



BALLOON

Stretching Procedure

ABSTRACT

This manual provides a controlled method for increasing the maximum volume of a Mylar (Nylon) spherical balloon.

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Pico-Tracker

Pico-Balloon Stretching Procedure

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Part 1 - Required Tools:

Aquarium pump

Water column pressure regulator

Manometer (optional pressure meter)

Part 2 - List of Materials:

2 feet of 1” PVC pipe

1” PCV end cap

32” spherical mylar balloon

Rubber band

Binder clip

¼” tubing

¼” T-couplers

1/8” aluminum tube

Acetone or lacquer thinner

Q-tips

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Part 3 - Modifying the Aquarium Pump for Vacuum Operation

Aquarium pumps pressurize the ambient air and usually have an opening in the enclosure to provide air. We are going to replace this vent with an inline $\frac{1}{4}$ " tube fitting. Make sure the pump is unplugged and open the case. Find the existing outside air vent and seal it with electrical or duct tape. Look for an area where you can drill a hole in the enclosure and insert the inline fitting without interfering with any inside components or structures. Drill a hole in the case slightly smaller than the fitting diameter and press the fitting into the case. You can also glue the fitting for additional strength. This is now the vacuum port, which can be used to deflate the balloon.



Figure 1. Modified Aquarium Pump

Part 4 – Assembling the Stretching System

Build the water column pressure regulator: Glue the PVC end cap to the 2-foot piece of PVC pipe with PVC cement or silicone glue. Once dry, tie the PVC pipe to the table leg where you will stretch the balloons or to a chair to keep it vertical. Fill the pipe with water to 4 inches from the top.

Assemble the tubing system: Cut two 3-foot and three 1-foot sections of $\frac{1}{4}$ " tubing. Connect a 3-foot section and a 1-foot section of tubing to a T-coupler. Connect a 3-foot section and a 1-foot section to a second T-coupler. Then connect the two T-couplers with the last 1-foot piece of tubing.

Attach the tubing system: Attach a 1-foot piece of tubing to the air pump. Attach the other 1-foot piece to the pressure meter if used. Place the 3-foot piece of tubing closest to the air pump into the

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water column pressure regulator. Cut and deburr a 6-inch piece of aluminum pipe and insert it 1 inch into the end of the last 3-foot piece of tubing. Then tape it in place with electrical or duct tape.



Figure 2. Balloon stretching system

Part 5 – Attaching the Balloon

If you have access to a compressor, you can save time by quickly filling the balloon until it is firm, but stop before stretching the mylar. Then transfer the balloon to the stretching system.

Place the aluminum pipe into the balloon fill stem until the taped section is just inside the balloon stem. Wrap a cut rubber band around the balloon stem and the pipe, but leave an inch of rubber band unwrapped at each end. Twist these ends together tightly and clamp with a binder clip.

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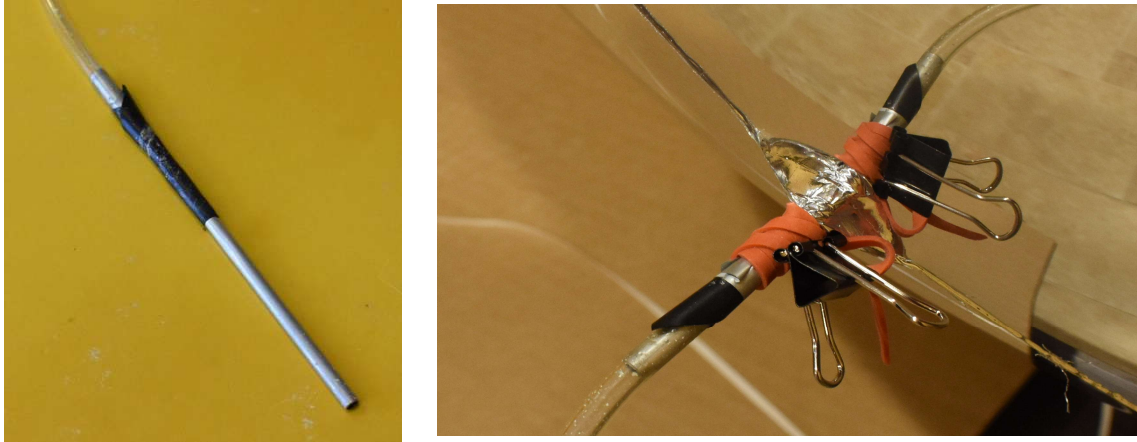


Figure 3. Balloon connection

Part 6 – Stretching the Balloon

Set the regulator tube to about 18 inches below the water level, then turn on the aquarium pump. The balloon will gradually begin stretching. When the regulator begins bubbling, check the pressure with the pressure meter. Adjust the tube depth in the water to set the pressure around 0.35 psi when bubbling. Stretching will occur faster and at lower pressure with warmer temperatures and higher humidity. You should stretch the balloon to a circumference of 100-106 inches. To measure the circumference, mark a string at 100 inches and wrap it around the balloon.



Figure 4. Stretched Balloon and view of internal self-sealing fill stem

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Part 7 – Testing for Leaks

After the balloon reaches the desired size, reduce the internal pressure to less than 0.3psi, record the pressure on the meter, remove the rubber band, and quickly remove the pipe from the balloon. The balloon will self-seal under pressure. Remove the balloon line from the T-coupler and attach the pressure meter to the end. After 15 minutes or more, retest the balloon pressure with the meter. If the pressure has dropped, it may have a leak. Pressure changes with temperature, so try to keep the temperature steady during testing. If the pressure is holding, the balloon is leak-free.

Part 8 – Cleaning the Fill Stem and Deflating the Balloon

Clean any coatings from inside the balloon fill port using acetone or lacquer thinner and a Q-tip. Removing the coating allows the balloon to be sealed after it is filled with lift gas. After cleaning, remove the meter from the fill tube and reinsert the aluminum pipe and tube to depressurize the balloon. Remove all air from the balloon using a modified aquarium pump or vacuum system.



Figure 5. Evacuated Balloon