

# Aquaponics Lab

## How to build the Air Actuated Water Valve V.1

Produces the ebb-and-flow effect to provide enhanced control over frequency, duration and period of operation in comparison to traditional auto-shippers.

Written By: Paulo Marini



## INTRODUCTION

**Authors: Lemos-Marini, P. Flecher, J. Coleman, G 2014** with the generous support of **FabLab Manchester** and **Incredible AquaGarden**.

## Uses

The enhanced features allow:

- increasing the irrigation frequency in warm days;
- stop the ebb and flow effect automatically at night for improved aeration of the media;
- Manage the flow of water in large growbeds when ebb and flow shipons tend not to work
- Avoid harmonic synchronization when several auto-shipons are installed together

The Valve uses the compressed air from the air pumps (for the fish tank aeration), two air solenoid valves and the Aquaponics Lab monitoring and controlling system.

Although it has no perfect seal, with the pressure utilized, it performs its function well.

Cost of replication

Estimated Cost of replication is around £70 not including Aquaponics Lab monitoring and controlling system. A electronically actuated valve will cost >£350

## Drawbacks

This is a working prototype currently in operation and test in our system. Improvements will be needed to have a fully reliable and replicable model. Two areas of attention:

1-The **air fitting** position is sensitive.

2-The elastomer (**inner-tube**) is theoretically the weakest point in the system. We are currently testing its durability in real operation.

## Log

Elastomer (**inner tube**) was installed on 12/09/2014

As per 22/08/2015 the elastomer has been working continuously without needing service.

## Open Source License

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## TOOLS:

- Drill Press (1)
- Drill Bit (1)  
*Slightly smaller than the threaded part of the hoesetail fitting*
- Hole Saw Arbor (1)
- Hole Saw - 64 mm (1)
- Scissors (1)
- Flat Blade Screwdriver (1)



## PARTS:

- Acrylic Tube (110mm x 5mm x 500mm) (1)  
*or a 110mm Pipe*
- Pipe 50 mm Solvent Weld (1)
- Inner Tube (1)  
*Bike or motorcycle inner tube - 2" diameter +/-*
- Tank Connector 2" (50mm) Threaded for Solvent Weld Pipe (2)
- Jubilee Hose Clips 55-70mm - Stainless Steel (2)
- O-Ring - Big (2)  
*For tank connector*
- O-ring Small (1)  
*For Hoesetail fitting*
- Hoesetail fitting - Brass Male - 1/8 Bsp Male, 1/8 = 3mm Dia, 1 (1)
- Double Socket Connector 110mm (2)
- Socket Plug 110mm (2)



## Step 1 — Video showing the Valve in action



- The video demonstrates the valve in action stopping the flow of water and then resuming it.

## Step 2 — Drill the two 110 mm socket plugs



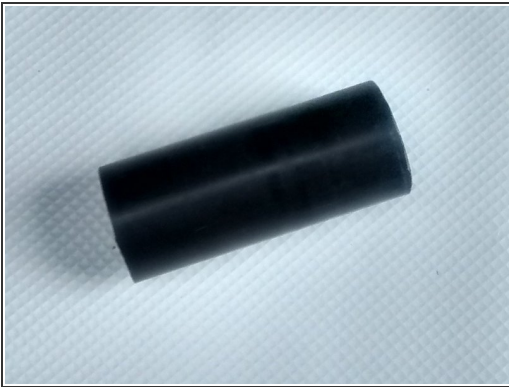
- Drill the centre of the two **110 mm socket plugs** using the **64mm hole saw**.

### Step 3 — Drill the hole for the "air connector"

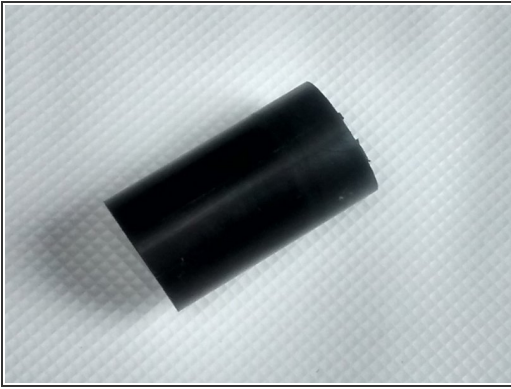


- Fit the **tank connector** into the place to examine and locate the best possible location for the **air connector** hole which will be drilled;
- Drill a hole for the **air connector** (e.g. the shown position) using the available **drill bit**.

### Step 4 — Cut two 13 cm pieces from the 50mm diameter pipe



- Cut 2 pieces with 13 cm length from the **50mm diameter pipe**.

**Step 5 — Cut two 10cm pieces from the 50mm diameter pipe**

- Cut two 10cm pieces of the **50mm diameter pipe**;
- Sand any leftover or rough edge off all the cut pieces.

**Step 6 — Cutting the inner tube - Component 1a and 1b**

- Cut a piece with 35 cm length from the **inner-tube**;
- Then cut it again following the fabrication seal to open it flat;
- Finally cut it one more time in half - same direction which is the direction of the length.



## Step 7 — Cutting the Inner tube - Component 2

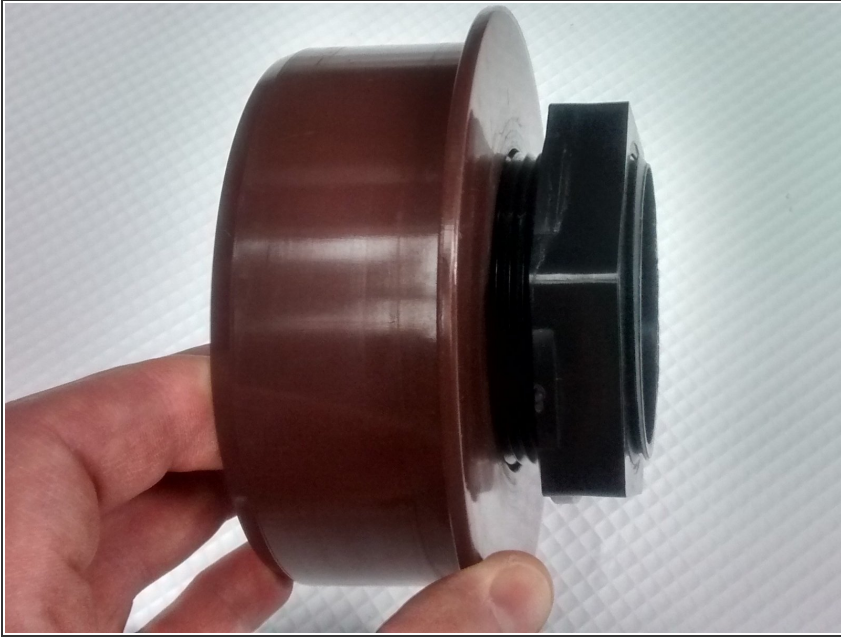


- Cut a 50cm length from the **inner-tube**.

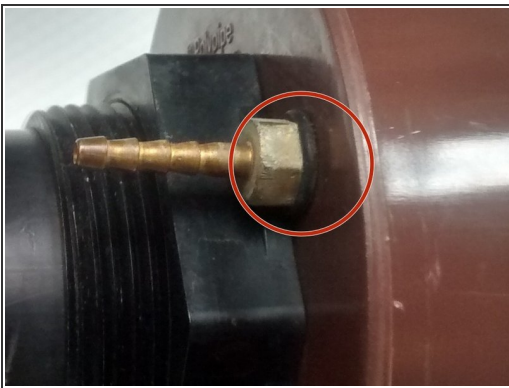
## Step 8 — Inserting big o-ring in the tank connectors



- Insert one **big o-ring** in each one of the 2 **tank connectors** as shown.

**Step 9 — Insert tank connector into the socket plug with the hole**

- Take the **110 mm socket plug** with the hole for **air connector** and insert one of the **tank connectors**.

**Step 10 — Install air connector into the socket plug**

- On the same **socket plug** (from step 9), install the **air connector** with the **small o-ring** as shown.



**Step 11 — Sleeve the two 50cm inner pipe pieces into the two 13 cm pipe pieces**

- Sleeve both sides of **50cm piece of inner-tube( component 2)** around the two **13 cm pipe pieces** by approximately 8 cm.

**Step 12 — Wrapping flat piece of inner pipe over the component from previous step**

- Wrap one **35cm flat piece of inner tube (Component 1a)** tightly on top of one side of the previously sleeved inner-tube (from **Step 11**).

### Step 13 — Use Jubille Clip to hold wrap in place



- Screw the **Jubille Clip** on top of the wrap formed by inner tube (from **Step 12**)
- Repeat the same procedure with the other side of the 50cm inner-tube.

### Step 14 — Insert one side of the component from previous step into the tank connector with air fitting



- Take the **socket plug with the tank connector and the installed air fitting** and insert one of the sides of **sleeved inner-tube** into the **tank connector** as shown in the picture.

### Step 15 — Insert the other size of the sleeved inner-tube component into the tank connector not in use yet



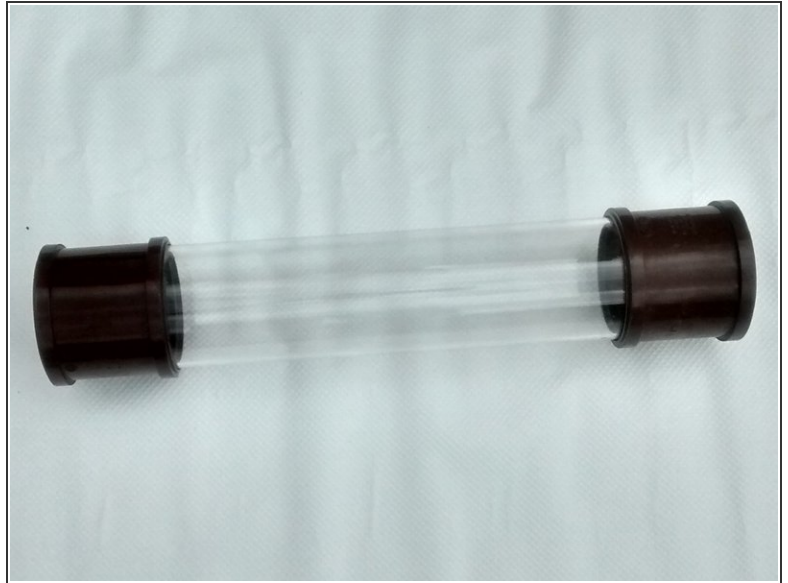
- Insert the other side of the **sleeved inner-tube** into the **other tank connector**.

### Step 16 — Insert the two 10cm pipe on the external side of the tank connectors



- Insert the **10 cm pipe** on both sides of the **tank connector** that are still not used (external side)



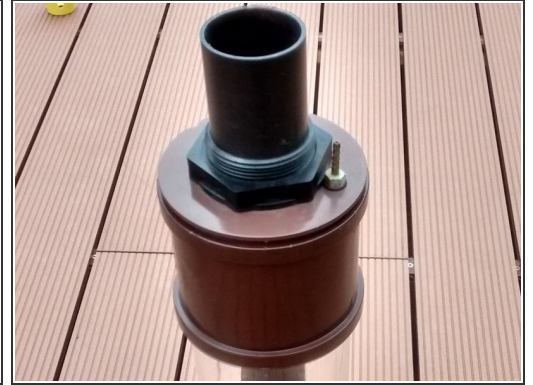
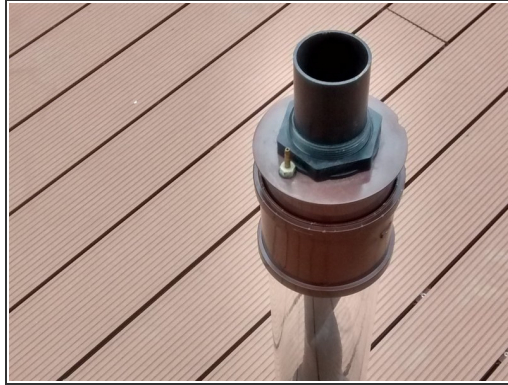
**Step 17 — Insert the two double socket connector into the acrylic pipe**

- Fit the two **110 mm double socket connectors** into the **110mm acrylic pipe**.

**Step 18 — Insert the Socket Plug ( not in use) in one of the double socket connectors**

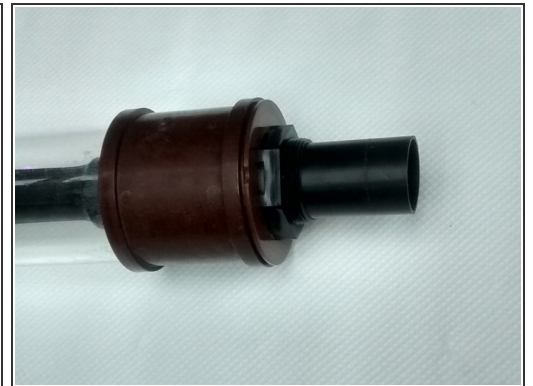
- Insert the other **110mm Socket Plug** (without air connector) in one of the **110mm double socket connectors**.

**Step 19 — Insert the socket plug with the air connector attached to the sleeved component into the acrylic tube as shown**



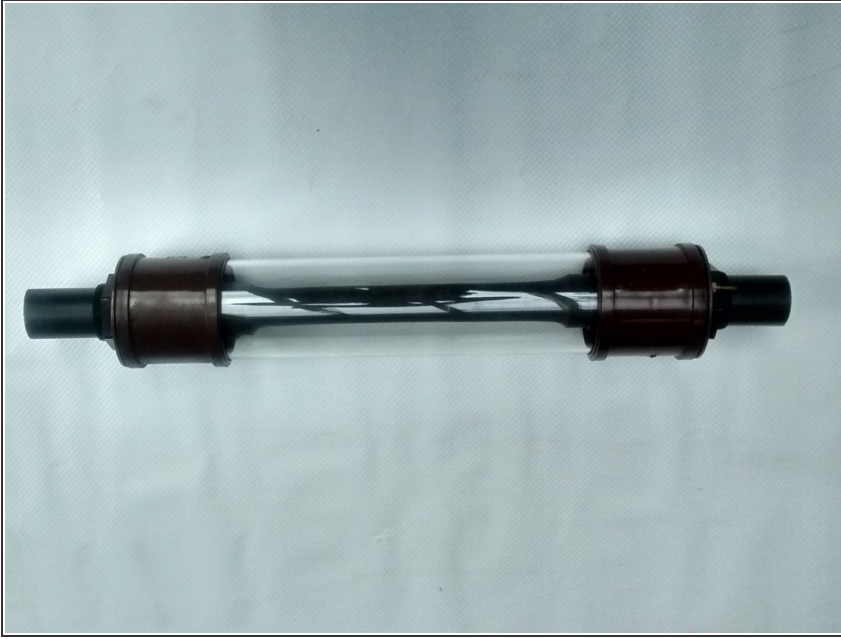
- With the **acrylic pipe** standing horizontally insert the **socket plug with the air connector** (attached to the sleeved component) into the acrylic pipe

**Step 20 — Pull the 10cm pipe through the hole as shown**



- Pull **10 cm pipe** from the other side and screw the tank connector as shown in the images

## Step 21 — Valve is read to use



- The valve is complete.
- To run this valve, you will need two air solenoid valves controlled by the Aquaponics Lab Electronic System and an air pump.
- We will develop the other guide explaining how to do it.