

# Use and Assembly of the Advanced Low Volume Membrane Kit

*This product information document will describe how to assemble the Advanced Low Volume Membrane Kit. The cell is designed to diffusionally isolate half-reactions using a membrane or separator, which is supplied by the researcher. The cell is not a pressure vessel, so if any insert gas is added (e.g., using a purge/sparge tube), be sure to add a vent in the headspace. This is true for both sides of the cell, as gas will not easily pass from one half to the other with traditional membranes.*

## 1. Advanced Low Volume Membrane Kit Assembly

### 1.1 Membrane Kit Items and Assembly

The Advanced Low Volume Membrane Kit (Pine Research part number AF01CKT1027) comes with the items shown below (see Figure 1-1).

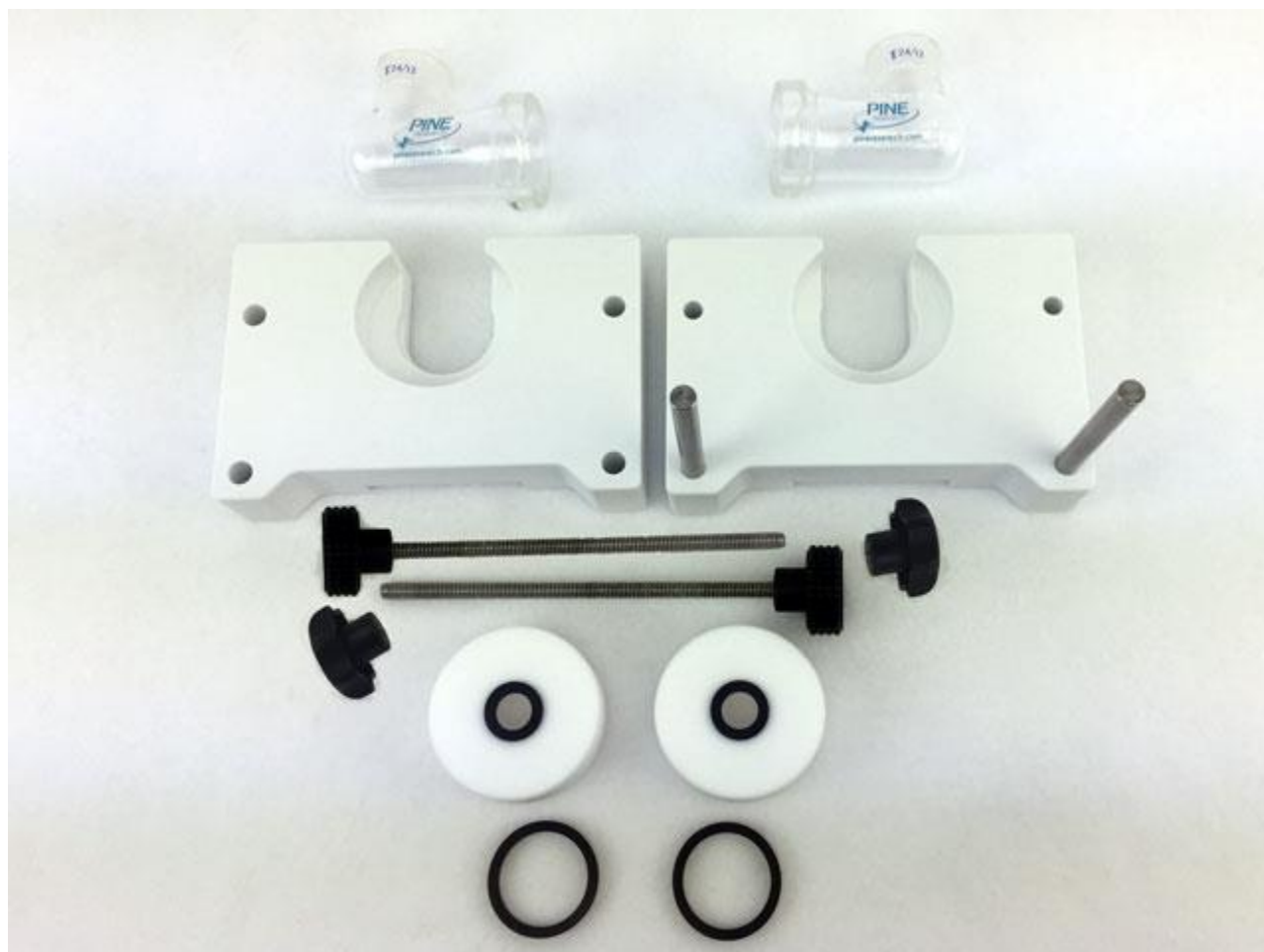
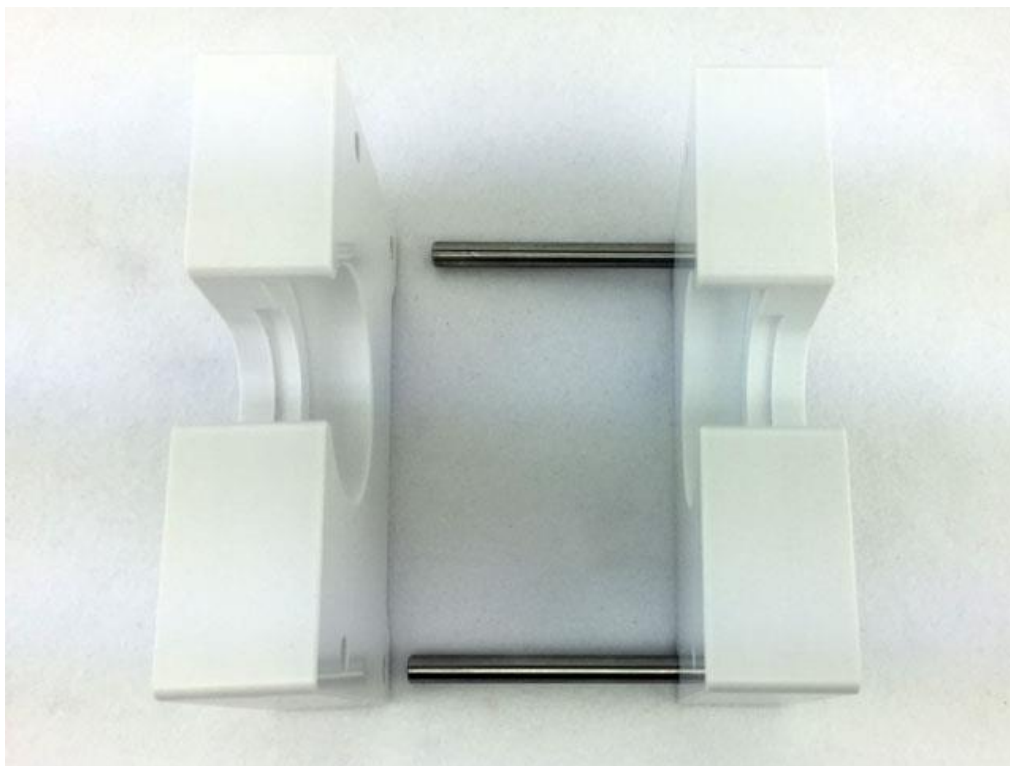
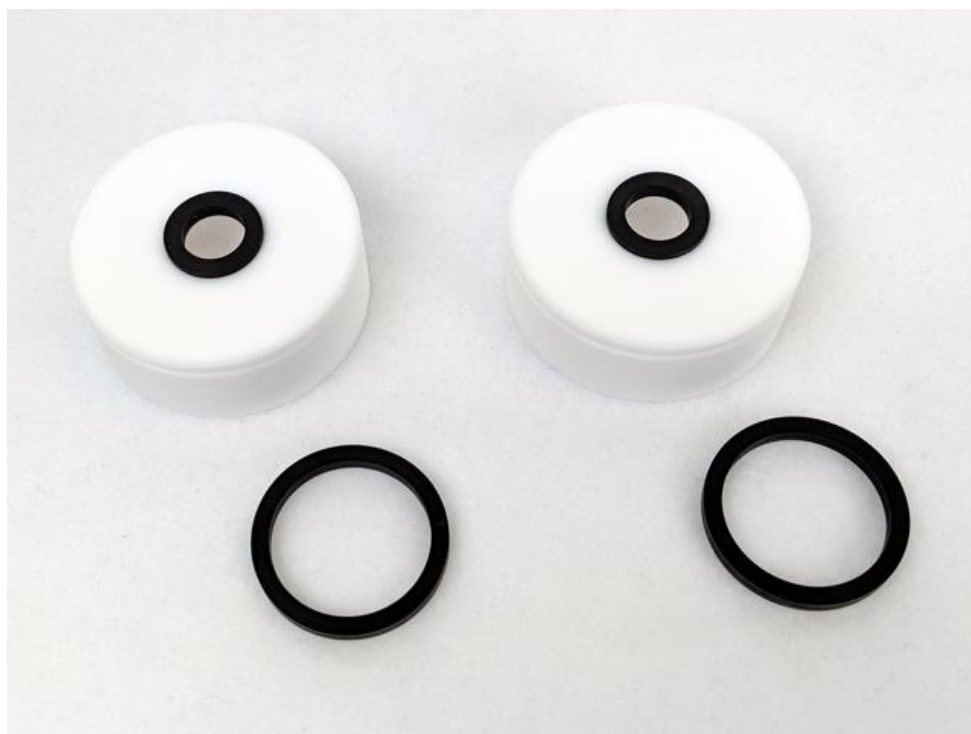


Figure 1-1. Hardware included with the Advanced Low Volume Membrane Kit

To assemble the membrane kit, first arrange the two PET frame pieces (Pine Research part number AF01CKT1021) directly facing each other as shown in the image below (see Figure 1-2). One of the frame pieces has two metal centering rods and the other has corresponding holes at the bottom where the rods can be inserted.



**Figure 1-2. Arrange the two PET frame pieces facing each other**



**Figure 1-3. Half cell “pucks” (1 cm<sup>2</sup> bore area) with O-rings**

The kit comes with two PTFE “pucks” – one for each half cell – as well as two O-rings per puck (see Figure 1-3). The standard pucks that come with the AF01CKT1027 kit (Pine Research part number AC01CKT1021M03) have a 1 cm<sup>2</sup> opening, meaning the exposed surface area of the membrane/separator between the two half cells will be 1 cm<sup>2</sup>. Pucks with different sized bore openings may be available upon request.

There are grooves on both sides of each puck where the O-rings sit. The smaller O-ring can be placed in the groove on the outside, flat surface (see Figure 1-3), while the larger O-ring fits inside the cavity (see Figure 1-4). Insert each glass half cell into their respective puck cavities (note: both pucks and half cells are identical, and can be used interchangeably) (see Figure 1-5).



**Figure 1-4. Glass half cell with PTFE puck and both O-rings installed**



**Figure 1-5. Glass half cells inserted into PTFE pucks**

Place each half cell-puck combination into the slots in each PET frame piece facing each other (see Figure 1-6). The pucks must be first positioned in front of the frame piece grooves and pulled back into the slots to fit properly. The user will notice that the diameter of the puck and glass cell flange is too wide to be simply dropped straight into the frame slot from above. This is intentional so that once it has been slipped into the groove, it will remain in place, facilitating easy assembly and centering of each cell half.

Begin moving the two frame pieces together, inserting the metal centering rods into the opposing holes as the pieces are closed together. Tip: it is often easiest to press near the bottom outer edged of the two PET frame pieces to begin closing them together. Next, insert the two long threaded rods into the upper holes of the piece from which the metal rods also protrude, and extend the rods through the opposing holes in the second frame piece. Begin threading on the small knobs at the end of each threaded rod (see Figure 1-6).

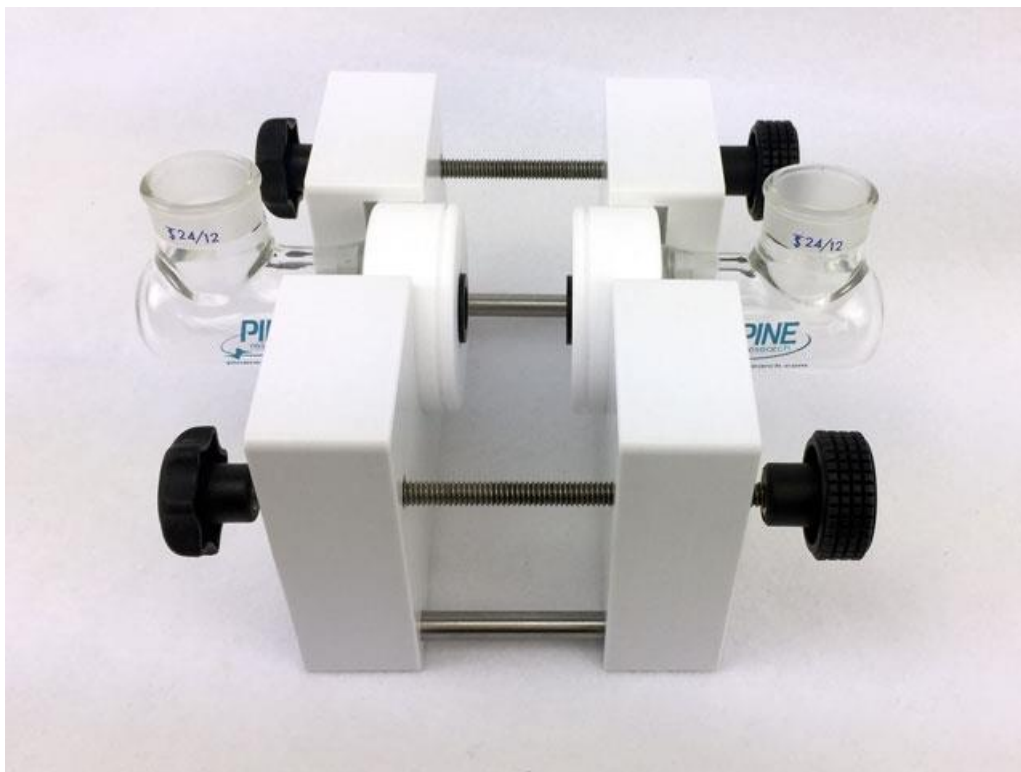


Figure 1-6. Half cells and pucks inserted into PET frame pieces; threaded rods and knobs also inserted

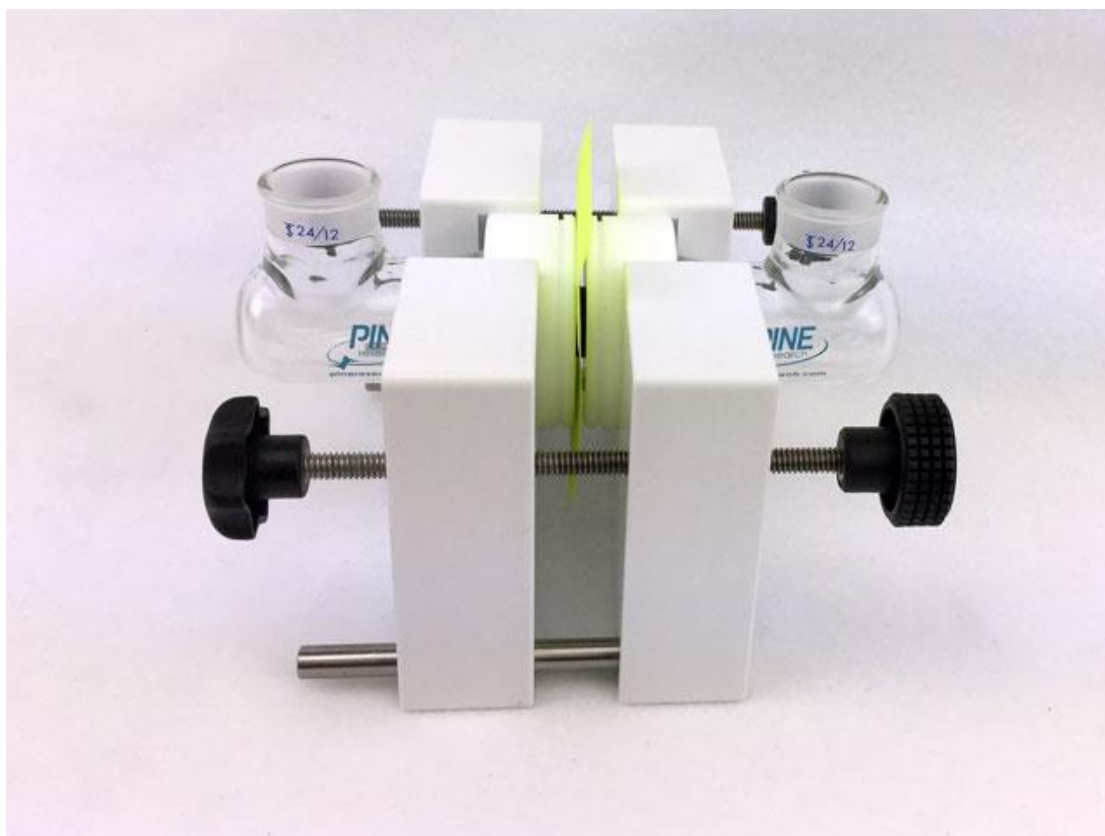
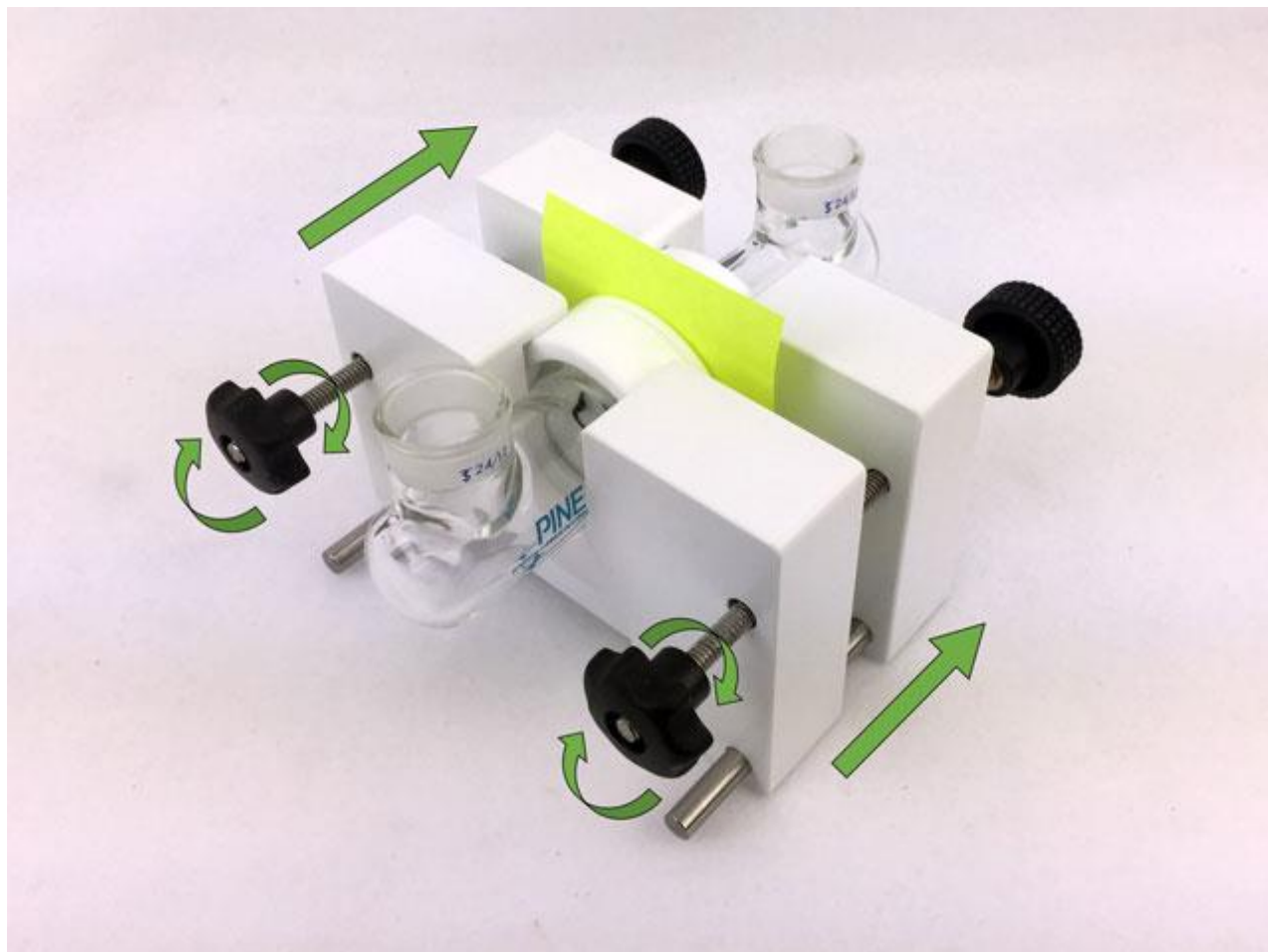


Figure 1-7. Tighten the cell together, then add membrane once pucks are close enough together

Once the two halves are close enough together, a membrane or separator can be put in place (see Figure 1-7). Final tightening of the threaded knobs will compress both the inner, larger O-rings onto each glass flange, as well as the two outer, smaller O-rings onto each side of the membrane/separator, fully sealing each half cell (see Figure 1-8). Be careful not to overtighten the knobs as this may compromise the seal and/or damage the O-rings.



**Figure 1-8. Finish equally tightening each threaded knob to complete assembly of the Advanced Low Volume Membrane Kit**

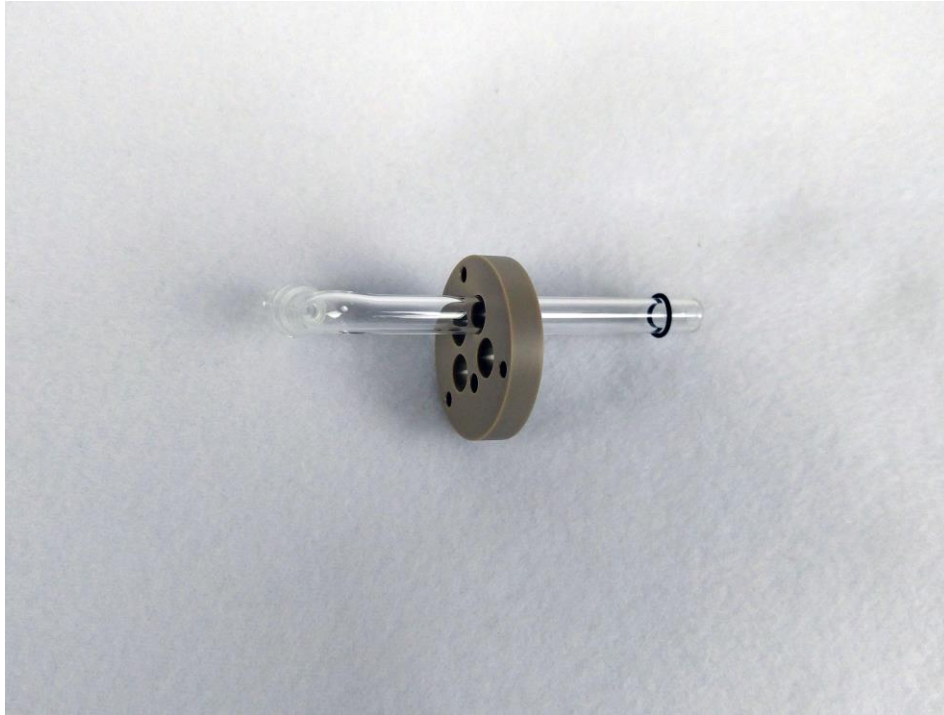
## 1.2 Sealing Electrodes and Purge/Spurge Tubes in Cap Kit

The Low Volume Cell Cap Kit (Pine Research part number AF01CKT1004) is designed to tightly seal around all LowProfile electrodes (E1B series electrodes) and purge/spurge tubes. Once assembled, the cap kit seals into the top 24/12 or 24/25 joints found in most Low Volume cells offered by Pine Research.

Use of this cap kit requires a plan prior to experimentation. You must have identified the working, counter, and reference electrodes and have them prepared and ready to use. Similarly, decide whether or not you will add gas into the cell and if so, plan for a vent as well (perhaps in the headspace).

The cap kit consists of four 7 mm holes and one 3.5 mm hole. The kit includes appropriately-sized O-rings for use with matching probe diameters. Pine Research offers working and counter electrodes to fit the 7 mm holes and reference electrodes to fit the 3.5 mm hole. To take advantage of the sealing aspect of the lid, select the appropriate plug to use in any hole that does not contain a probe.

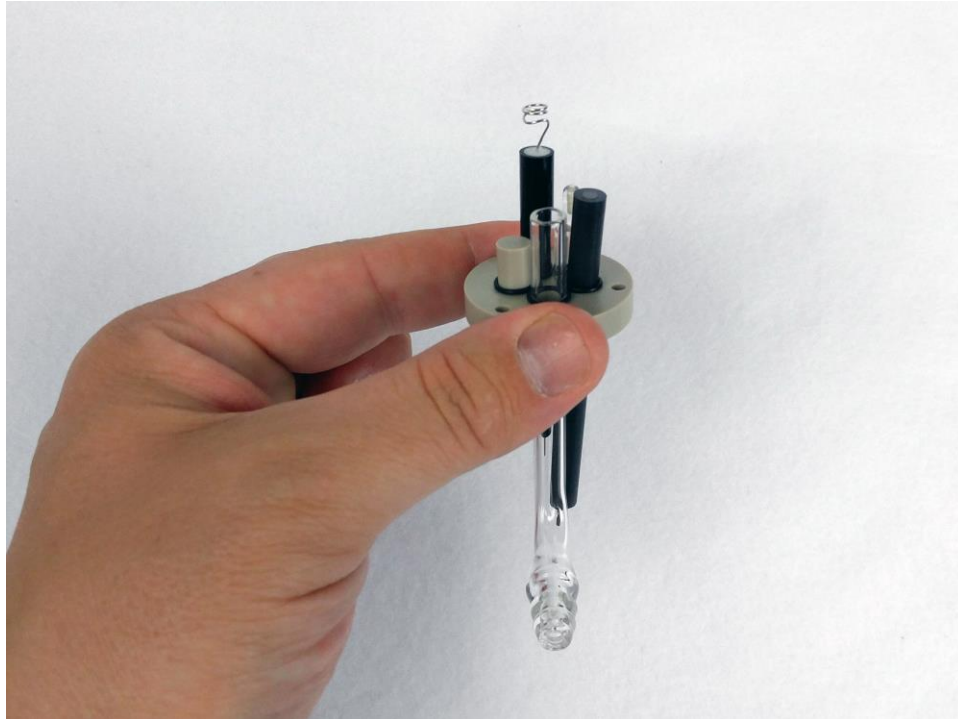
The basic principle of the cap kit is to seal all probes (*i.e.*, electrodes) into the cap by wedging a soft O-ring between the upper and lower halves of the cap and clamping the halves together to seal any gaps. Then, the assembled cap kit seals directly into the half cells. The following images will walk through the steps to position and seal the electrodes in the cap.



**Figure 1-9.** With the thin aspect of the cap kit, insert a probe (a purge tube in this image) through the appropriate hole and add an O-ring.



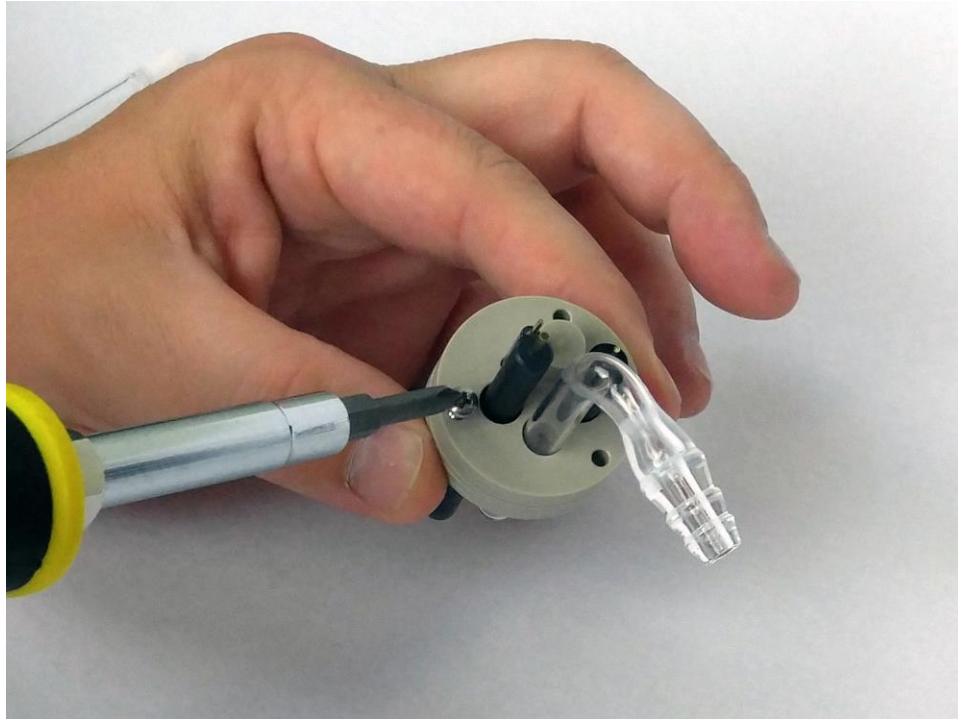
**Figure 1-10.** Repeat the probe and O-ring insertion for each type of electrode, plug, or glass tube. Take special caution to appropriately adjust the height of the O-ring to ensure the assembled cap will fit into the cell without the probes hitting the bottom of the cell surface.



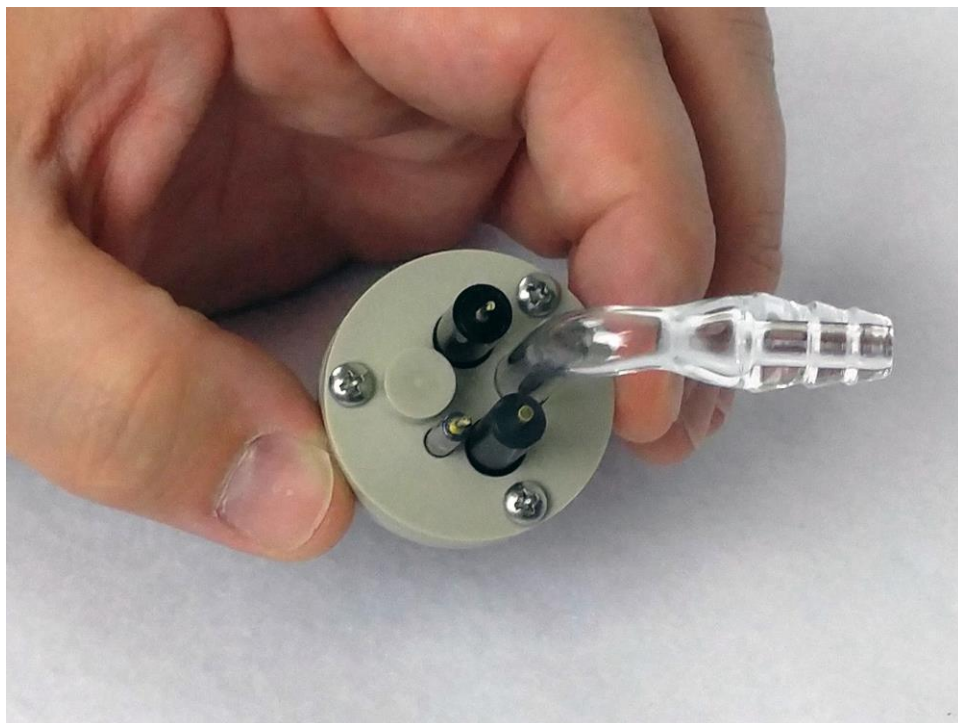
**Figure 1-11. Invert the cap so that the probes are held in place when the O-ring hits the cap. Again, adjust height appropriately.**



**Figure 1-12. Slide the larger part of the cap kit onto the probes. Note: there is a directionality and the cap will only fit on in one orientation. Shown here is the cap kit with probes and O-rings installed, just before sealing the probes into the cap.**



**Figure 1-13.** Install a screw to join the two cap halves. Loosely tighten one screw at a time to appropriately balance the cap seal. **Note: DO NOT YET TIGHTEN SCREWS.** It is useful to insert the cap kit with electrodes into the cell at this stage, before completely tightening the three screws. This allows any displaced air in the cell from becoming pressurized as the cap kit is pressed into place.



**Figure 1-14.** Once all three screws are loosely installed, insert the kit into a cell, then slowly tighten each in a random order, watching the side of the cap to ensure even pressure is applied.