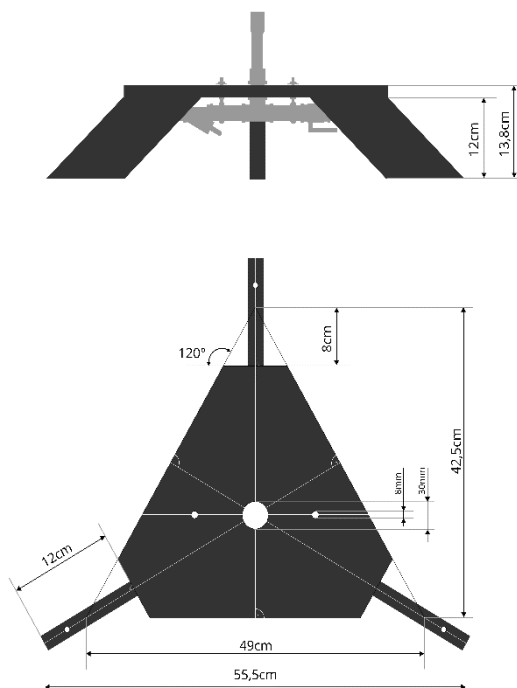


TUTORIAL: LAUNCHER WITH FILLING SYSTEM

PDF WITH ADDITIONAL INFORMATION AND PICTURES

The best plan, the strongest pressure vessel and the most reliable parachute system is completely useless if the launch fails before it really starts. To prevent this, we want to show you in this tutorial the construction of a launcher, which is not only extremely stable, but is also able to fill and accelerate the rocket sufficiently. While smaller water rockets often use a launch system based on garden hose components, we want to show you the construction of a Full Bore Launcher (FBL) in this video. The advantage of a FBL is that the entire bottle opening of the pressure vessel can be used to push the water out of the rocket as quickly as possible, while other systems often require smaller openings.

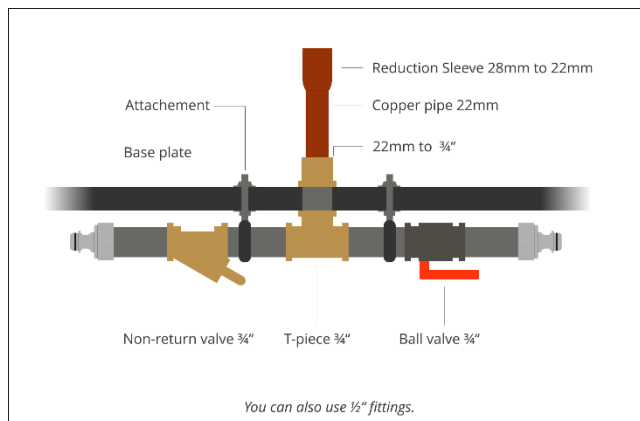
MAIN CONSTRUCTION



First of all, let's talk about the main construction. In our case, this consists of **18mm thick plywood**. This thickness is necessary to withstand the heavy forces during operation. The components of the launcher are a base plate and three feet of the same size, which are cut out of the plywood. The feet should have a hole on the underside, which will later allow it to **secure the launcher to the ground**. The base plate has some holes as well, so that the pipe system can be attached later. You can download a detailed technical drawing with all relevant dimensions of the main construction as a PDF file. Next, you should prime the construction and then apply **external coating**. After waiting a day, the feet can be screwed to the base plate.

PIPE SYSTEM

Now, we can now take care of the core of the launch pad - the pipe system, which will later supply the rocket with compressed air and water. This consists of a set of **fittings** that are screwed together. Use some Teflon tape to seal the threads well. At both ends of the water and air supply there are fittings for **garden hose couplings**, so that hoses



can be connected without any problems. Alternatively, you can also use **pneumatic connectors**. On the side of the air connection there is a **non-return valve** which prevents water from entering the air pump. On the other side there is a **ball valve** to manually disconnect the water filling system. In the middle of the system there is a T-piece into which a short pipe with a suitable thread has been screwed in. The system is now **attached from below to the base plate** of the launcher. We recommend using two **pipe clamps** and threaded rods. Next, we'll make the connection between the rocket and launch pad. It consists of a **copper tube** with a diameter of 22mm. An **adapter** is attached to one end of the tube system. On the other side, a **reduction sleeve** from 28mm to 22mm is fitted. They are attached by **soldering** them together. First of all, the parts are sanded with a **special cleaning fleece** at the corresponding points. Next, you should apply some **flux** to the soldering area. Wear gloves and do not to get in contact with the flux. Next, you should put some flux on the soldering area. Wear gloves and try not to get in contact with the flux. You can then put the parts together and heat them with a **blow torch** or a gas burner. It is best not to heat the joint directly, but to keep the flame at a nearby point on the pipe. After the tube has been sufficiently heated, the solder can now be held to the joint from above. Once you have applied the flux correctly, the solder runs around the joint and seals it. As soon as a small drop forms on the bottom, you can continue with the second junction. When the connector has cooled down, you can wipe off the remains of the flux and start **placing cable ties around** it. Put a bottle of the same type as you used on your rocket into the reduction sleeve. The cable ties should be placed directly against the collar. First you can use some tape to fix the cable ties. Then pull two **hose clamps** around the cable ties as tightly as possible. Now the connection can be screwed onto the launcher. Don't forget to use **Teflon tape** for that too.



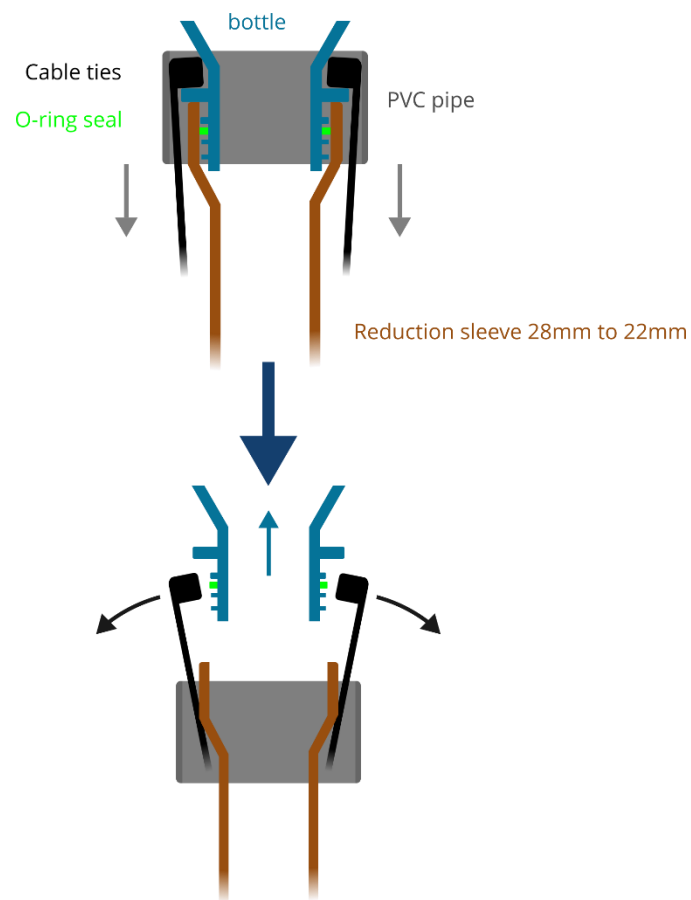
LAUNCH TUBE

To ensure a stable and straight launch of your rocket, we recommend the use of a launch tube. This is basically just a tube, which is inserted into the connector and has the effect that the rocket reaches a higher altitude. We recommend to wrap some tape around the launch tube before inserting it into the launcher. Unfortunately, conventional PVC pipes are often too weak to withstand the high forces at launch. Therefore, the PVC pipe with a **diameter of 20mm** should be reinforced on the inside with a steel pipe.



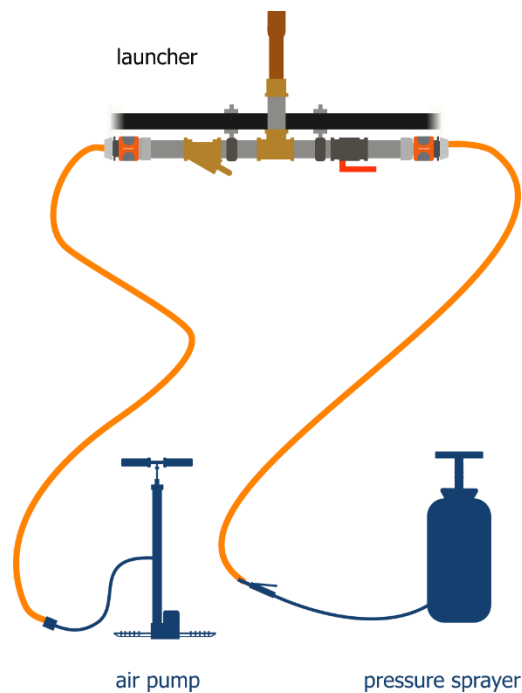
TRIGGER

Now only the trigger for the launch pad is missing. You can use a short **PVC pipe**, which you put over the connector and the rocket. As soon as you pull the PVC pipe down, the rocket will launch. To prevent an unintentional launch, we suggest using multiple cable ties as a spring. Now you need a **deflection**. We use a U-piece made of bent aluminum for this purpose. Two nylon cords are attached to the PVC pipe. You can now attach your **release line** with a snap hook. Before you can place your rocket on the launch pad, you will need to install an **O-ring seal** above the thread of your rocket. We use a O-ring with a *diameter of 15.5mm* and a *thickness of 2.6mm*, but slightly different sizes should also be just as good.



WATER AND AIR SUPPLY

The last thing we have to do before the launcher is completed is to take care of the air and water supply. The air is supplied using a 10-meter-long garden hose, which can be connected to the launcher with a coupling. If you have installed compressed air valves at your launcher, use a compressed air hose instead. On the other side of the hose you have to attach a **car tire valve**. Sand it, wrap it with teflon tape, put it into the hose and fix it with a hose clamp. You can now connect your **air pump** to this valve and build up pressure in the rocket. The water filling system is a bit more complex, but it allows a comfortable filling of the rocket. We use a pressure sprayer of which the nozzle is sawn off. Instead, we have attached a garden hose to it using a hose clamp. To use your filling system, simply fill water into the **pressure sprayer** and build up pressure using the integrated pump. Then open the valve of your launch pad and water will flow into the rocket. It is important that you fill the water into the rocket before you build up pressure with the air pump.



To succeed with the construction of a water rocket, you will have to work very precisely and carefully. Especially some of the adhesives and resins are pretty dangerous. Thus, please wear gloves when working with adhesive or epoxy and don't breathe in the gases. It is recommended to work outside whenever toxic gases could develop. The launch of a water rocket may need permission from the competent authority, depending on your location. You need the permission of the landowner if you launch on foreign territory. Please wear safety goggles when pressure testing or launching your rocket. Keep a safe distance to the pressurized rocket. We can not guarantee the accuracy, completeness or feasibility of any of our tutorials. We are not responsible for any damage or harm on objects, animals or humans. We do not guarantee that the information provided on this web site is complete, accurate and always current. This applies also to all links cited on this website points, either directly or indirectly. We are not responsible for any damage or harm to objects or individuals.