

Hydrophone Potting

December 17, 2022



Important safety note

Please read the safety datasheet before using this product ([link](#))

Read through the entire procedure before starting as you will want to prepare some things ahead of time to get a better result when molding. This process will go more smoothly and yield better results with 2 people.

At the time of writing, all CAD for mold and standoff of the 10mm hydrophone can be found in “CETI/Phillip/Hydrophone”.

1.0 Preparation Before Molding

1.1 Parts, Tools, and Equipment

Gather all necessary components, fasteners, and tools before you start the molding process. The mold components and fasteners for 3 hydrophone molds are shown below.



Note that the hydrophones are glued to standoffs with the wire running through the channel in the standoff.



The molds and standoffs should be polyjet printed with vero clear and a gloss finish.

Ensure you have access to the following equipment before starting this procedure

1. Mixer
2. Vacuum Chamber
3. Pressure Tank
4. Drill

Make sure all of the above are available before starting.

1.2 Preparation

Threaded inserts must be press-fit into the molds with heat. The threaded inserts go on the side of the mold opposite the fasteners.



They can be inserted by pressing them into the molds with the tip of a soldering iron.

The acoustically transparent rubber is a 2 part mixture. Part A is black and part B is clear. As stated in the data sheet, part A must be heated to 100 C before mixing. Crack the lid open on part A and place in oven at 100 C. Check on it every 5 mins and stir thoroughly. When the material is ready, you should not feel any granular bits when mixing. The heating process should take about 20 mins.

Bring the part B, pipette, wires, and syringes near the mixer. Part B is quite viscous so cut the tip of the pipette to make a larger intake hole



Prepare the fasteners by grouping them together and inserting screws through the washers. Once the mold release goes on, the hydrophones should be potted as quickly as possible so this should be done ahead of time.

1.3 Mold Release

Do not apply mold release until the mixing station is ready, part A is heated and stirred, and the fasteners are prepared. You do not want to waste time getting syringes or other materials after applying the mold release.

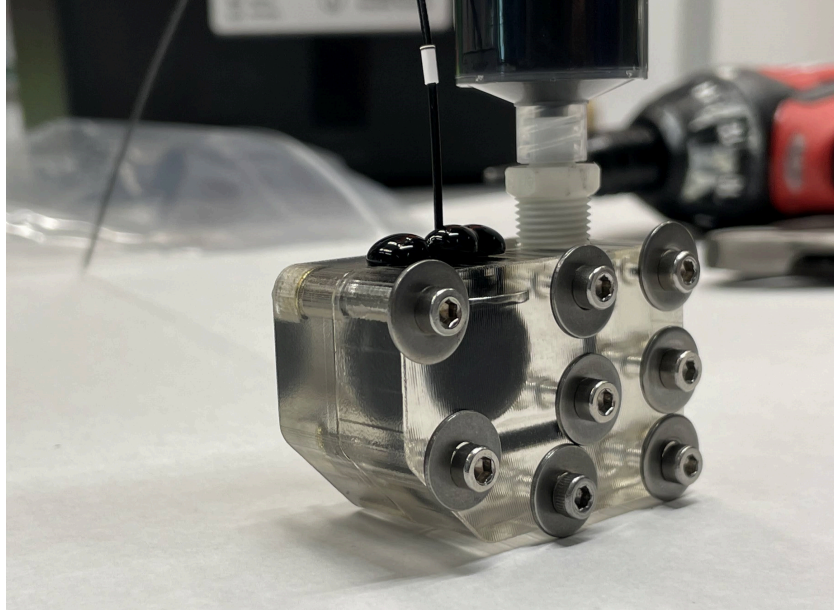
Apply mold release generously to the inner surface of both halves of the mold. Due to the small features in the mold, it is recommended to spray from closer and for longer than normal to ensure that the rubber does not stick inside the small features.

If you are unsure of which mold release to use, ask someone.

2.0 Molding

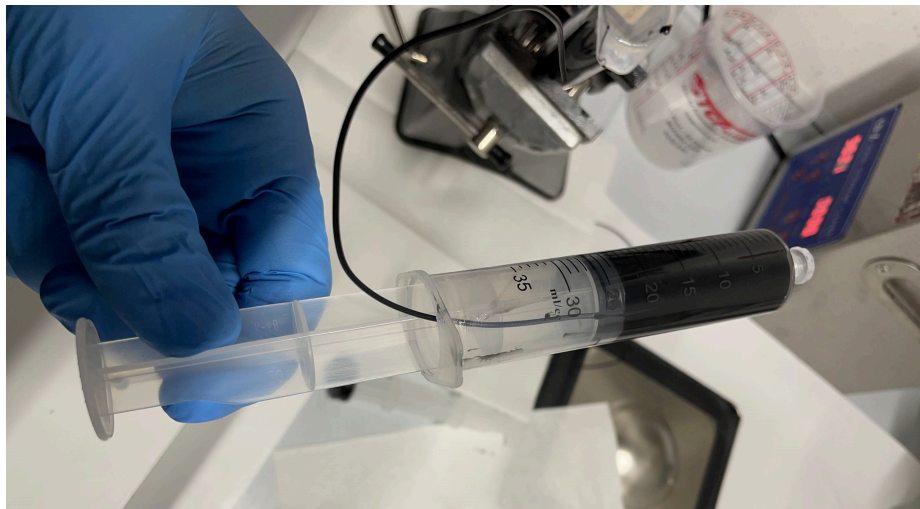
There are 2 “clocks” that are ticking during this process. 1 starts when you apply the mold release, and another starts when you take part A out of the oven.

As stated previously, 2 people should be used for this process. Person A being the “Mixer” and person B being the “Injector”. While the Injector is spraying mold release, the Mixer can get part A from the oven and begin the process of combining with part B and filling syringes. The mixing ratio is 32:100 of Part A: Part B. For 3 hydrophones, aim for about 4g of part A which results in 12.5g of part B. This will be more than enough for the procedure. During the mixing, the Injector applies mold release and fastens the molds together with the hydrophone inside. Once the molds are fastened together, thread in the white plastic part that the luer lock syringe will be secured to during injection. The threads on this piece have very high engagement, so you will likely need a wrench or pliers to thread it in. You shouldn't need to thread this part in more than a few mm. This image shows the white threaded part in the mold with the syringe threaded into it.



The Mixer fills a syringe and passes it to the Injector to perform the injection. While injecting, the Mixer is preparing the next syringe. Repeat this until all molds are injected. The Injector should **leave the syringe threaded into the mold after injecting**.

When filling the syringes, use the “wire method” to eliminate air in the syringe. Cap the Luer Lock syringes first. Pour the rubber into the syringe, then place a small wire in the opening as you insert the plunger. The wire will provide an outlet for air as the plunger is pressed down.



Once the plunger is pressed all the way, maintain pressure on it as you pull the wire out.

Inject very slowly and inject extra rubber so it comes out of the air holes in the mold. Use this video as reference of what a good injection looks like:

https://drive.google.com/file/d/1W3PGikW5jRrHKkNH_ZZblb_B2bXhzncS/view?usp=sharing

3.0 Post Processing

Vacuum

Once all the molds are injected, they should be placed in the vacuum chamber and brought to a vacuum of at least -25 psi. You can rest the syringes up against a wall to make sure they are stable.



Let them sit in this vacuum for about 30 seconds. Remove the molds and inject more rubber. Repeat this process of vacuum and injection at least 3 times.

Pressure

Put the molds in the pressure tank at about 100 psi. The pressure tank should also be heated. Refer to the data sheet of the rubber for the exact temperature to use while curing. Also refer to the data sheet for the minimum length of time to leave them under pressure. According to the data sheet the Curing time is as follows, the curing temperature should be 180 °F or 82°C. 2 hours until tack free, 3 hours until mold release, and 7 hours until cure time is complete.

4.0 Hydrophone Retrieval

It is best to remove the molds from the pressure chamber and let them cool slightly before retrieving the hydrophones. Doing so makes it less likely that the threaded inserts will spin when removing the fasteners.

Remove the syringe and the white threaded piece using a wrench. Then remove the fasteners. Use the hole where the white threaded piece was to insert a pair of needle nose pliers. Pry the mold halves apart. The hydrophone should be stuck in one of the halves of the mold. Try and pull the hydrophones out by hand if you can. If this does not work, you may need to use a small flathead screwdriver to pry them out. When doing so, be careful to not damage the surface finish.

Once the hydrophone is out of the mold it will look something like this:



Notice that some rubber has cured where the air holes were and around the wire. The standoff flange is also still attached.

Using a sharp blade, **very carefully** cut off the rubber that cured in the air holes. **Use even more caution** when cutting the rubber around the wire and the standoff. Once all the excess rubber and the flange from the standoff is removed, the hydrophones should look like this:

