



Everything starts with an idea. But ideas are fast, easy and free. The work, sacrifice and true cost of making something a reality is tedious, difficult and costs time, blood and effort. Sticking to a single thing is pretty great though and leads to new places.

I started our project in a thermodynamics class with Keiran Holland and a guy called Timo Lumukka, we counted energy savings based on my idea for a recycling shower with a heat exchanger. I couldn't give it up and convinced Keiran to help me build it so we could see if it could work.

Hi,
I'm Jason and here is a glimpse of how ShowerMagic has turned into Showerloop & what I have learned on the way.



Showerloop is a shower that filters and reuses shower water while you are in the shower, dramatically reducing water and energy consumption by saving hot water from going down the drain. The water is pumped through a series of filters to collect particles and clear the water after which UV light is used to sterilize the water so that it's bacteria free and even safe to drink. The system is designed to be modular, so assembling, repairing and upgrading is done by the user ensuring a long lifetime for the product. Completely sustainable and affordable off-grid solutions are also possible.

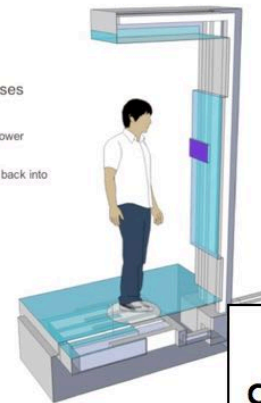
My rules

Make it:
fixable

- symmetrical (if you can)
- transparent and understandable
- simple is beautiful, cheap is better
- use materials that are abundant and environmental
- recycle and reuse ideas and materials
- learn from everything
- don't waste anything

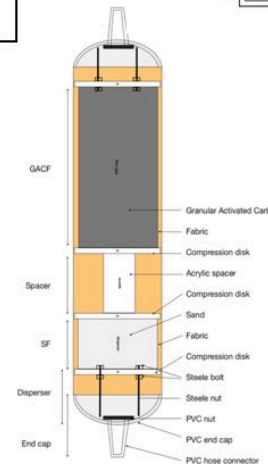
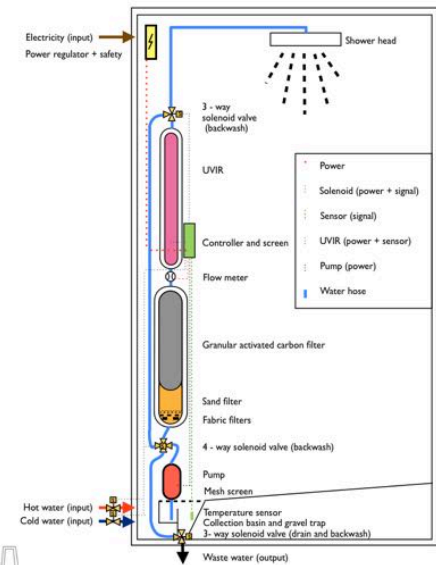
- Can I produce it quickly, affordably, easily?
- How much can I automate?
- Is it worth outsourcing if it means I understand it less?

Shower Magic Reuses
water by first filtering shower
water and then pumping it back into
the shower head

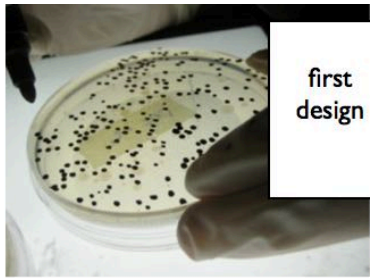


first
concept

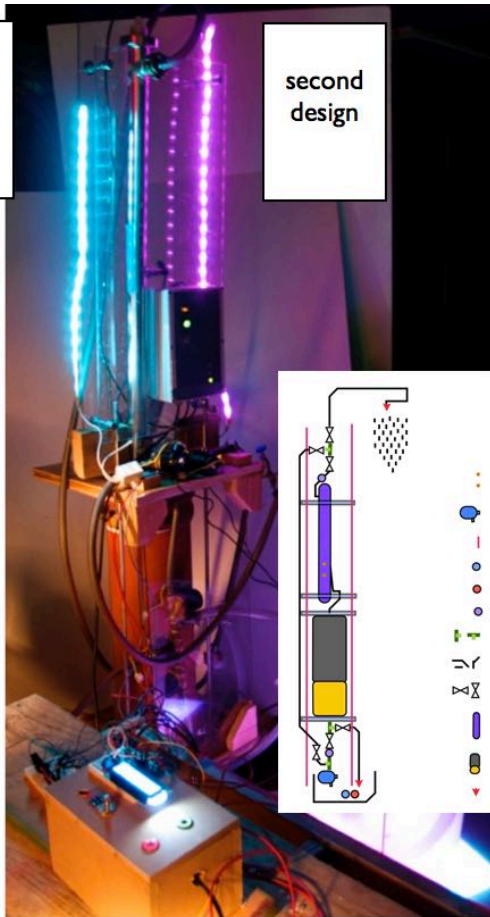
first filter
design



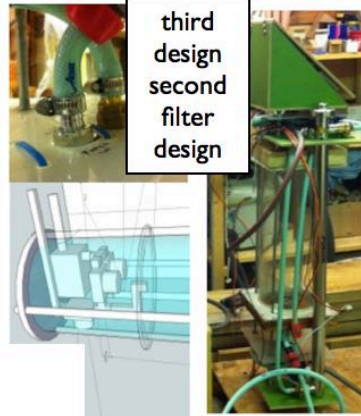
idea
design
from
thesis,
still
working
on it :/



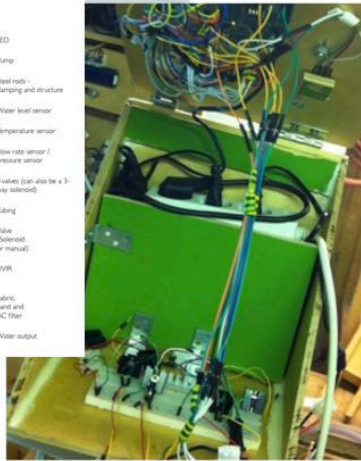
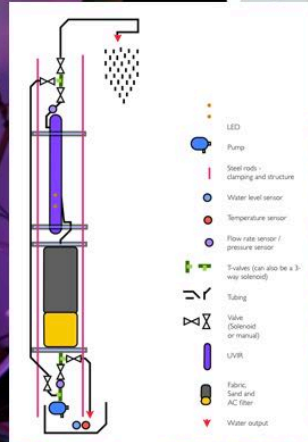
first design



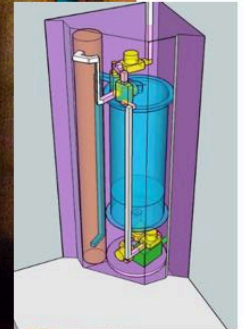
second design



third design second filter design



third stall



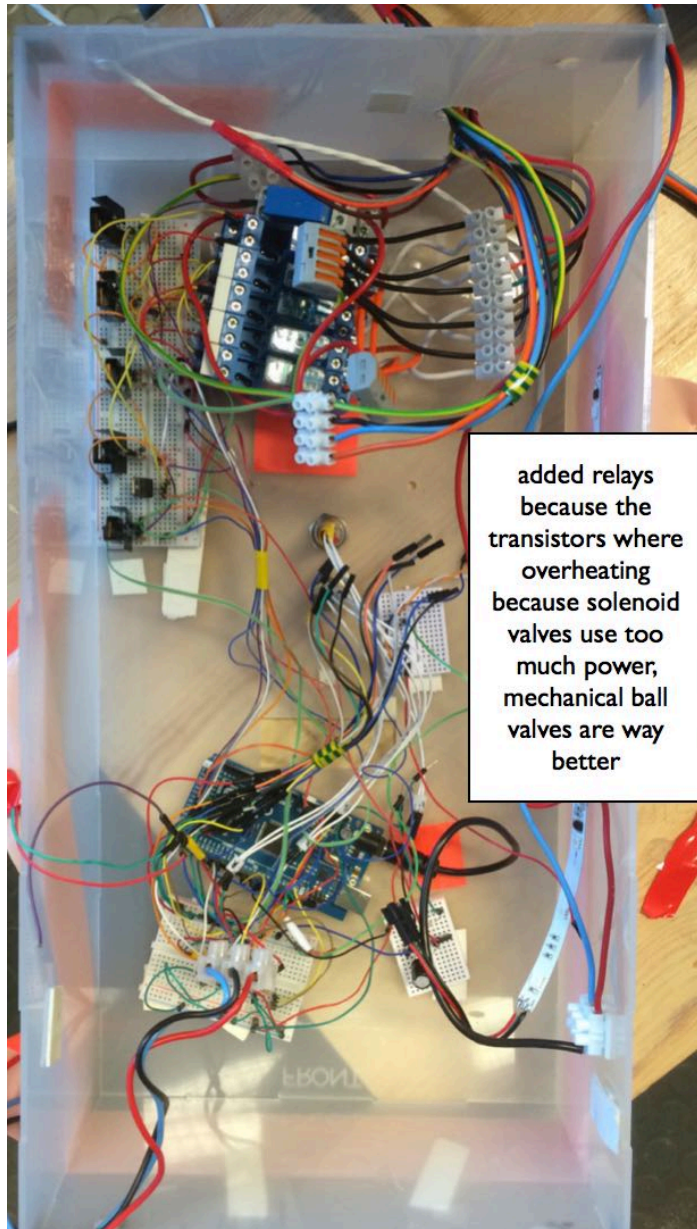
SHOWERMAGIC



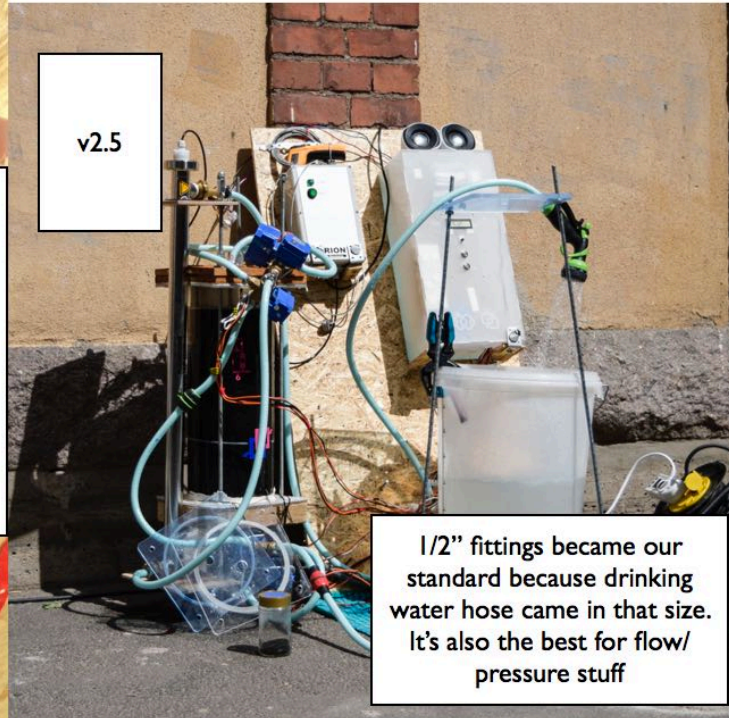
Our bachelor thesis with Keiran Holland was primarily based on finding a low cost and efficient way to purify shower water of impurities for sanitary reuse. He is now studying something about metal processing technology in Aalto. Without any initial funding we had to make it as cost effective as possible. We used equipment found around the labs for the most part. Our research took months longer than normal but we solved dozens of unexpected technical, research and design problems and ended up with very promising results. The sense of accomplishment from solving problems (including organizational ones) gave us confidence to continue with the R&D of our idea. Also worse ideas succeed all the time.

The tower/pillar shape is so that the system could fit in a corner of an existing shower. The smaller version on the right is a compromise to allow it to stand on its own legs, however, water can't drain from the system without adding yet more valves. The ideal solution would be to build our own valves, uv lamp form and eventually heater (no even considered at this point), but our most expensive tool at this point was a 150e table saw.

shower loop

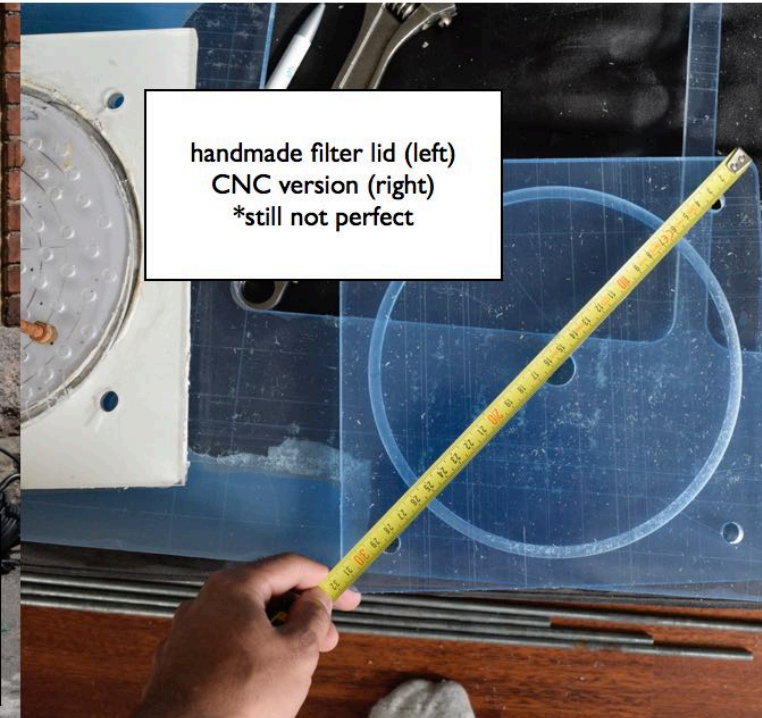


added relays because the transistors were overheating because solenoid valves use too much power, mechanical ball valves are way better



v2.5

1/2" fittings became our standard because drinking water hose came in that size. It's also the best for flow/pressure stuff



handmade filter lid (left)
CNC version (right)
*still not perfect

The version here is basically the same as the green one but I was slowly replacing handmade parts with lasercut and CNC milled part from AALTO FABLAB. We're still at the breadboard stage since both of us were learning electronics. By this point I had found new valves ordered from a company in China (this was before I discovered the joys of Ebay and online shopping). The UV lamp was very expensive from Germany. Everything else was mostly sourced from hardware stores. The activated carbon and sand were in new bags that I had sewn, a skill I learned during our bachelors thesis.

OSCE days, FABLAB and getting into POC21 made 2015 a fantastic year. Even though I didn't make any money.

Progress on construction was slow because I could only go to the open days at the Fablab. I think they started letting me in more often since I'd always help the other students with laser cutting or something I knew how to do.

Often it was more fun to help others than do my own work



POC21 showerloop model (left) actual build (right)

v3

Autodesk sponsored POC21 and taught us how to use Fusion360

This was the first time I helped model something that looked like the real thing, or was it the other way around?

I broke my front teeth and jaw a week before POC21 started, so I was a bit late and broken on arrival

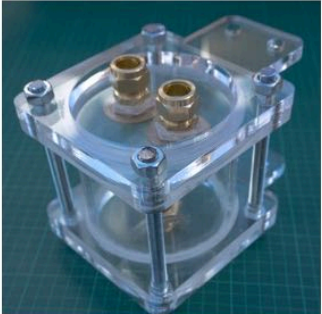
Also I didn't sleep much in the last 3 days.

POC21 was great for the project in terms of media attention. But it was really tough to build the prototype since I'd spent a year searching for in Helsinki and Vantaa and there weren't really dedicated people to find what I needed. It was a bit of a nightmare really, but with the help of volunteers and another engineer kinda like me (Timm Wille) I managed to build this, still the prettiest version of Showerloop.

A stall was gifted by a sponsor and copper was used because I wanted it to look good on it's own.

I would have rather built the stall from scratch but I didn't know how to use a CNC at the time.

Also this version was very simple and didn't have the electronics, valves or additional features that I had wanted to build because I didn't get as much help as I was expecting. Also materials were unfortunately scarce so improvising was necessary, such as the UV lamp hidden in the back.



This is basically a fancy brass T or T-connector that splits/combines water from the two filters, balancing flow and also letting the user see water clarity (accident) It looks great but it's not really needed.



elements where mounted through the plywood wall, while it works well, it's not an option for most bathrooms as a fastening option.

After POC21 we were commissioned by Autodesk Foundation to display Showerloop in Vegas for Autodesk University. But a whole unit was too much so we built WishyWashy or SinkLoop

The S... will n... many t... when...
The magic part

v4.5

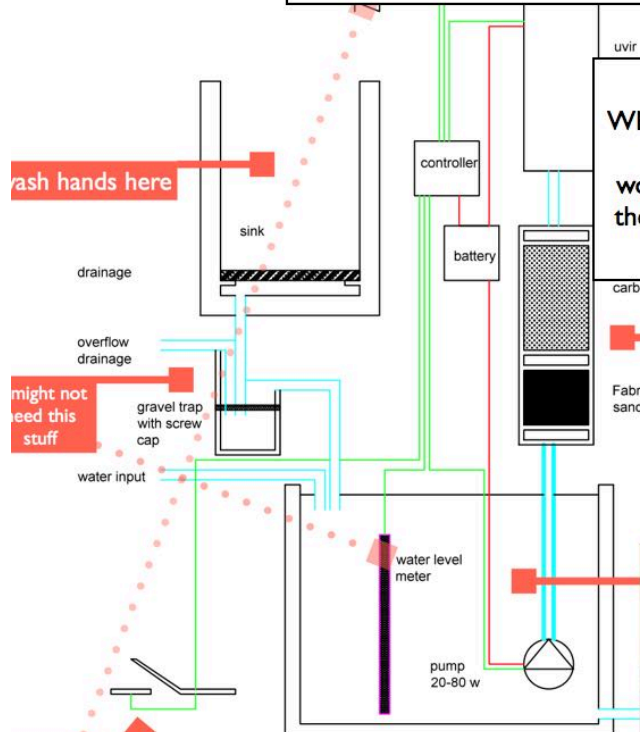
WE tried several forms, and ended up with a box so that there wouldn't be assembly required at the destination, just plug and play.

finally the bread boarding was clean, though a PCB is still in order.

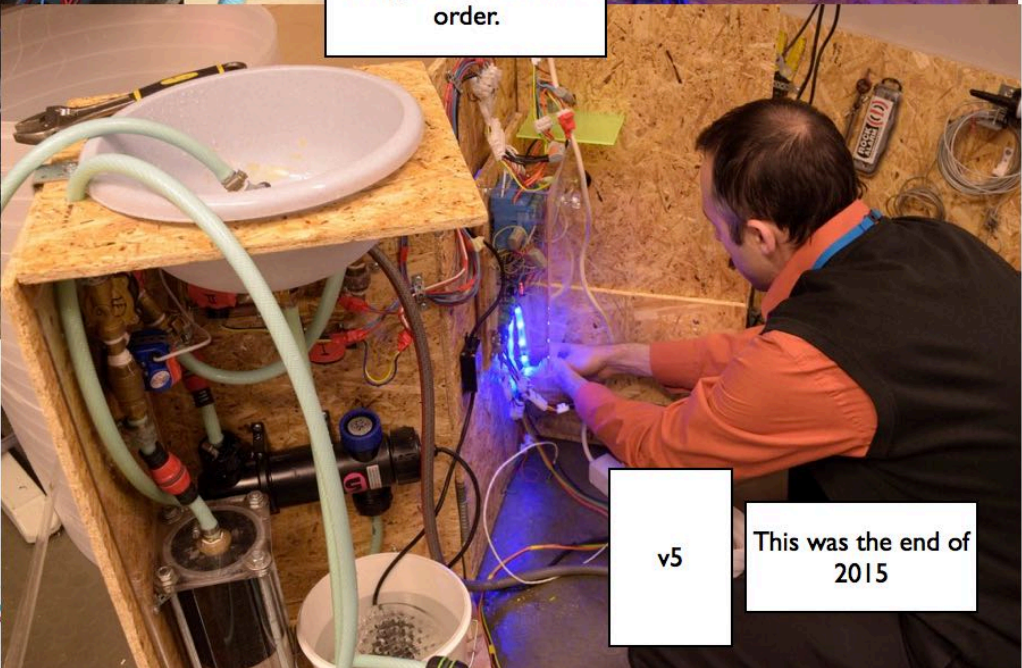
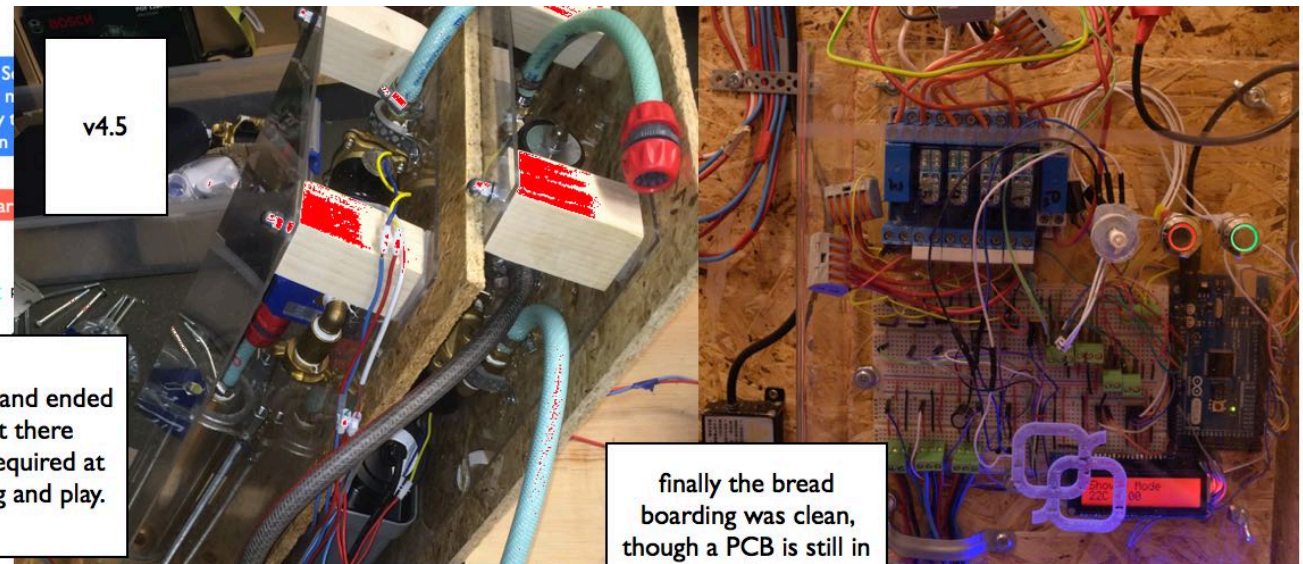
the TSA, British Airways, or even Finnair had something else to say about it. + they stole my relays and broke stuff.

This was the end of 2015

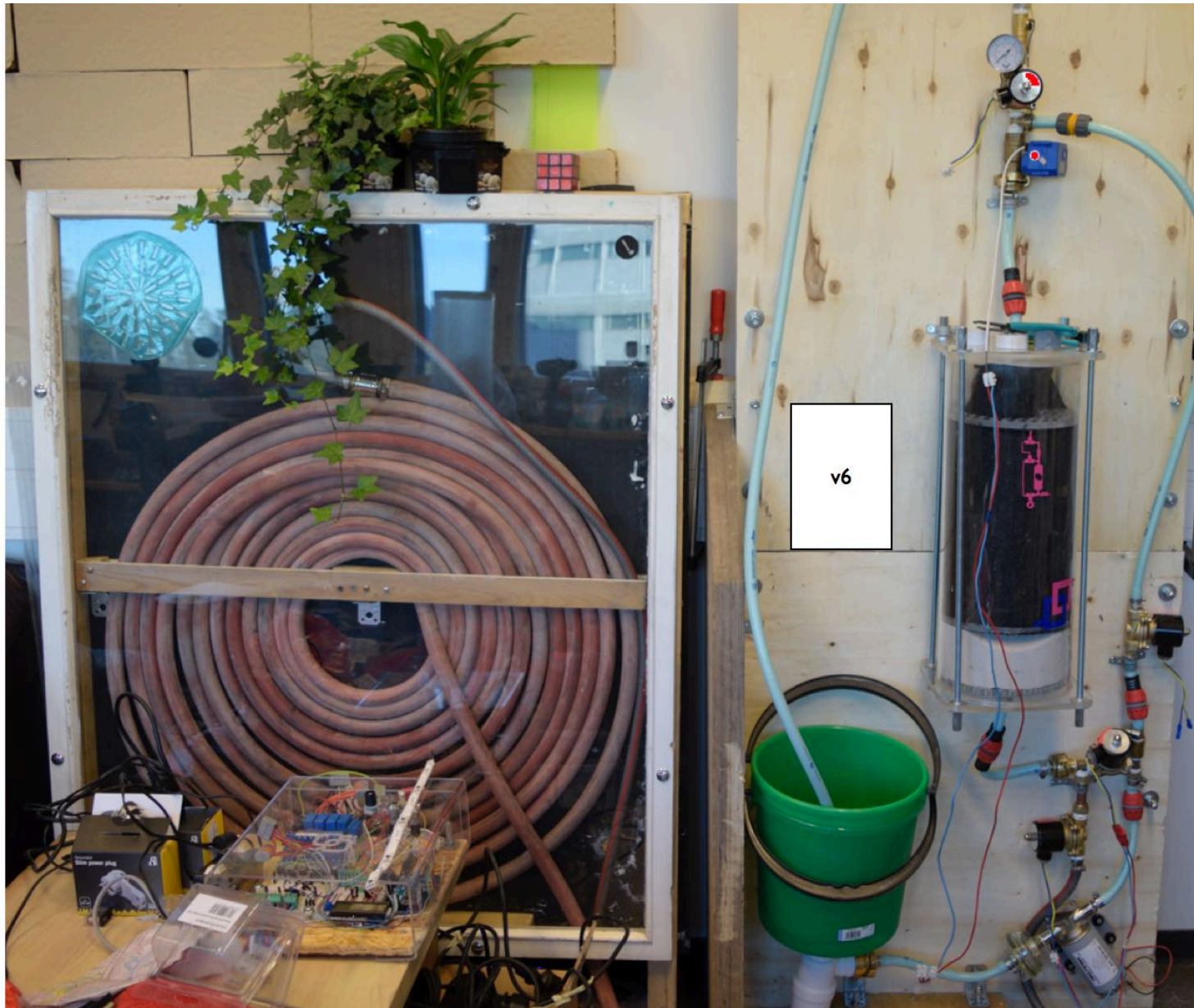
v5



3. Use the pedal to activate the pump or the Infra red sensor
A normal tap for getting water uses more power because then the water needs to be pressurized at all times



The round circle things is a solar water heater that was made from 95% recycled parts. An old glass window a neighbor was giving away, gardening hose from the cemetery I used to work at, wood from wherever and the black film in the back to absorb sunlight apparently can cost a lot. it's used as a liner to waterproof bridges.



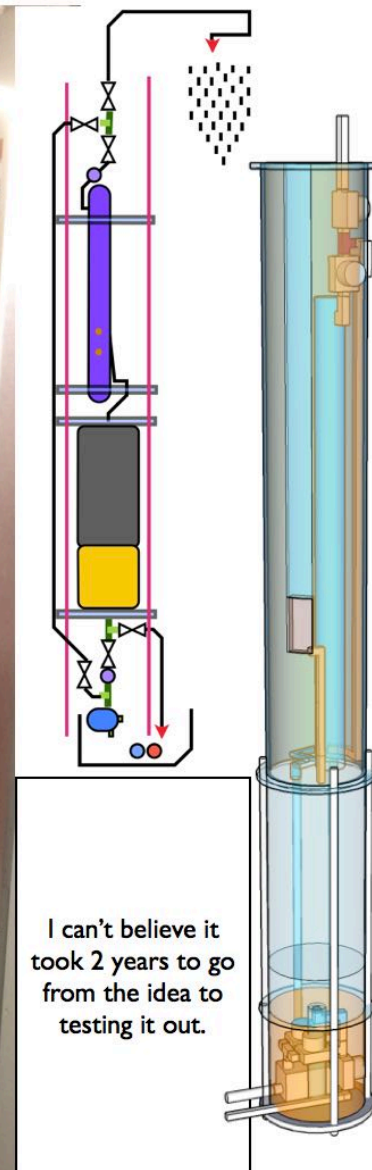
never even used this one. almost always at the 11th hour I realize what I've made it crap and I need to quickly start again on the new and improved one. This time I was building v6 and v7 for the media crew simultaneously... A lot of my ideas didn't work. And I was using those stupid solenoid valves again

Between 2015 and summer 2016 I was mostly sourcing components. I made my first real sale to a customer in France, a young guy that just believes in my. Benoit, he's my hero.

He understood what and who I was working for, like many others. But no one else has put their money into it. I'll always appreciate that.

A media crew from France came to film this - it wasn't even close to my best work. I thought I had figured everything out. I had outsourced gasket production and make the perfect filter lid. My understanding about the compression of the lids was wrong and things leaked. I fixed it the next day but it was frustrating that they only wanted things to look and sound nice, instead of showing what it's really like to try to make something new - failure is part of it, learning is part of it and working hard and not giving up will get you to the next mistake.

I understand why media is such an echo chamber or simple narratives, but it sucks and I don't like it. It's dangerous. Even though it's our fault.

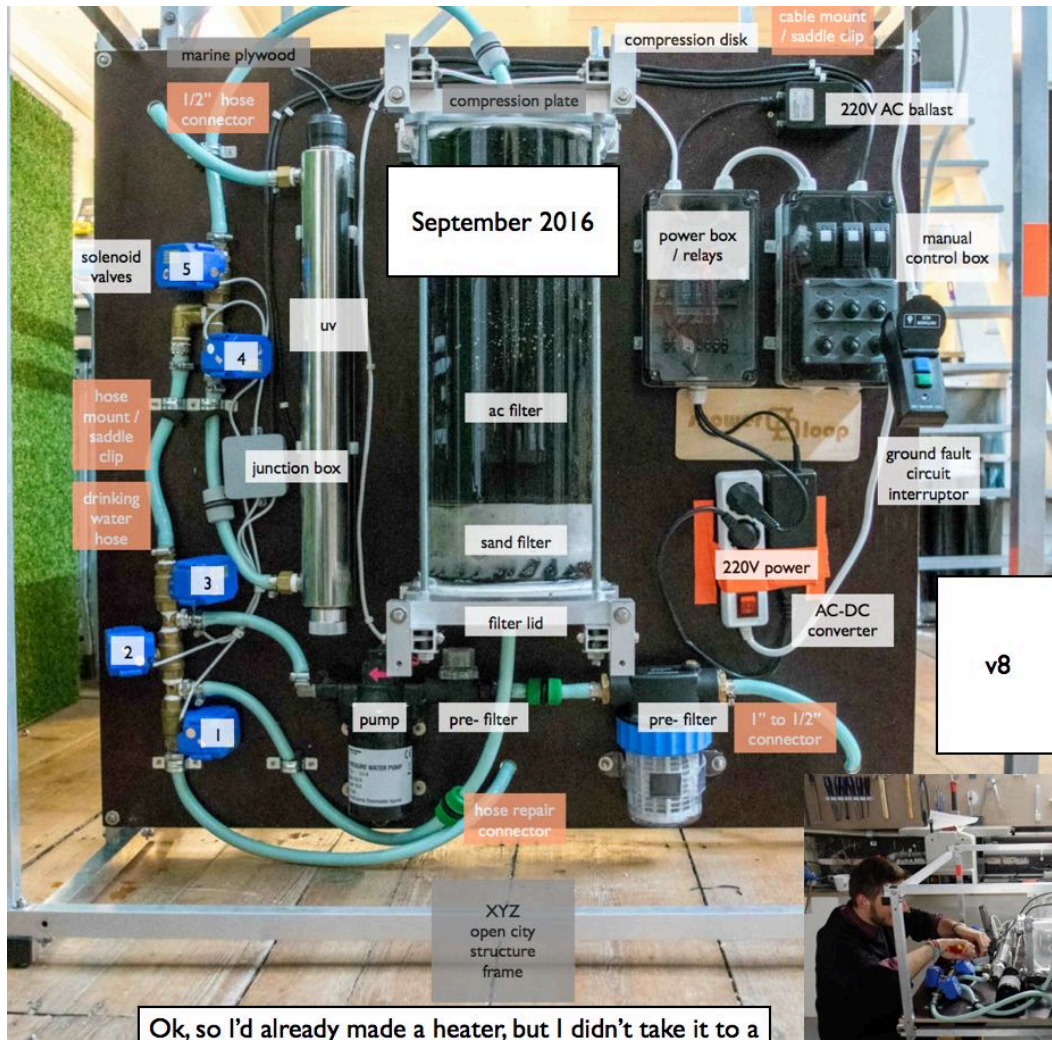


I can't believe it took 2 years to go from the idea to testing it out.



Progress on the actual physical side of the project was a bit slow, but I was focusing on getting an in house production ready version, this means sourcing material of sufficient quality and in a decent price range that I can dare to experiment with, also safety and robustness was coming into play, so we went ANALOG. I felt less like I had to make everything, because that would be a never ending story.

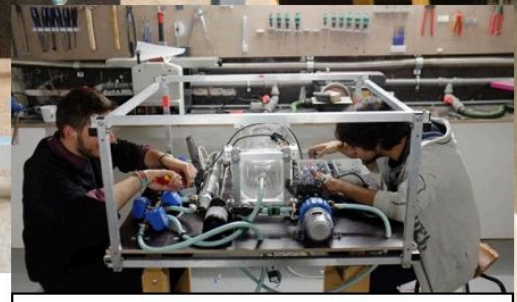
This form would be close to ideal but without manufacturing unique components it would be too expensive to get everything to fit inside the 200mm tube



September 2016

v8

Ok, so I'd already made a heater, but I didn't take it to a workshop week we had in Hamburg at the HQ of the n55 art kollektiv. Till had a fantastic workshop and I saw what I could aspire too. The version for Benoit was already late but I had almost everything down as seen above.



This was the 2nd time I got to work with Timm. Everyone thinks we fight and argue, but we're just too excited to speak politely and want to get to the solution ASAP.

So I was supposed to give the shower to Benoit, but the shape (left) still wasn't quite right. It has the same lack of drainage as past versions, so it was fixed with the green garden hose repair parts, and the membrane pump could pump air (compared to the impeller pumps that had plagued us for years).

This was a quick build for some people from Helsinki Business Alliance, again I had hopes that I could collaborate with some entity in Finland. It didn't work out, but we built the best, most functional and probably cheapest feature full version to date. *filtrate is missing, and safety is abysmal.



for safety the control box (in the shower or the right side) runs on 5 or 12V DC, which can trigger the relays on the power box -great names right - on the top left. In the Powerbox are relays which switch on and off 230V AC power for the heater, uv, and the pump.

The 12V DC has also been a mini goal so that we can build a fully self sufficient shower that runs on renewable energy and batteries directly, it's also safer as it's unlikely to rupture the skin on contact and so hopefully won't lead to electrocutions.

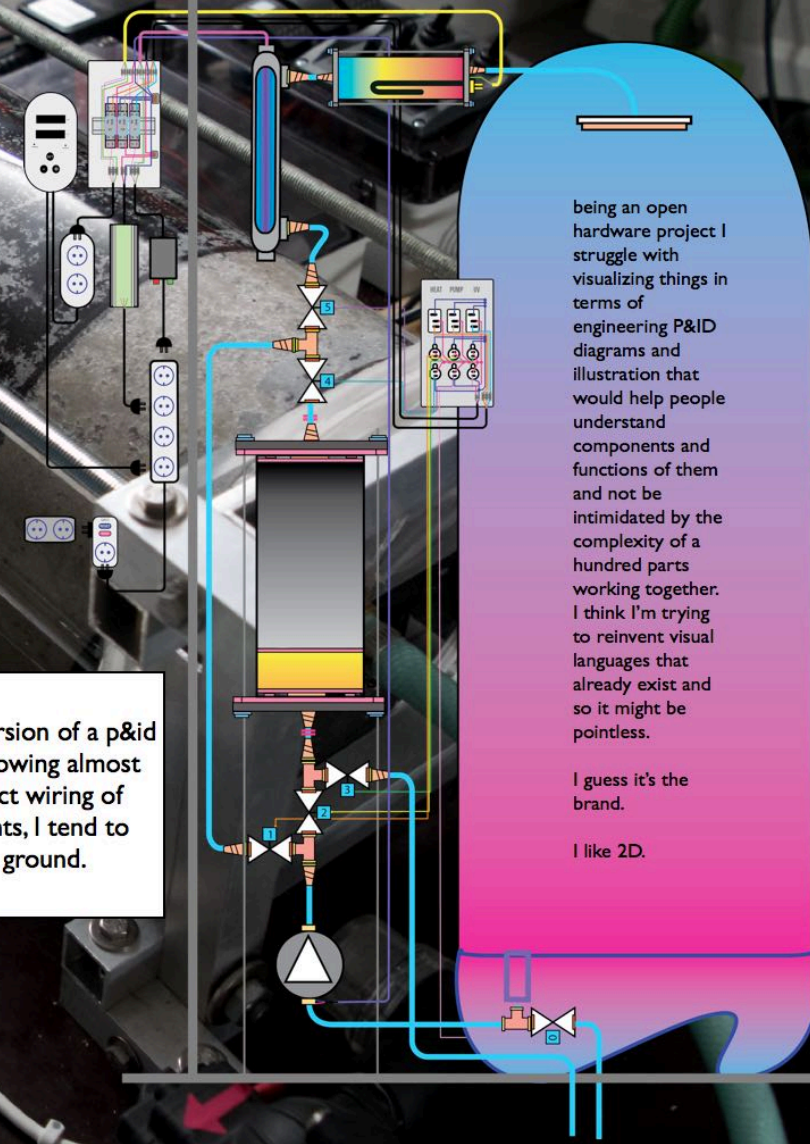
A Ground Fault Circuit Interruptor has also been added just in case.

this is my version of a p&id diagram showing almost the correct wiring of components, I tend to forget ground.

being an open hardware project I struggle with visualizing things in terms of engineering P&ID diagrams and illustration that would help people understand components and functions of them and not be intimidated by the complexity of a hundred parts working together. I think I'm trying to reinvent visual languages that already exist and so it might be pointless.

I guess it's the brand.

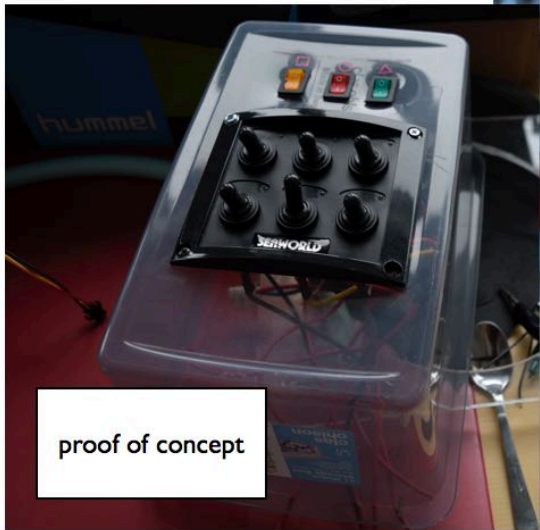
I like 2D.



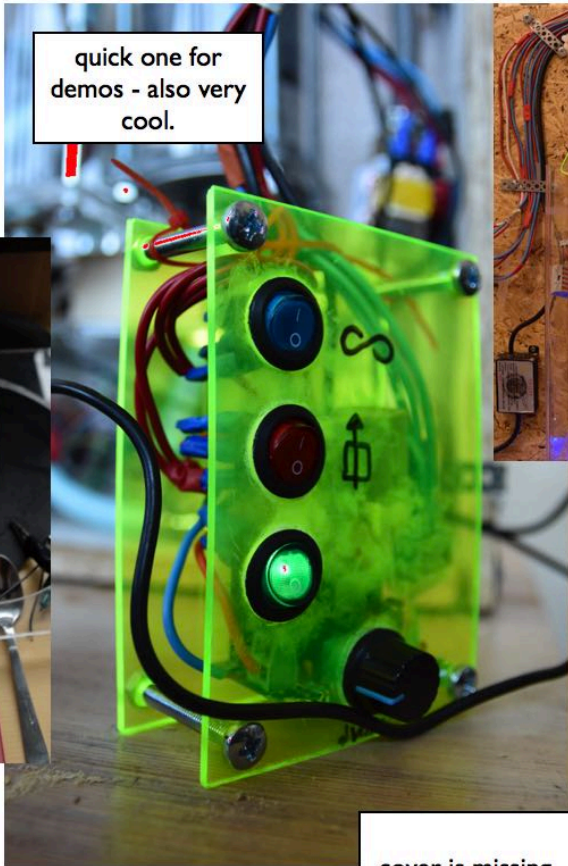
Every time I think we've solved the problem, I learn how to use a new tool, find a new component or face some arbitrary restriction, and I go off and make yet another new thing. Mostly it's just for testing and learning though. Balance must be placed between our production capabilities, functionality, cost, reliability and aesthetics.

quick one for demos - also very cool.

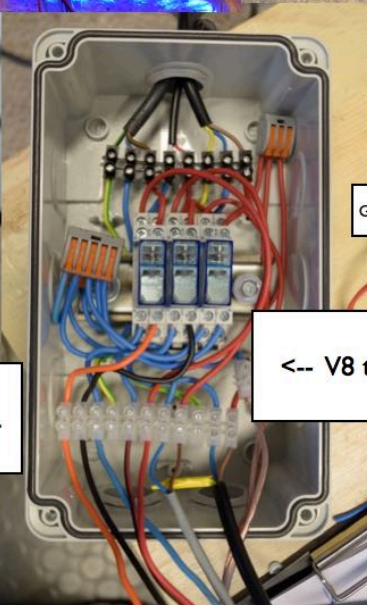
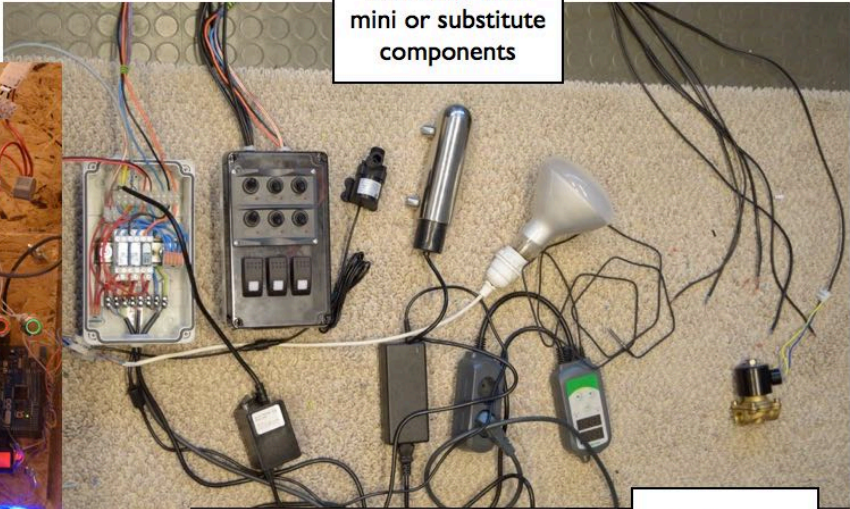
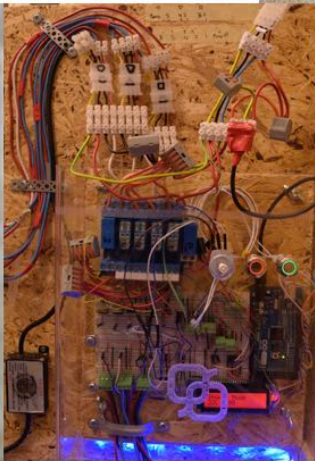
testing the controller with mini or substitute components



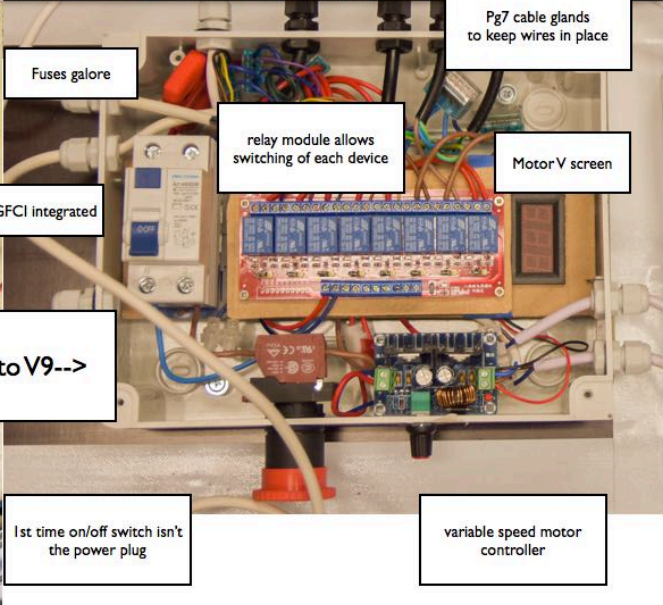
proof of concept



cover is missing...



<-- V8 to V9-->



Fuses galore

GFCI integrated

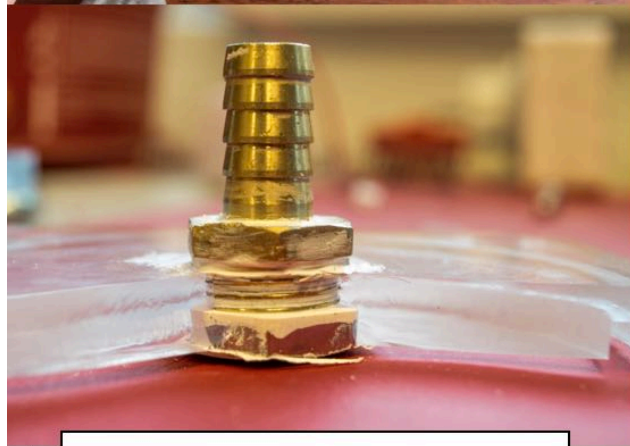
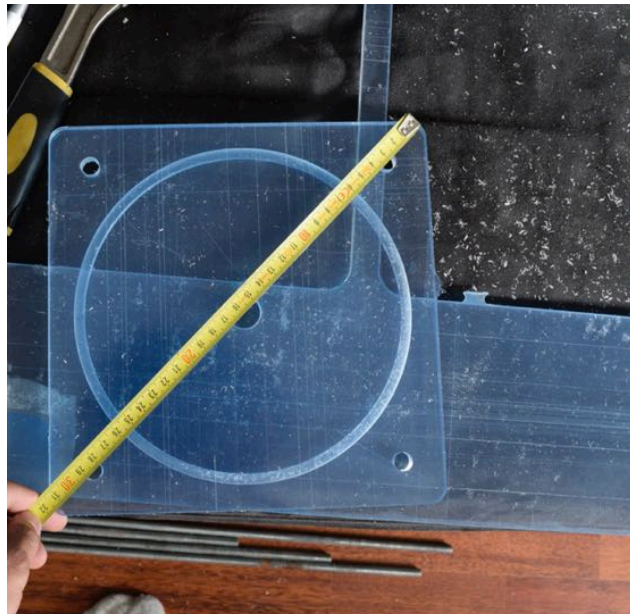
relay module allows switching of each device

Pg7 cable glands to keep wires in place

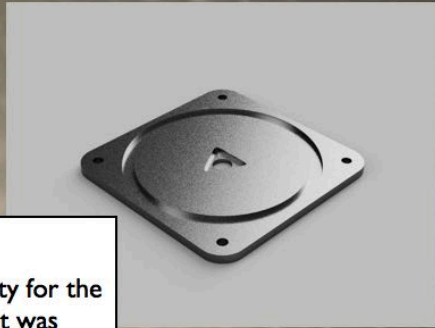
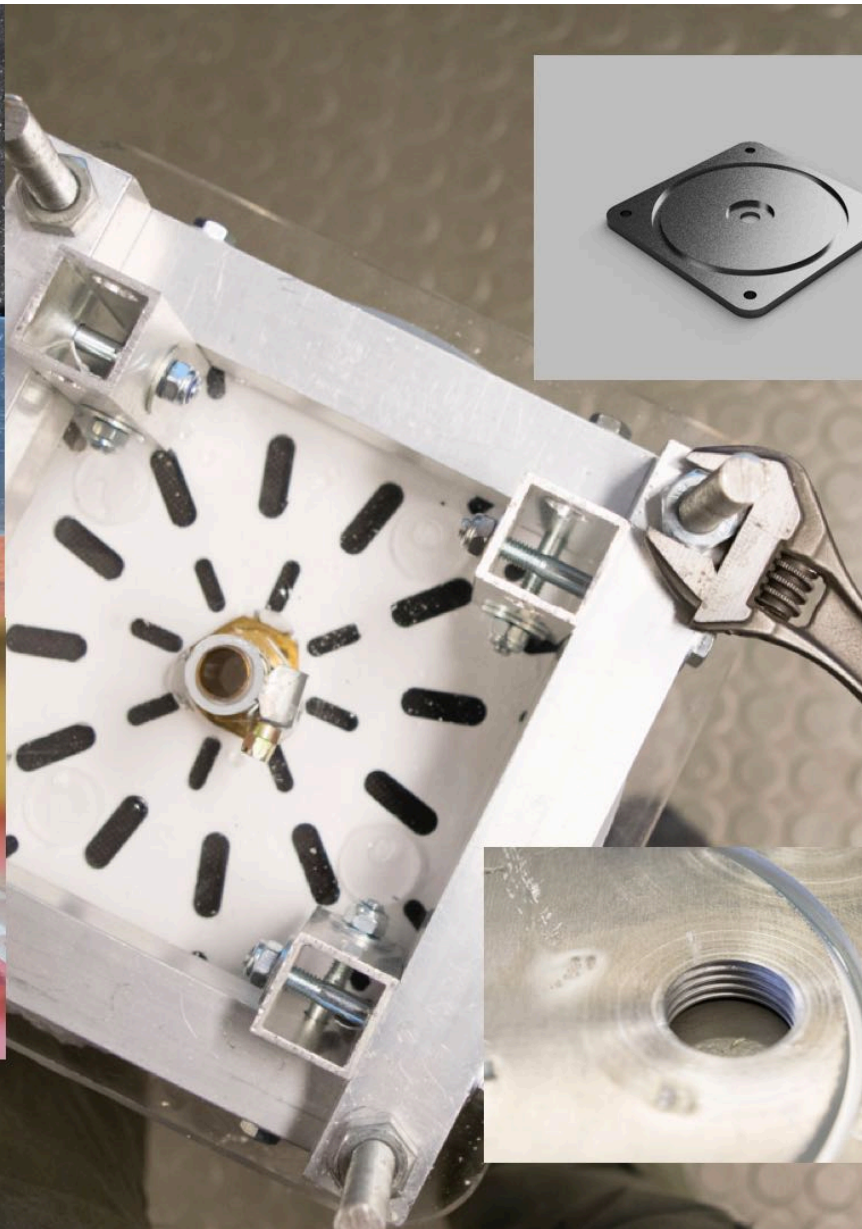
Motor V screen

1st time on/off switch isn't the power plug

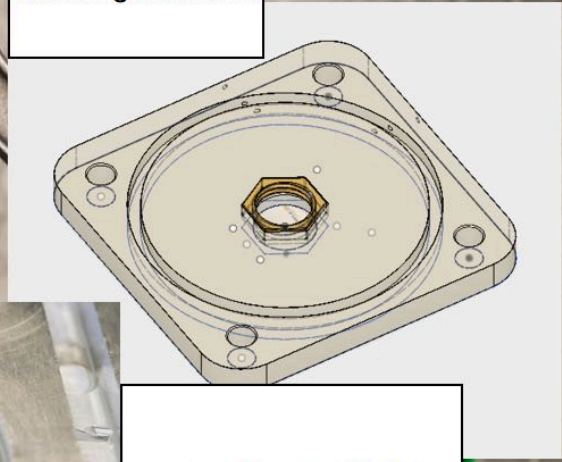
variable speed motor controller



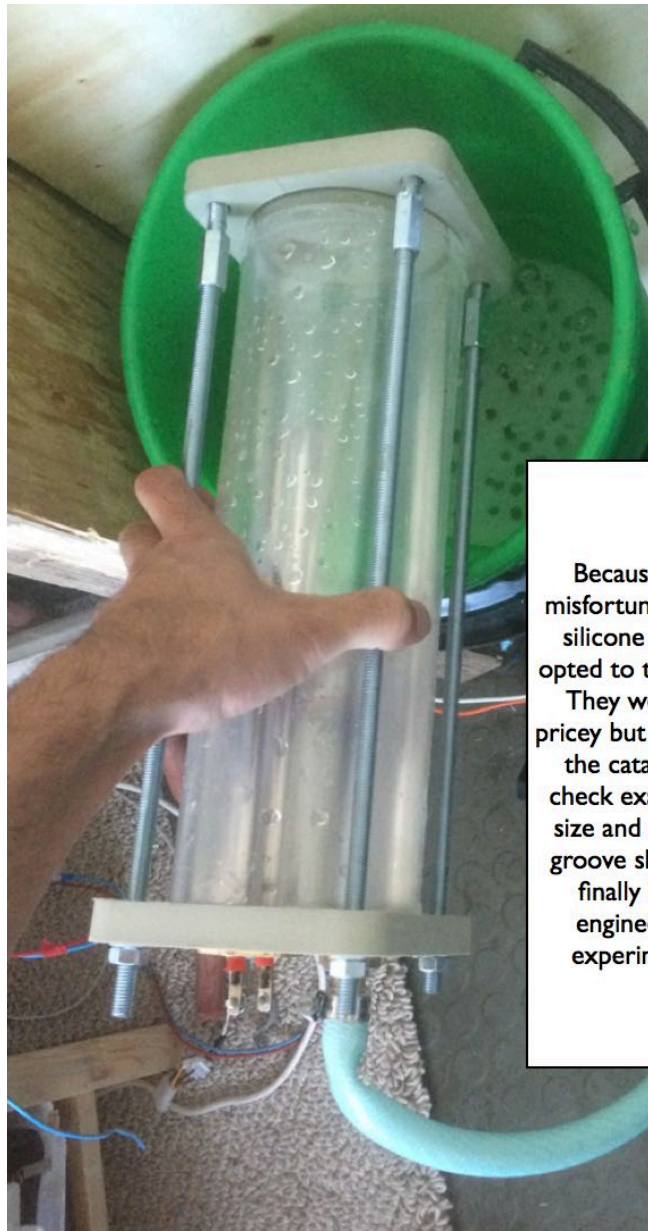
A perfect fit leaves some room for movement, otherwise it will crack under strain



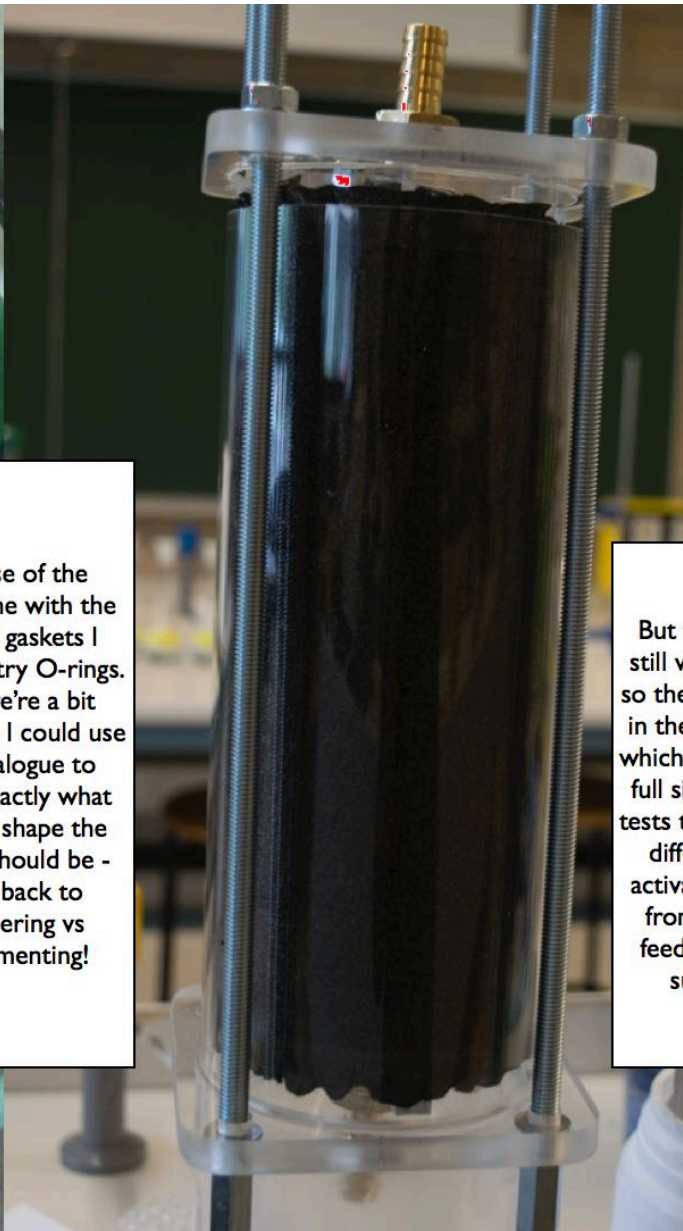
the necessity for the lock nut was discovered at POC21. Variations of the socket have been tried to account for machining tolerances.



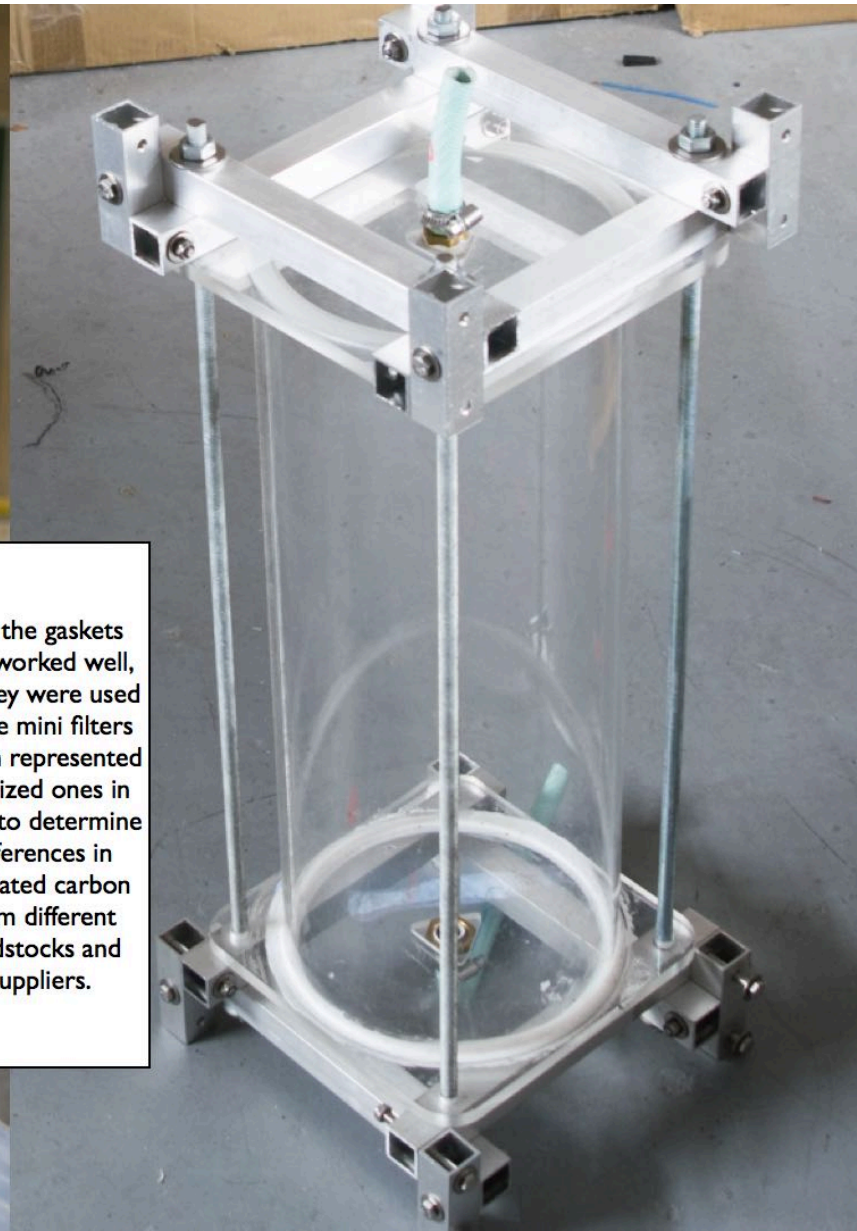
a thread tap (used in the heater) simplifies the shape but complicates the construction

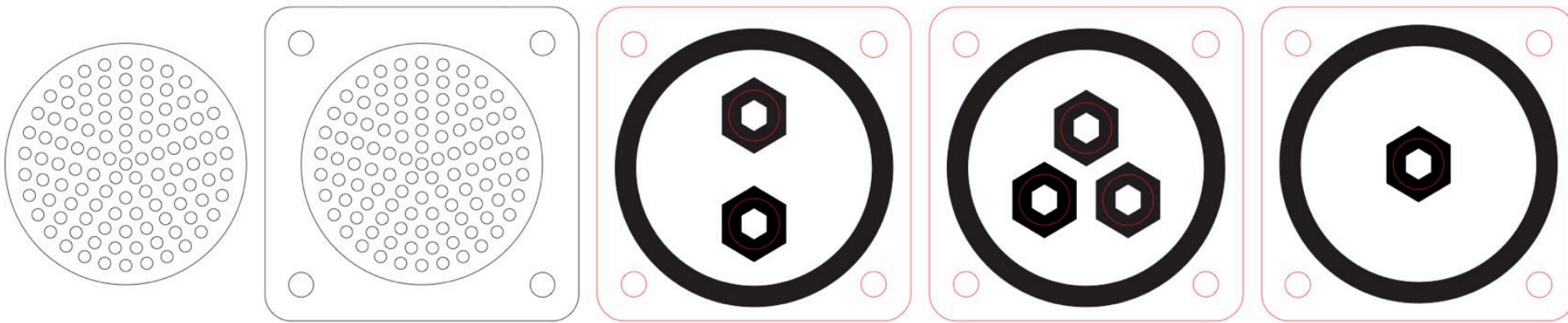


Because of the misfortune with the silicone gaskets I opted to try O-rings. They we're a bit pricey but I could use the catalogue to check exactly what size and shape the groove should be - finally back to engineering vs experimenting!

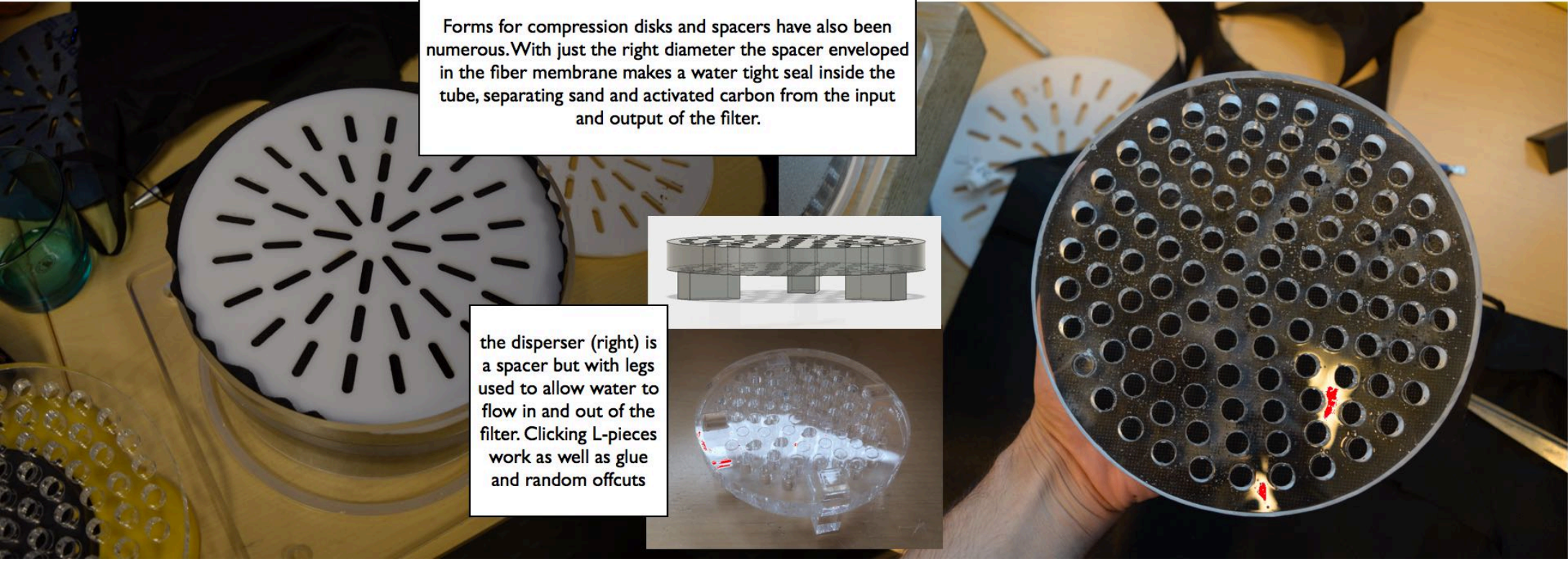


But the gaskets still worked well, so they were used in the mini filters which represented full sized ones in tests to determine differences in activated carbon from different feedstocks and suppliers.

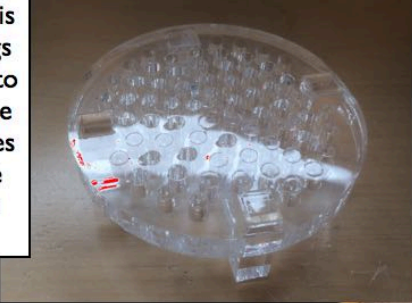


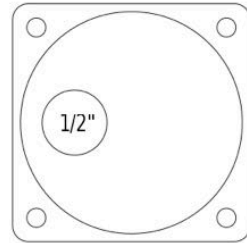
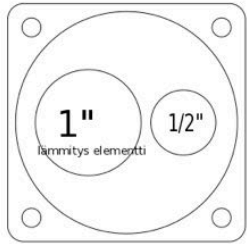


Forms for compression disks and spacers have also been numerous. With just the right diameter the spacer enveloped in the fiber membrane makes a water tight seal inside the tube, separating sand and activated carbon from the input and output of the filter.



the disperser (right) is a spacer but with legs used to allow water to flow in and out of the filter. Clicking L-pieces work as well as glue and random offcuts

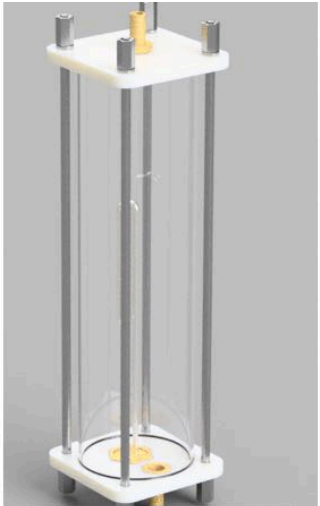
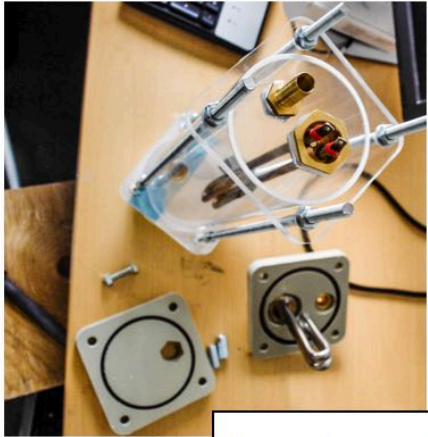




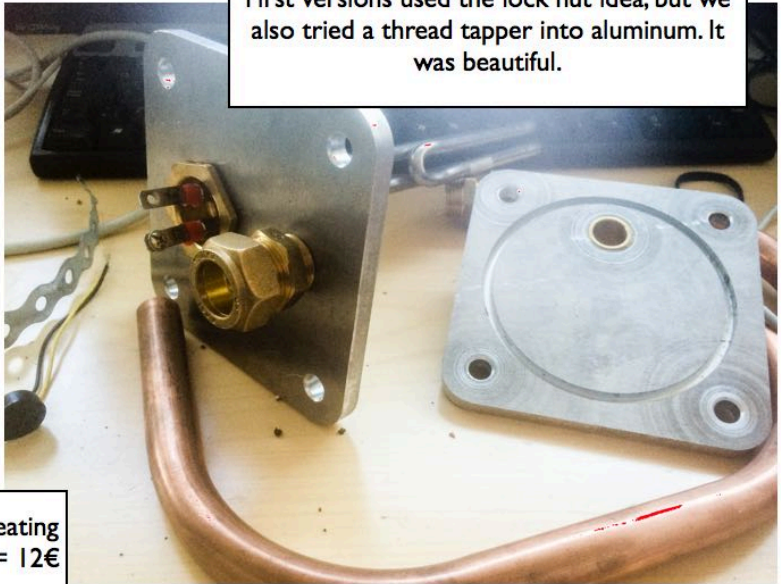
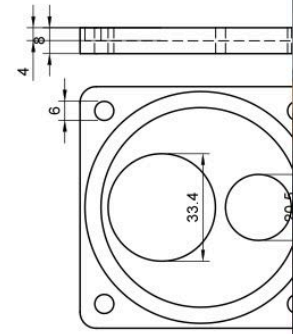
Specification:
 Material Iron
 Color Silver
 Voltage 220V
 Power 2000W
 Mounting thread: (1 inch) supporting the pipeline DN20
 Suitable For: steaming machines, drinking fountains, water boilers, distillation pots, pans or other
 Size: 28 x 2.7 x 2.8mm(0.84 x 1.06 x 0.87") (L x W x H)
 Weight: 10g
 Note: Iron tube, the heater head is made of iron.
 Package Include:
 1 x Iron Heating Element Tube



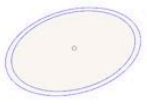
Mentioned earlier, the heater has been a slow going project for Benoit as he requested a water reheater. I foolishly promised him we could do it without having any firsthand experience in it. There are ready products available but not quite suitable ones and quite expensive. So let's use the mini filter design for a resistive heater and thermostat. I made a simple concept on the left to communicate to a teacher in Varia (Janne Saari) what I was thinking about, and later rendered it with Fusion 360 as I was using it to machine my own parts with the Fablabs CNC.



First versions used the lock nut idea, but we also tried a thread taper into aluminum. It was beautiful.



quick test to learn about PTC heating elements and thermostats. cost = 12€ and 1 hour.



Dept.	Technical reference	Created by	Approved by
		Document type	Document status

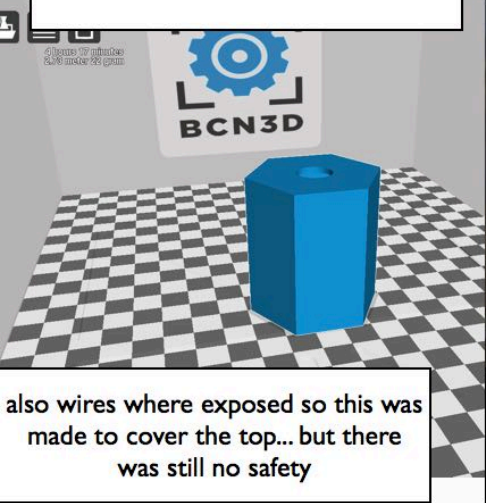
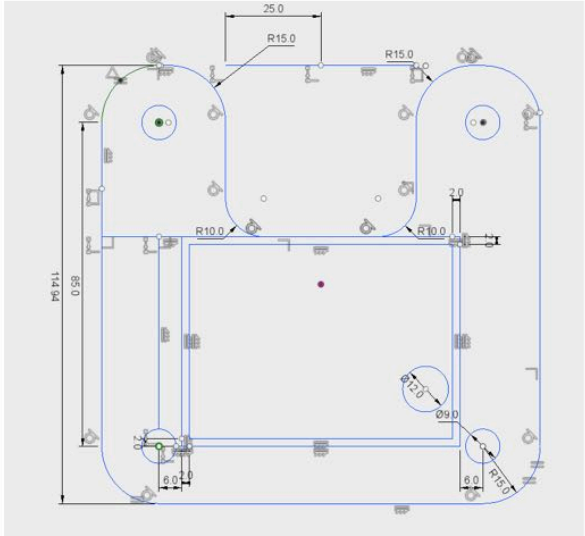
There was a problem though, the heater was missing safety features

it would start a FIRE!

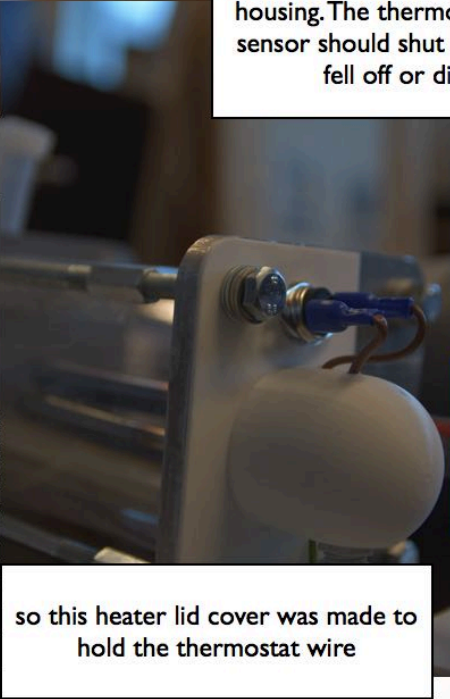
if R2D2 was a shower

without water inside it would melt the housing. The thermostats temperature sensor should shut it off, but what if it fell off or didn't work?

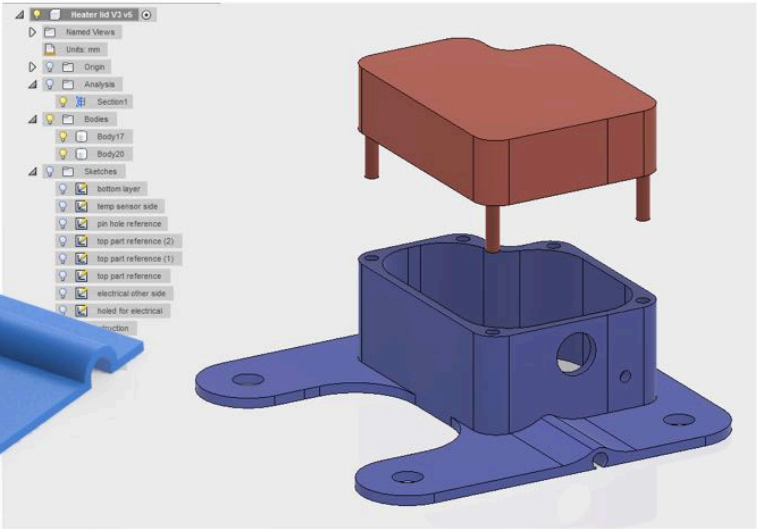
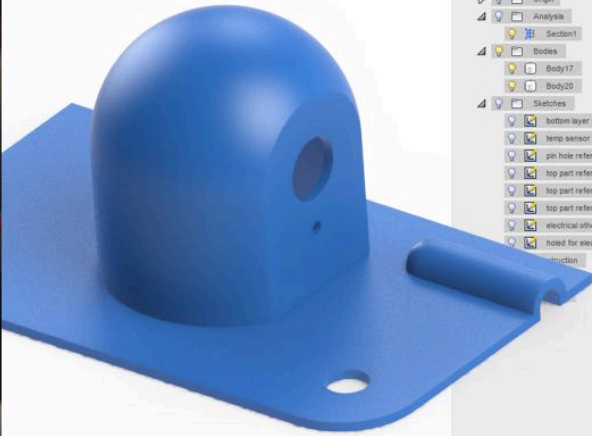
learning 3d printing



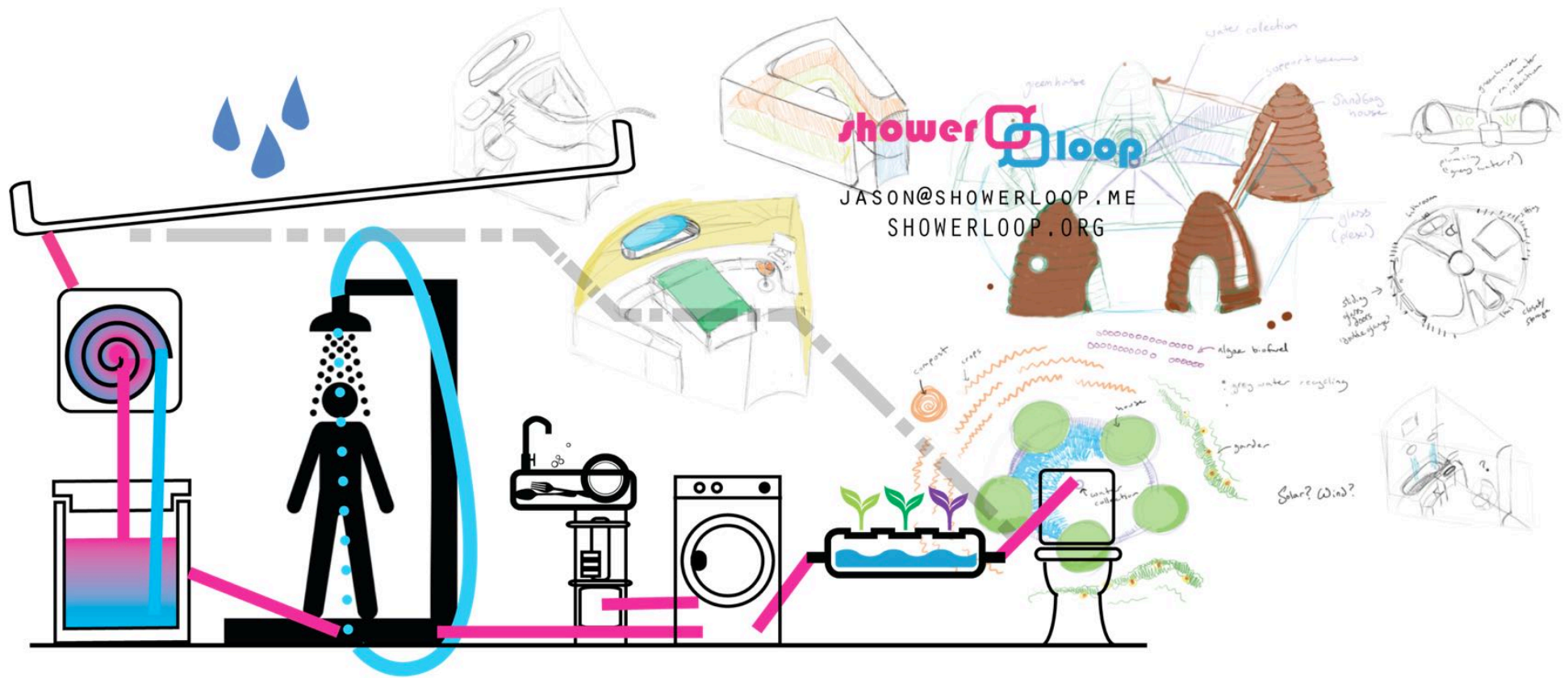
also wires where exposed so this was made to cover the top... but there was still no safety



so this heater lid cover was made to hold the thermostat wire



I'd want to close or loop energy, air and water flows in a house as much as possible.
maybe society.



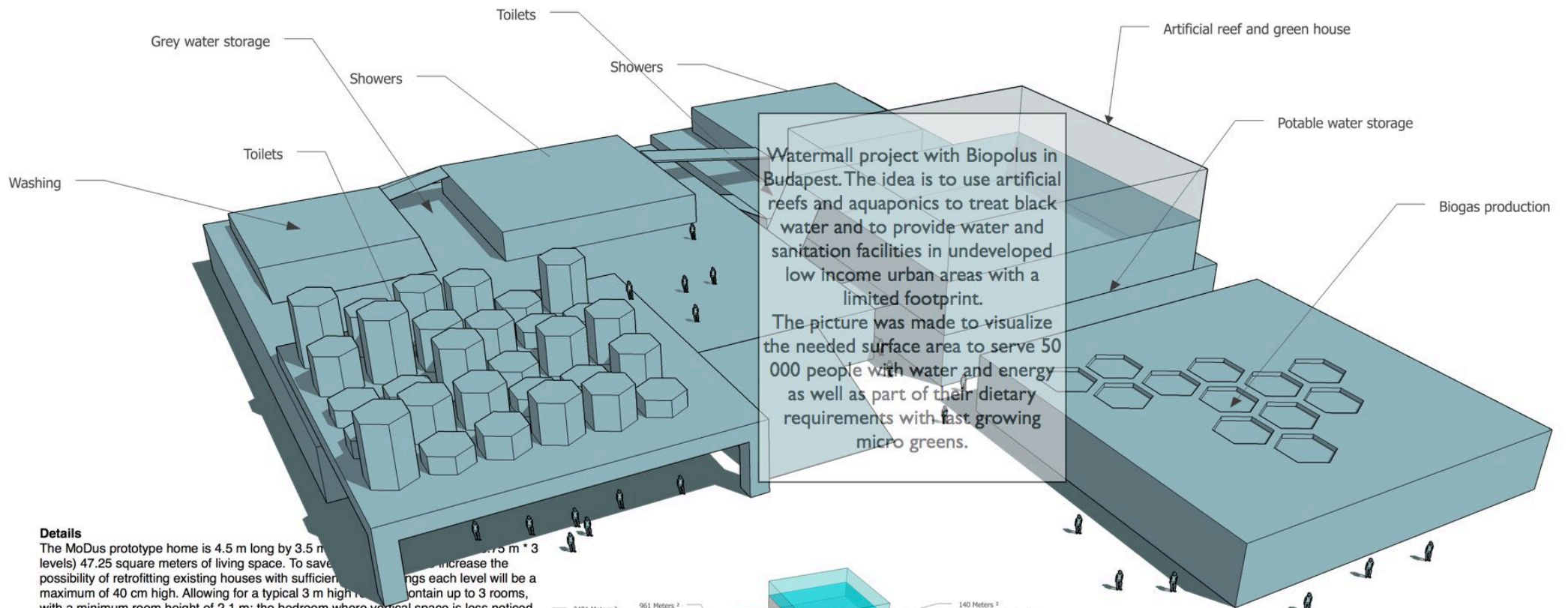


Couple other things about me

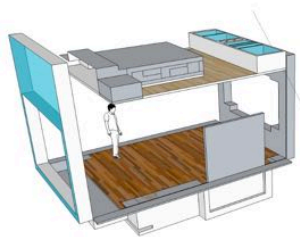


I build a bike trailer from recycled parts so I could tow OSB board from the hardware store to my garage 6 km away. It was fun, but I should have used wheels with air

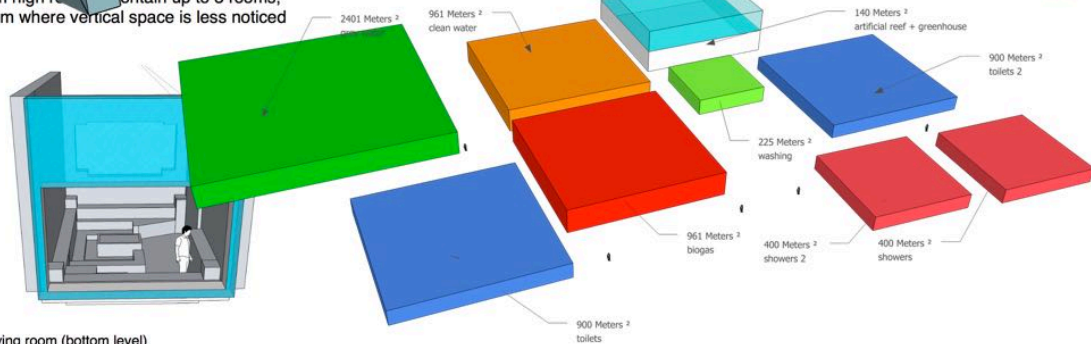




Details
 The MoDus prototype home is 4.5 m long by 3.5 m wide (3 levels) 47.25 square meters of living space. To save space, increase the possibility of retrofitting existing houses with sufficient living space, each level will be a maximum of 40 cm high. Allowing for a typical 3 m high room to contain up to 3 rooms, with a minimum room height of 2.1 m; the bedroom where vertical space is less noticed and a maximum of 2.5 m for the living room.



Side view of modular house without walls. Bedroom on top level, minimalist room in the middle, and the living room is beneath it.



tiny house with elevator floors for rooms

Excess energy is delivered back to the neighborhoods and during shortages the greenhouse may utilize electricity from the grid.

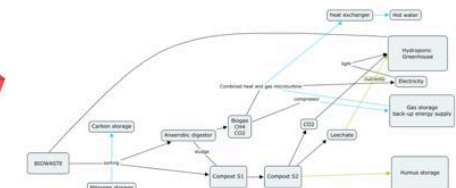
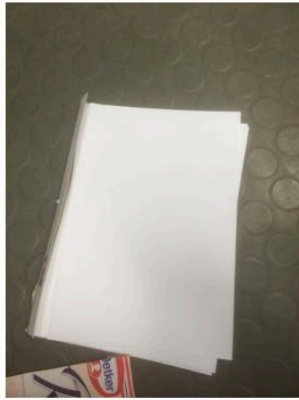


Figure 2. Process diagram of the BioHaus.

biogas and greenhouses



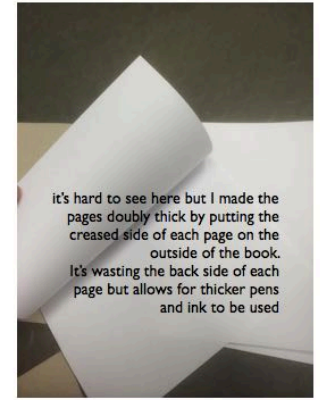
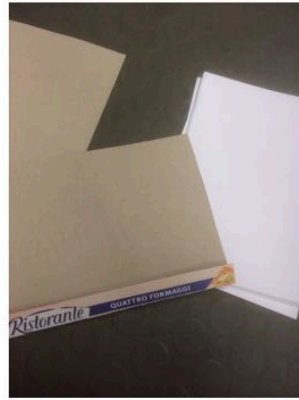
fold paper



cut out a pizza box, to fit the shape of the folded paper
+
the spine and the front of the book
(so like 1.5 + 2 cm)



Now is a good time to color the inside and laminate the cover if you want

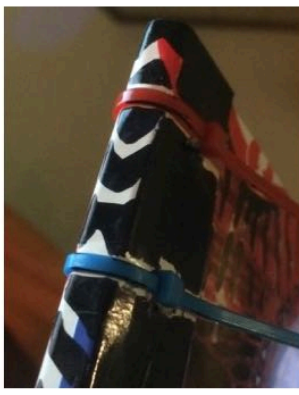


it's hard to see here but I made the pages doubly thick by putting the creased side of each page on the outside of the book. It's wasting the back side of each page but allows for thicker pens and ink to be used

MAKE a Pizza BOX BOOK

by Jason

Using clamps or a vice, squeeze the book together and use a drill to make holes. Then add washers around the holes to protect the cardboard and add zipties. It might be that only one side needed them.



I was going to paint the whole thing but because the idea was to upcycle the pizza box, why not use it as part of the book. Using a black permanent marker I drew a design over the packaging.

I added a sleeve in the inside back cover for storage.





This framework was made to compress the showerloop lids together to make a water tight seal that can handle up to 1.5 bar pressure.

Components:
1x1" wood (25cm),
M10 threaded rod (60cm),
nuts and washers.

The added block stops the stand from closing. They are tight fitting.

Use it as a bench!

