3-4 ft tail. Tighten hose clamp.

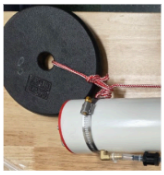
2) Attach hose clamp to bottom of tube, tie rope.

3) Tie rope tail to weight (you will need 7-10 lbs). Mark rope to desired soak depth.

4) Prepare and attach filter, stabilize with velcro


Rope through top hose clamp with tail, tie & tighten


Rope through bottom hose clamp, tie & tighten.


Tie on weight near bottom

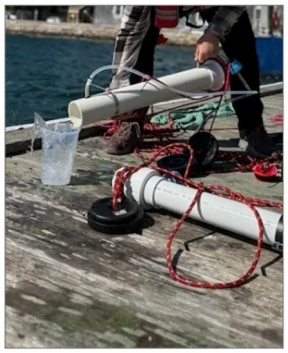

Attach & velcro filter


Ready to Deploy!

DIY-DiP-FAST Kit

Deploying the DiP-FAST





1) Lower to **soak depth** using rope and leave at soak depth for at least **soak time** for **max fill**. (See table below)

2) Recover. As you pull up the DiP-FAST, you should see bubbles from the outlet valve as pressurized air escapes.

3) Remove filter and freeze or preserve. Remove top cap and pour water into a measuring vessel to get accurate estimate of volume captured.

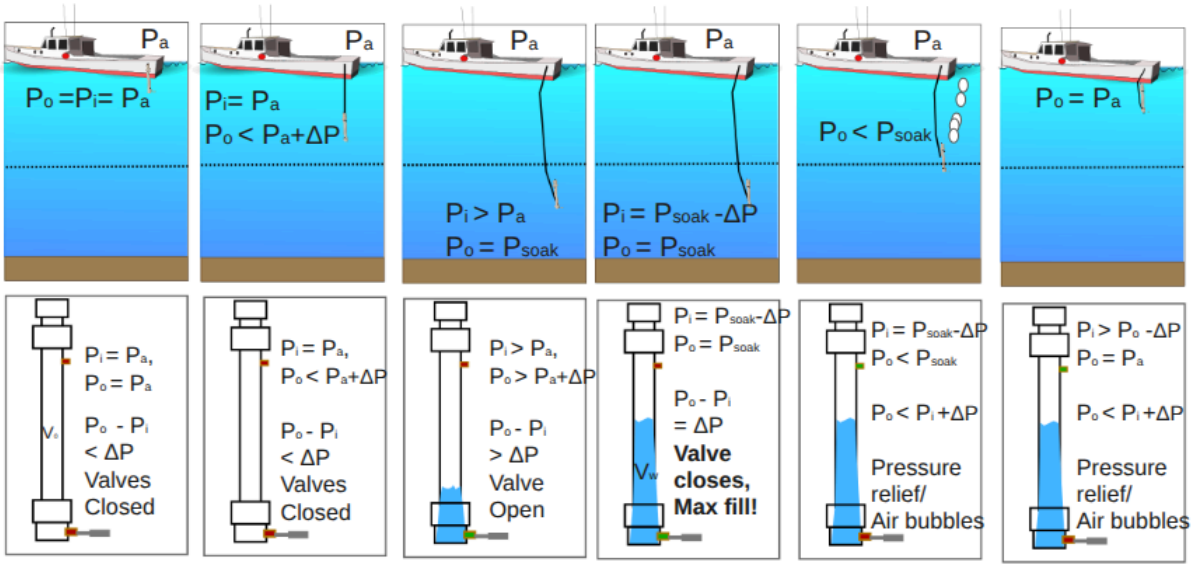
4) Clean and sanitize with 10% bleach solution as needed.

DiP-FAST DIY Fill and Soak Table		
Soak Depth	**Max fill (mL)**	**Soak time (s)**
3	260	31
5	659	79
10	1269	152
15	1614	194
20	1836	220

Note: for shallow operation (<5 m), we recommend attaching a ¼" or 9 mm aquarium tube stretching from the outlet of the DiP-FAST to the surface along the deploy rope. This will provide near-complete fill.

Note: To increase fill, you can also do a "double dip": after initial soak, raise the DiP-FAST to the surface, then lower again and repeat as desired. This will increase the max volume fill.

How it works



$V_w = V_0 - V_0 P_a / (P_{soak} - \Delta P)$

P_o = outside pressure, P_i = inside pressure, ΔP= 2.9 PSI = valve pressure
P_a = atmospheric pressure, P_{soak} = water pressure at soak depth
V_w = wet fill volume, V_0 = volume of DiP-FAST

Soak depth: Depth to which you lower the DiP-FAST, with corresponding water pressure $\mathbf{P_{soak}}$.
Max Fill (V_w): Maximum volume of water expected in the DiP-FAST. For DiP-FAST-DIY, ΔP ~= 2.9 PSI = 20 kPa.
Min Soak Time (τ): Minimum time expected to achieve max fill at soak depth, $\tau = V_w / F$
Filter rate (F): Filter flow rate for selected filter. F~=500 mL/minute for Smith-Root Filter holder and provided filter papers/drain discs.