

HydroForge



From Zero to Herb Hero — Grow (almost) Effortlessly!

Welcome!

Thanks for choosing my 3D-printed HydroForge design! You're just a few steps away from building your own automated indoor garden. This easy-to-use system is designed to grow plants with minimal maintenance, featuring water level control, oxygenation, and an adjustable light timer. I've made the entire process simple—from printing the parts to assembling and sourcing everything—so you can start growing with ease.

Cost and Filament: The entire system weighs approximately 2.4 kg of filament, and the total cost of parts is around 115€. While the grow light (49€) and oxygen pump (39€) make up the bulk of the cost, the rest of the components are incredibly affordable.

Build Plate Size: The largest part you'll need to print measures 260x280 mm, and the tallest part is 200 mm, so ensure your 3D printer has a suitable build volume. However, if your printer has a smaller build plate, as small as 140x260 mm, you can still print splitted parts and glue them together afterward.

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II. Get Your Gear!

Before diving into assembly, let's gather all the components you'll need for your Hydroponic Station. Below is a comprehensive list, categorised for your convenience:

Things to Print

- **PlantsBox:** The main container for your herbs.
 - **Lid:** Features slots to insert hydroponic cups for growing plants.
 - **Parting:** A divider that separates the plant section from the sensors.
 - **Sensors Housing:** Two mounts for securely placing water level sensors.
 - **Sensors Lid:** Covers sensors
- **WaterTower:** Holds the water reservoir for your system.
 - **Lid:** Covers the water tower.
 - **Flap:** Opens and closes for easy water refilling.
 - **Knob:** For operating the flap.
- **Electronics Bay:**
 - **Mounting Plate:** For organising and securing the electronics.
 - **Lid:** A protective cover for the electronics bay.
 - **Wall:** A second closing plate.
- **Planters** (6pcs): Individual cups for plants and growing medium.

Electronics, Hardware, and Supplies

- **Water pump:** Circulates water to your plants.
- **Plastic tube** (Ø8mm, 1m): Connects the water pump to the PlantsBox.
- **Water level sensors:** Monitors the water levels in the PlantsBox.
- **Water level controller:** Automatically maintains the water at the desired level.
- **Air stones:** Disperse air from the pump, improving water oxygenation.
- **WiFi controller:** Allows for remote control of the light.
- **Power supply unit** (PSU): Provides power to the electronic components.
- **Power plug:** Connects the PSU to your main power source.
- **Epoxy resin:** Ensures a watertight container, even with potential printing errors.
- **Heat inserts:** Provides durable, threaded connections for the 3D-printed parts.
- **Electrical wires and connectors**
- **Screws, nuts, and washers**
- **Lamp**¹: Provides light for the plants and can be scheduled via the controller.

If your station is in a dark area or lacks direct sunlight, invest in a good-quality grow lamp. This will ensure your plants get the light they need for optimal growth.

- **Air pump:** Pumps air into the water to increase oxygen levels.

All the noise pollution in the HydroForge comes almost entirely from the air pump. I've tested several options, and while this one is the quietest I've found (though not silent), it's worth investing in a better one if noise is a concern.

¹ Or just use sunlight, you don't need a wifi controller for that.

Growing Supplies

- **Clay Pebbles:** Provide a stable medium for plant roots to grow.
- **Rockwool Cubes:** To germinate seeds and support young plants.
- **Seeds:** Choose the herbs or plants you want to grow.
- **Hydroponic Nutrient Solution:** Essential for feeding your plants and promoting growth.

Note: For your convenience, a detailed parts list, including quantities and suggested sources with links, is available in the accompanying sheet.

III. Print It Up!

Before you start printing, make sure you've got the right settings dialled in for optimal results. The goal is to ensure water-tightness. Here's what I recommend:

- **Material:** PETG (excellent layer adhesion, food-safe, significant chemical resistance).
- **Nozzle:** 0.6mm for faster prints and durability (wall thickness is 2.8mm).
- **Temperature:** Tune your filament, then add 10°C. A little stringing is normal.
- **Layer height:** 0.4 mm for a good balance between speed and quality.
- **Infill:** Doesn't matter.
- **Vertical shells:** 6
- **Horizontal shells:** 6
- **Supports:** Not required, nothing to support.
- **Build plate adhesion:** Use a brim for long prints (WaterTower and PlantsBox).
- **Cooling:** Disabled.
- **Extrusion multiplier:** Tune, then add +0.05. The design incorporates slight over-extrusion.
- **Colour:** Darker colours absorb more heat in sunlight, raising the nutrient solution's temperature. Plan accordingly!

IV. Let's Assemble!

Waterproofing with Epoxy Resin

To ensure your **WaterTower** and **PlantsBox** are fully watertight and leak-free, it's essential to coat the interior surfaces with epoxy resin. Keep in mind that the curing agent (hardener) can release harmful fumes, so it's important to take safety precautions.

1. **Prepare the Parts:** Make sure both the WaterTower and PlantsBox are clean and dust-free for optimal adhesion.
2. **Safety First:** Always work in a well-ventilated area and wear a carbon filter face mask to protect yourself from the fumes.
3. **Mix the Resin:** Follow the epoxy resin packaging instructions for the correct mixing ratio.
4. **Apply the Resin:** Evenly coat the inside surfaces of the WaterTower and PlantsBox using a brush.
5. **Let it Cure:** Allow the epoxy to fully cure (typically 24-48 hours).

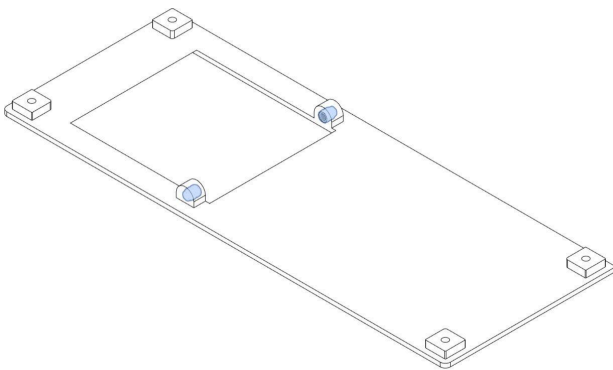
Installing Heat Inserts

Install heat inserts into the designated spots using **soldering iron**. These inserts provide strong, threaded connections for assembling your system securely.

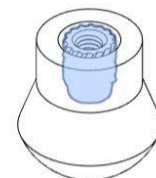
1. **Heat the Insert:** Using a soldering iron, heat the brass insert.
2. **Press into Place:** Gently press the heated insert into the designated hole. Make sure the insert is fully seated and flush with the surface.
3. **Let it Cool:** Allow the heat insert to cool and bond with the plastic before proceeding.

Insert Locations: refer to the images below to see exactly where the heat inserts need to be placed.

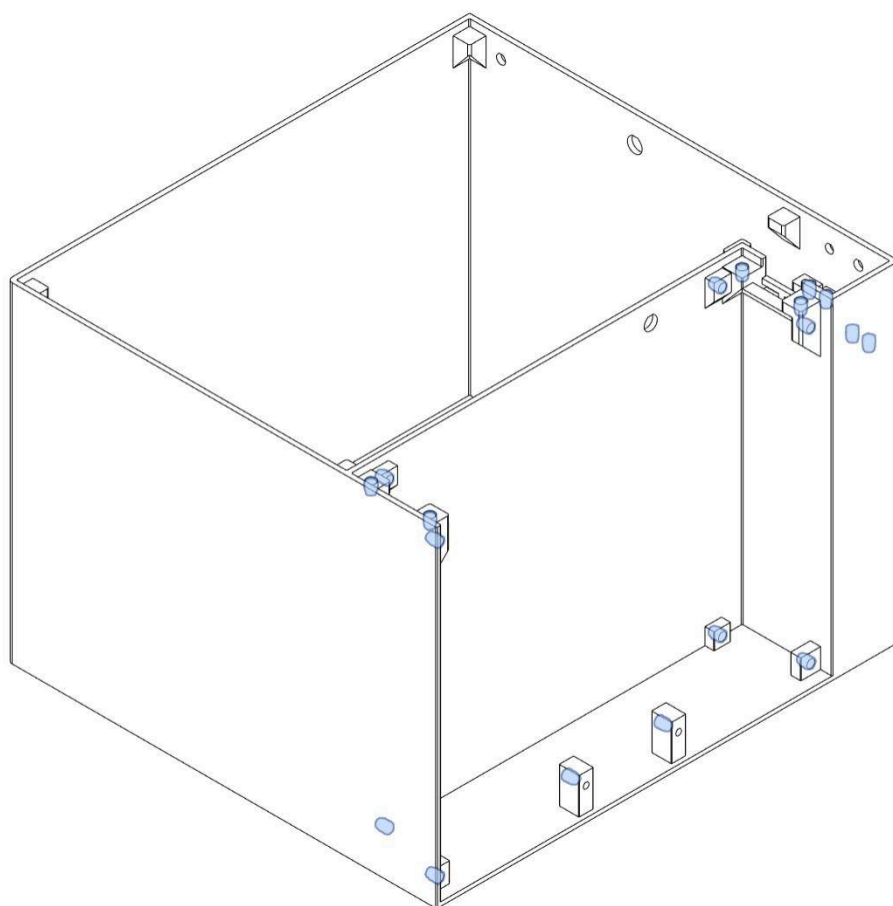
WaterTower Lid - 2 inserts



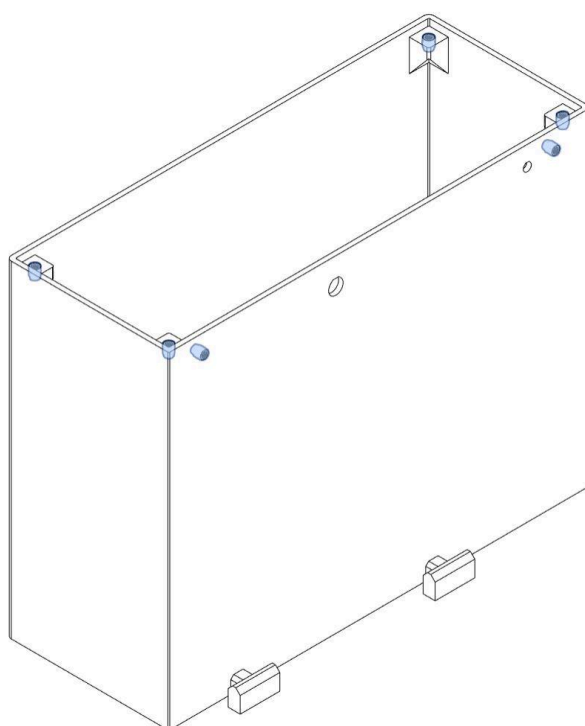
WaterTower Knob - 1 insert



PlantsBox - 18 inserts

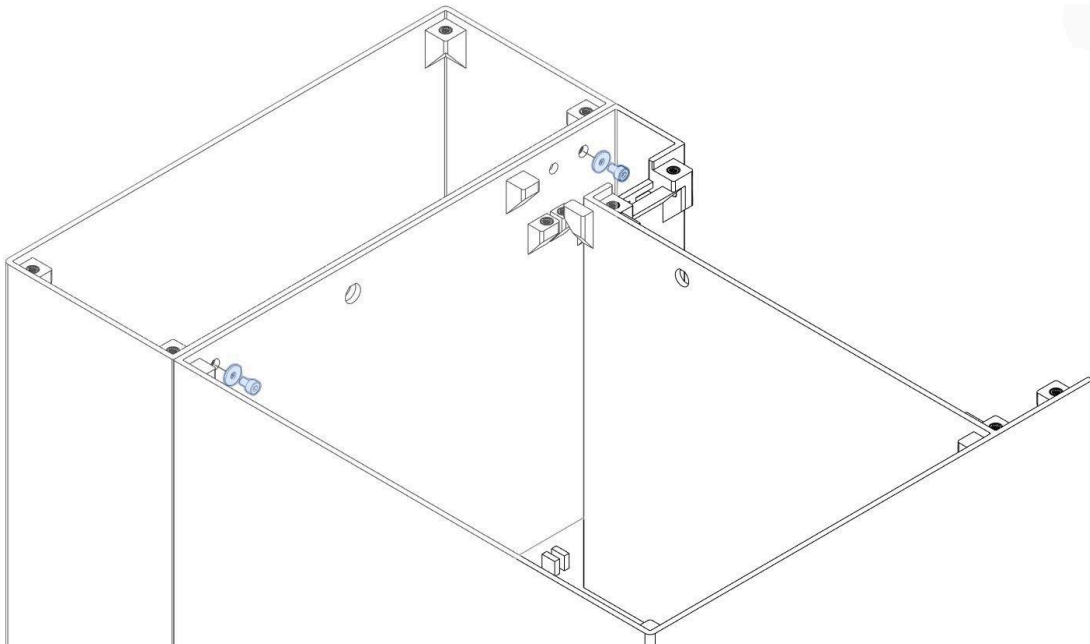


WaterTower - 6 inserts

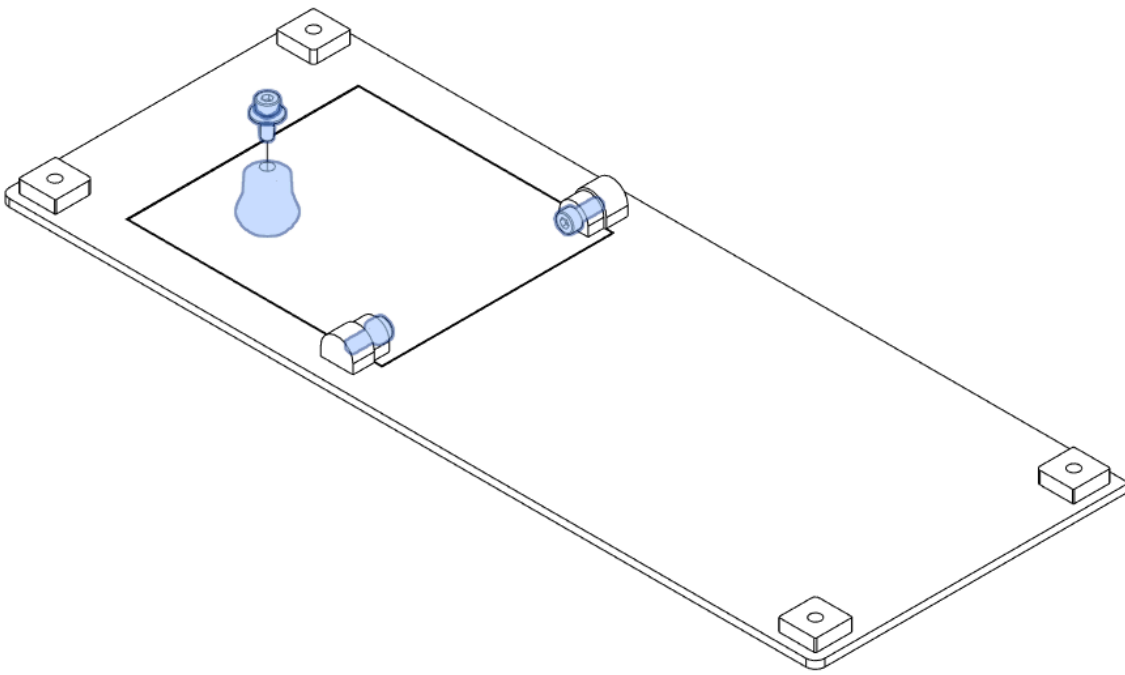


Assembly Steps

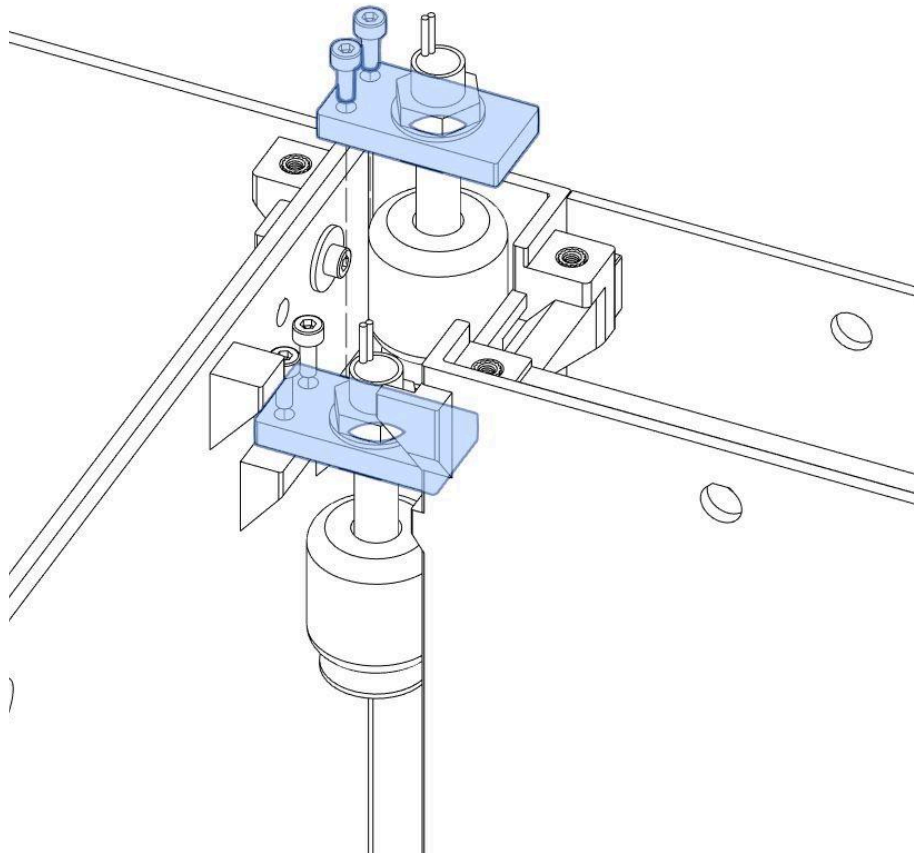
1. Connect the **PlantsBox** and **WaterTower**.



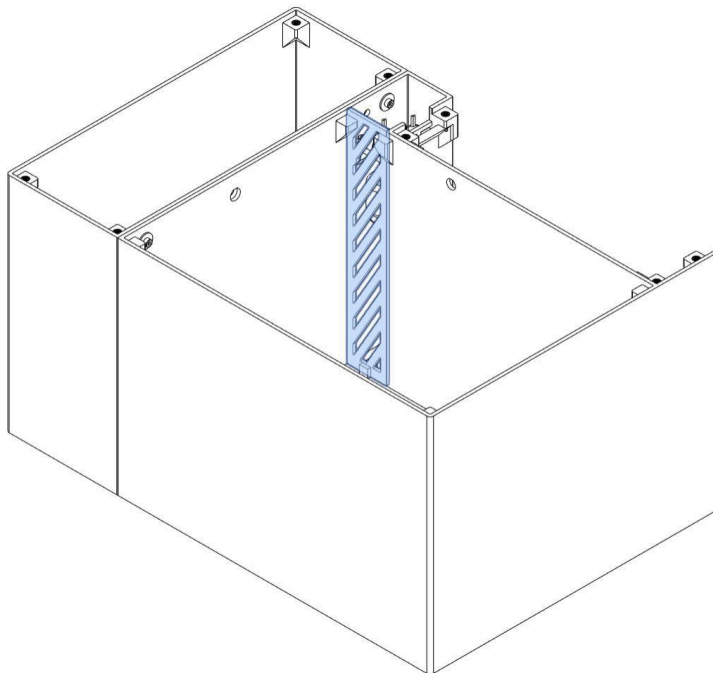
2. Assemble the **WaterTower Lid**, **Knob**, and **Flap**.



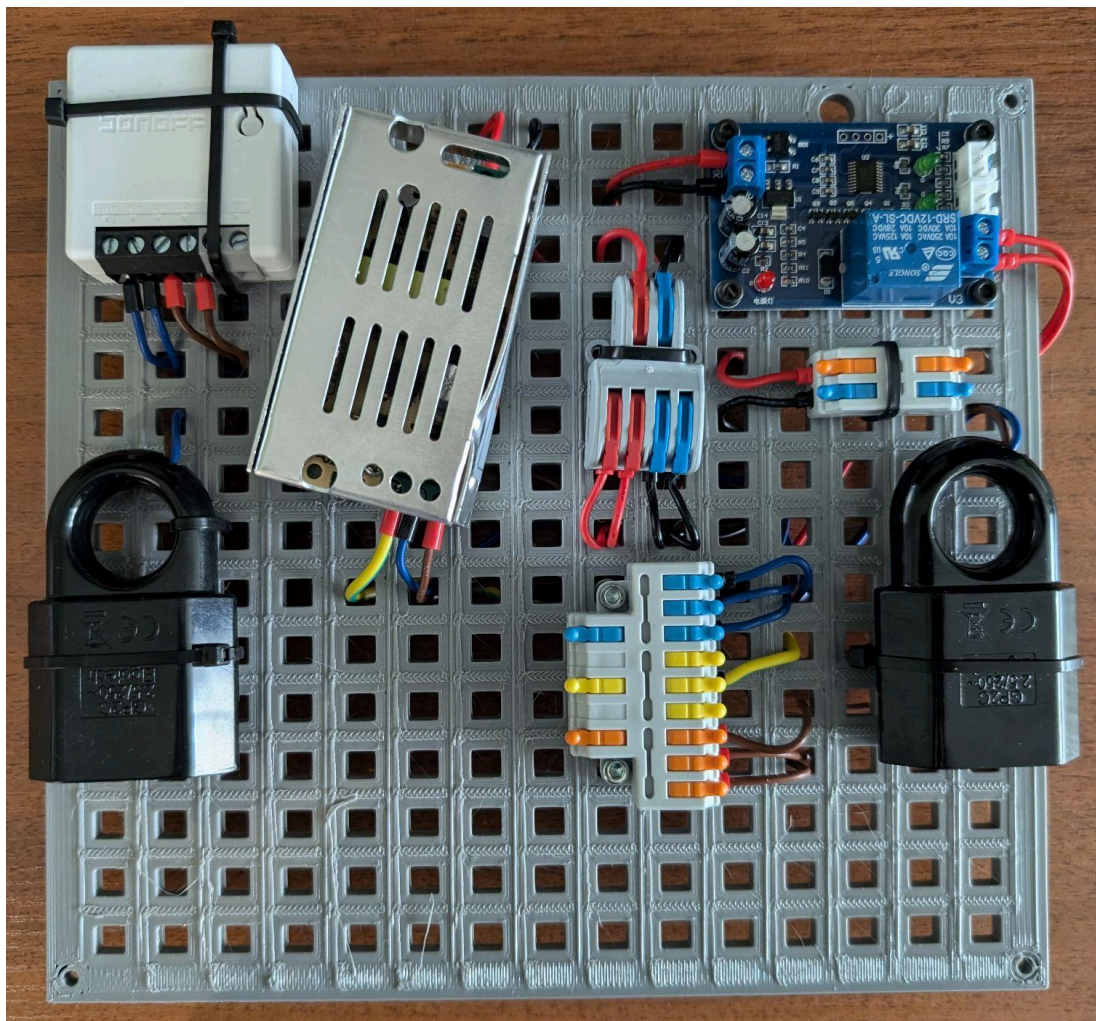
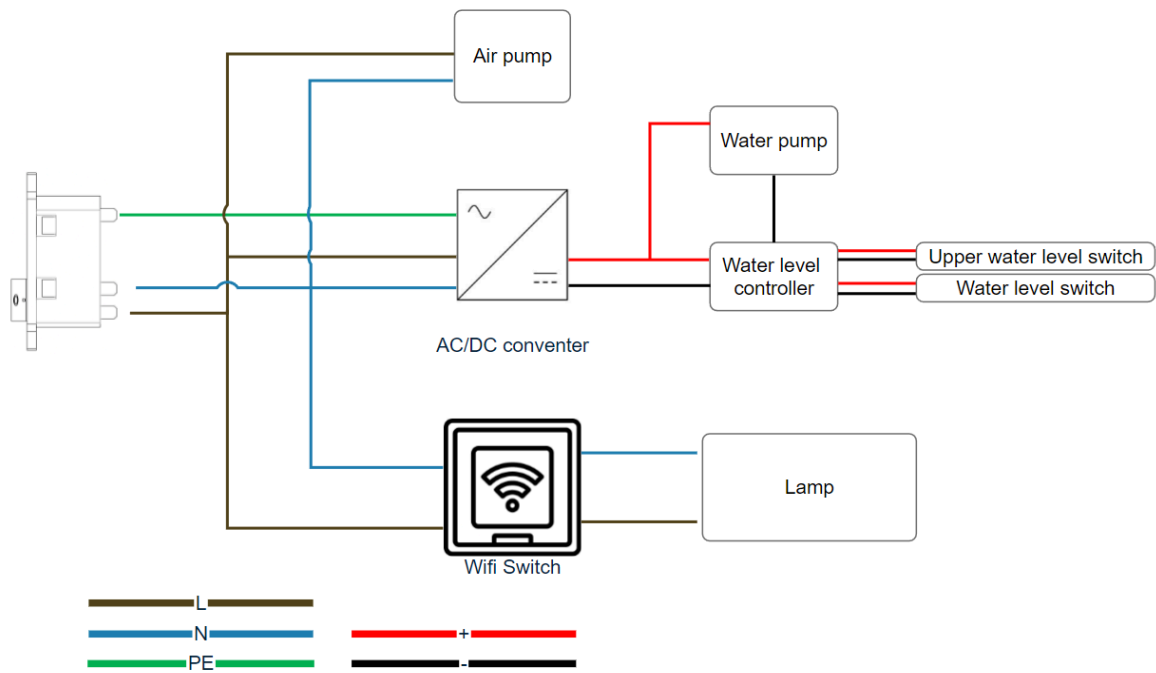
3. Mount water level sensors using the **SensorsHousing** and screws.



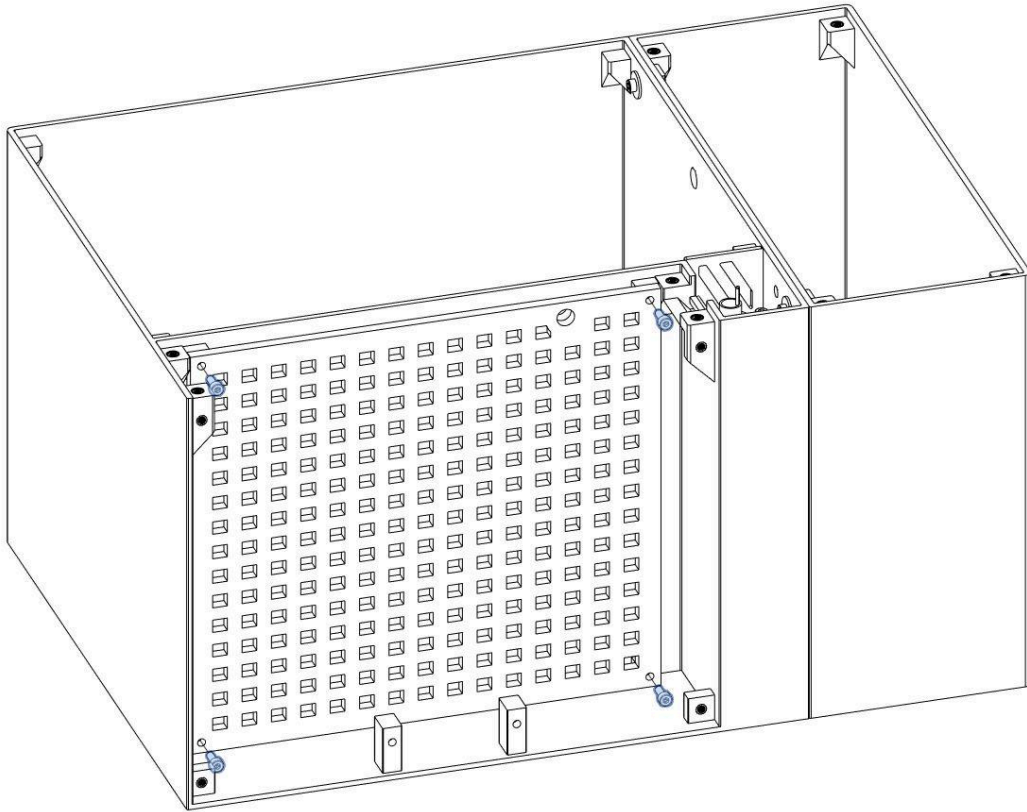
4. Place the **Parting** in position.



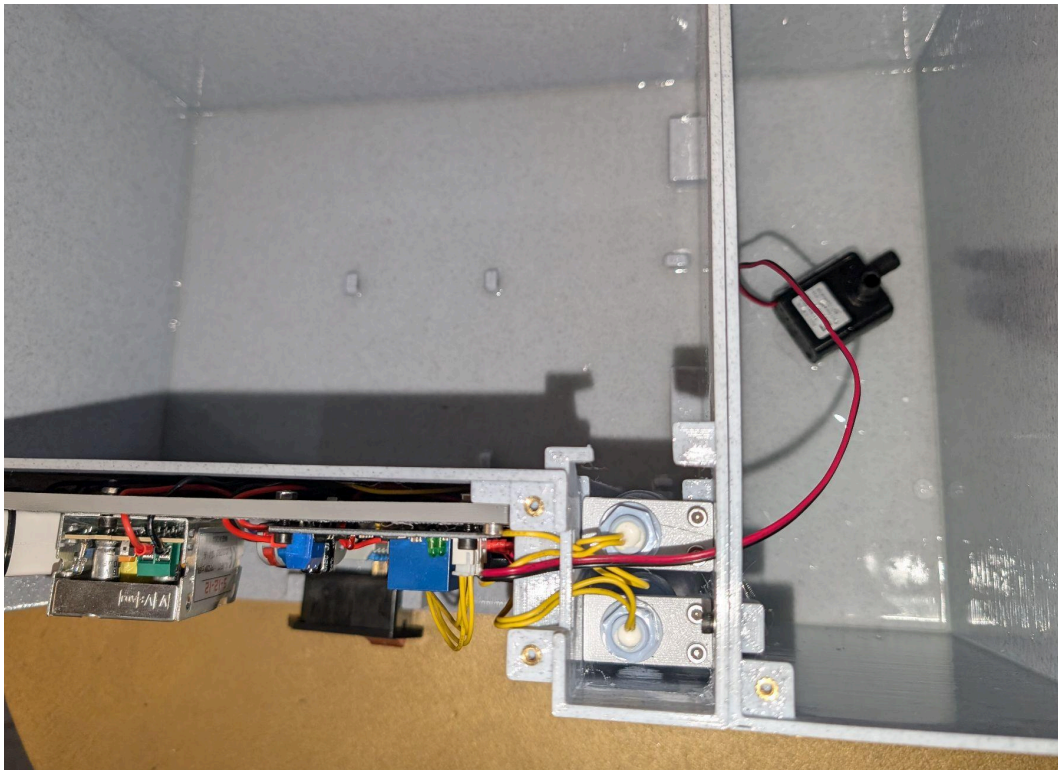
5. Organise and secure the electronics on the **ElectronicsBay Mounting Plate**.

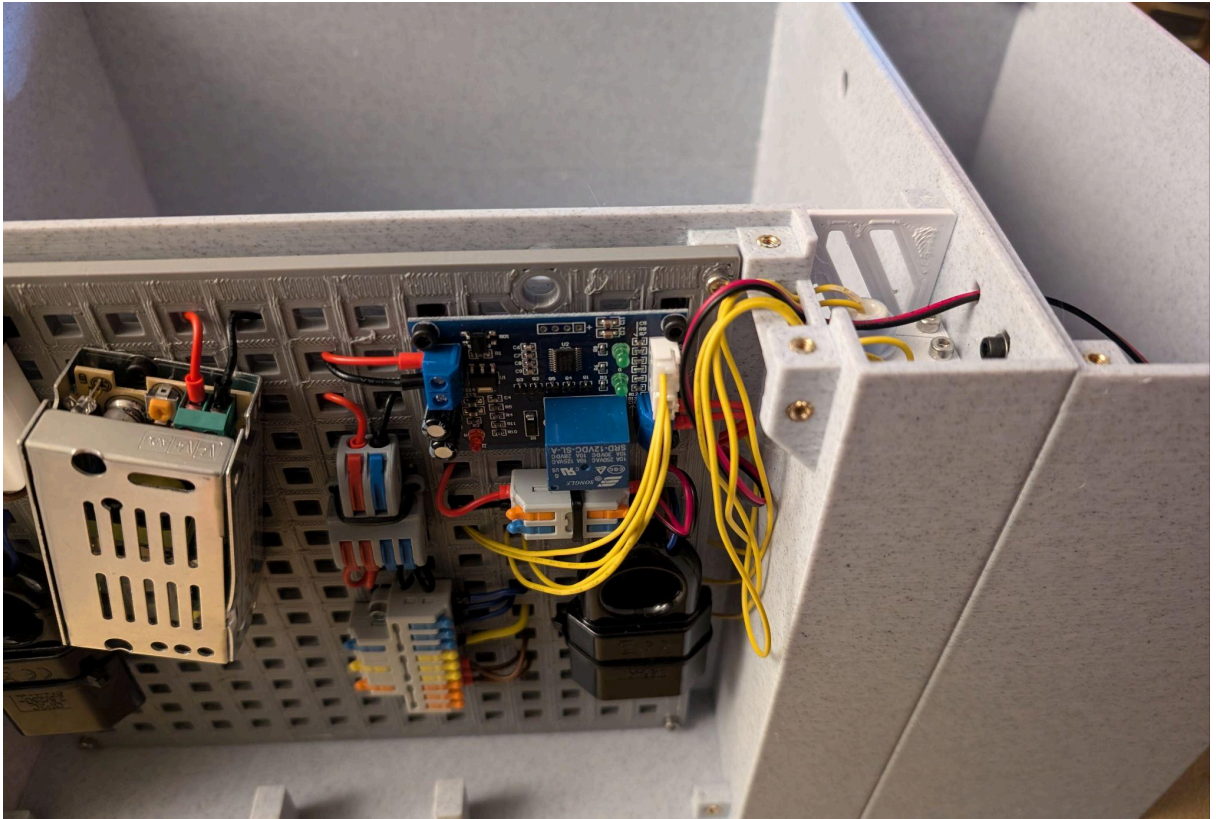


6. Insert the completed **Mounting Plate** and secure it with screws.

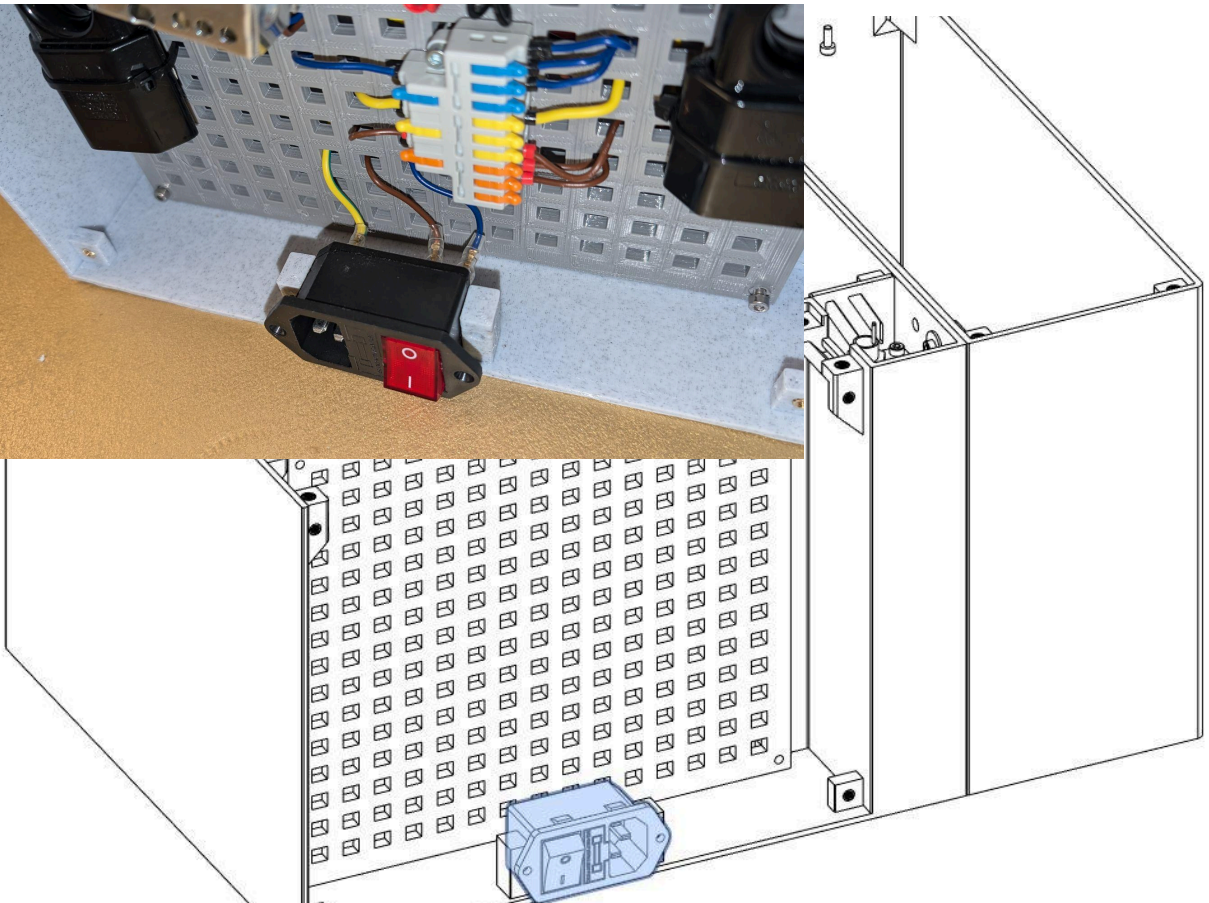
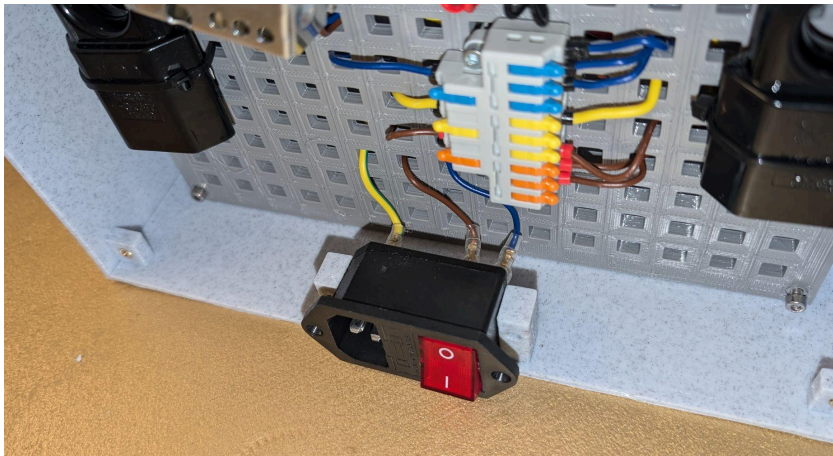


7. Connect the **water pump** and **sensors** wires.

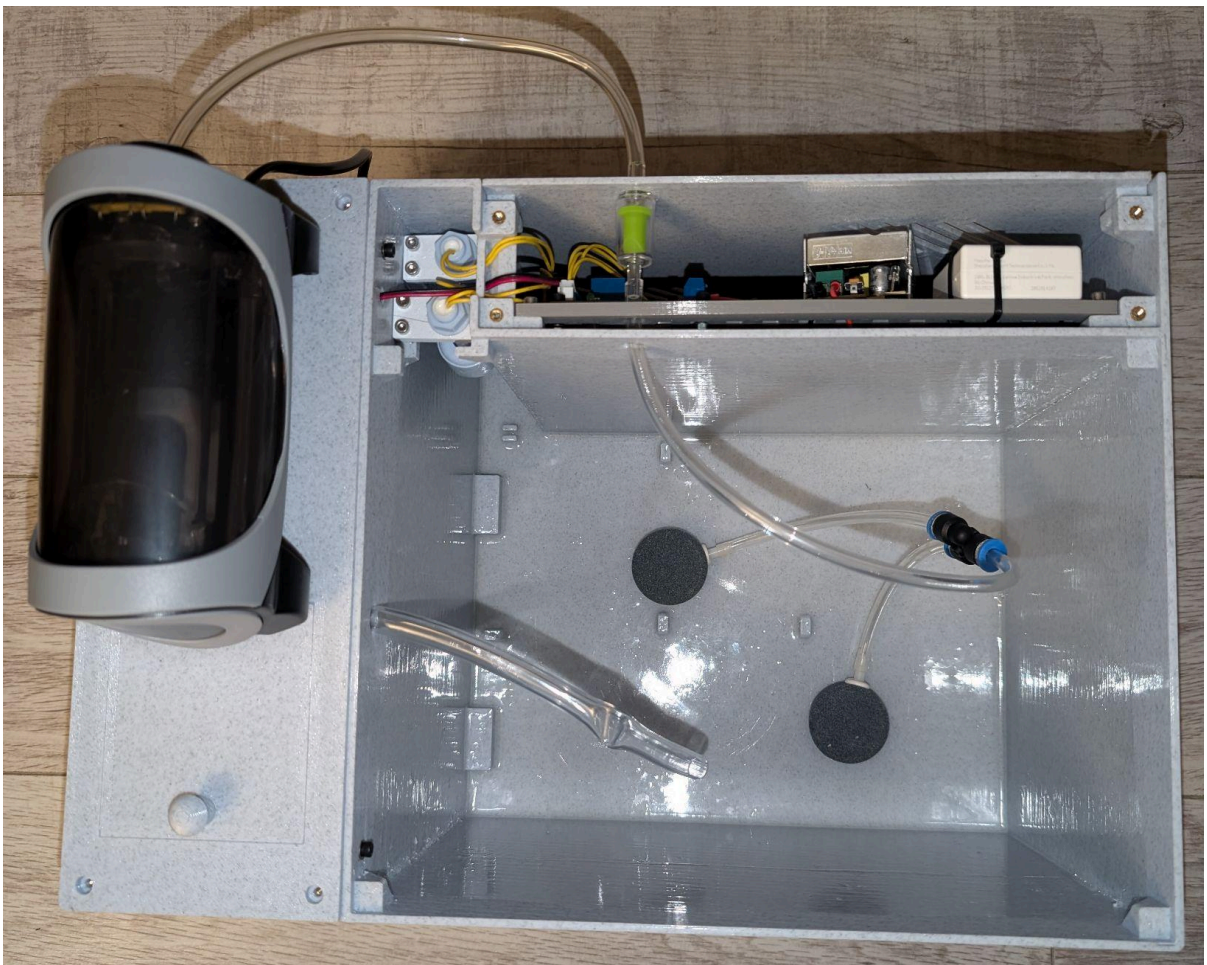
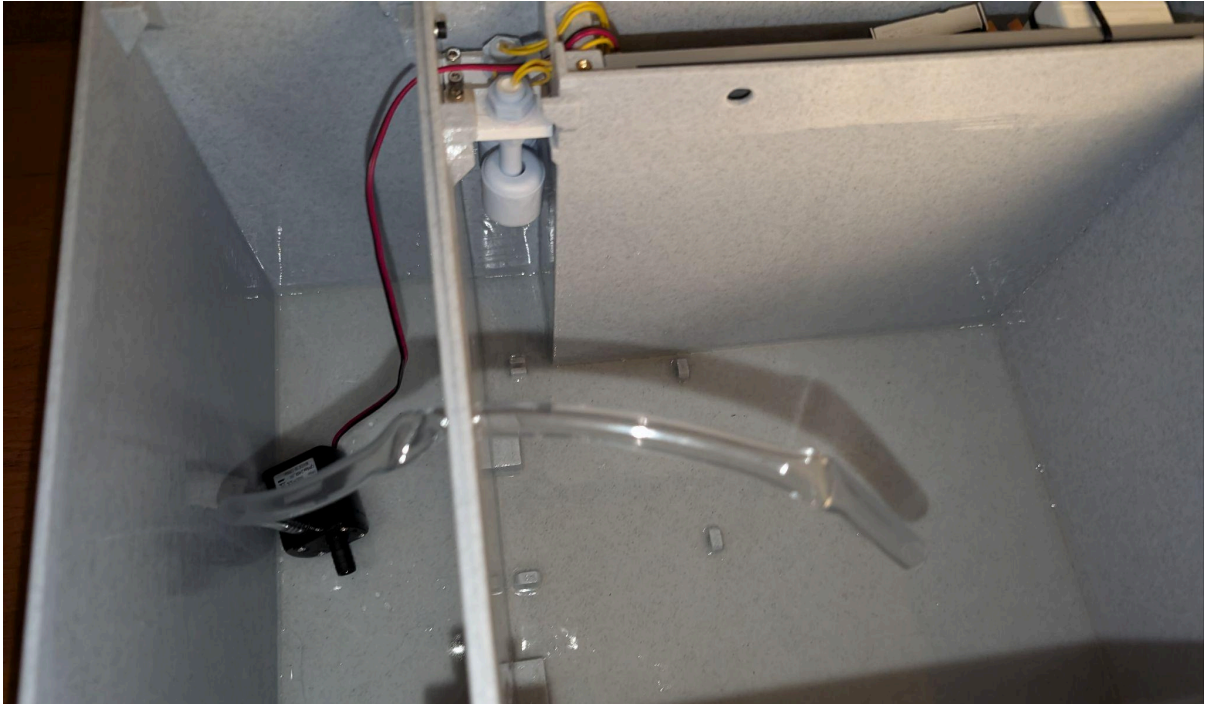




8. Install the **C14 socket**, (don't secure it with screws yet).



9. Place **oxygenation** and **water tubes**.



10. Set-up Wifi Timer and check the water level controller.

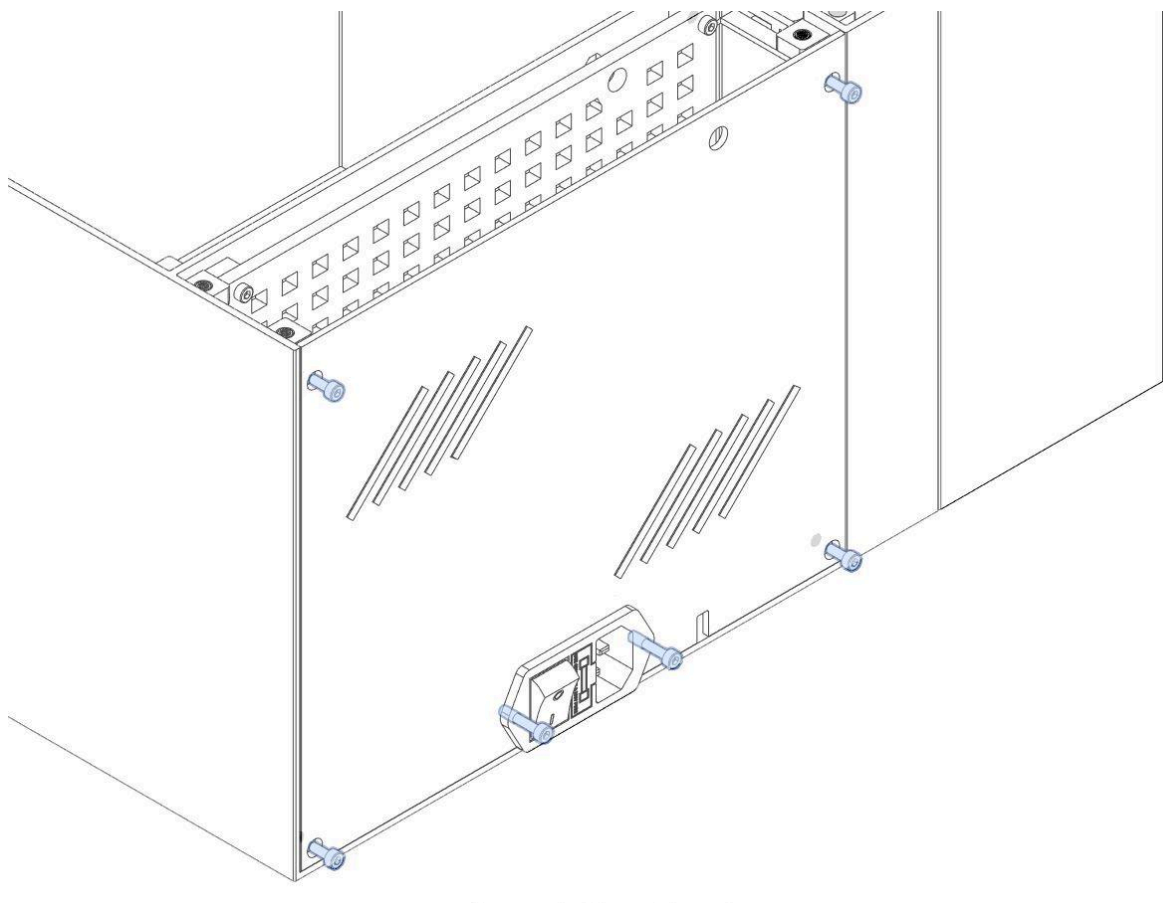
Setting the WiFi Timer for Your Grow Lamp

Since the timer is a generic Chinese model, I recommend not connecting it to your home WiFi for privacy and security reasons. Instead, you can create a WiFi hotspot using your phone. Connect the timer to the hotspot, set the desired lighting schedule, and then turn off the hotspot once the settings are saved. The timer will still operate on the scheduled hours without needing a constant connection.

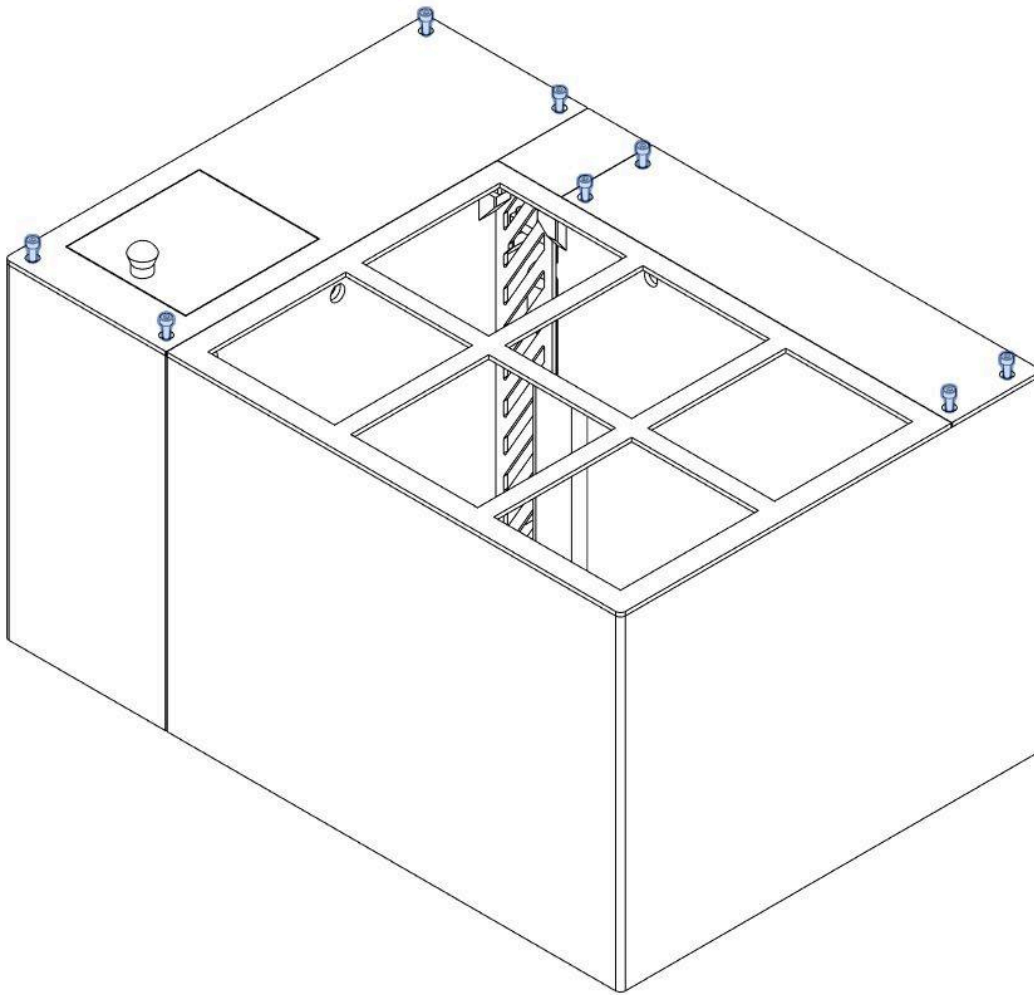
Checking the Water Level Controller

Make sure the XH-M203 water level controller is working properly by testing both sensors. The water pump should automatically turn on when the water level sensor drops to the lower position and switch off when it reaches the upper position in the upper sensor. This ensures your plants always receive the right amount of water without overflowing or running dry.

11. Close the **ElectronicsBay** with the **Wall**.



12. Attach the **PlantsBox Lid**, **WaterTower Lid** and **ElectronicsBay Lid**.



Assembly completed!

V. Plant Picks and Planting!

Now that your Hydroponic Station is set up, it's time to start planting. The process is simple, and in no time, you'll have fresh herbs growing in your system. Whether you're starting from seeds or transplanting an already-growing plant, here's how to get started:

Planting Process from Seeds

1. **Prepare the Clay Pebbles:** Wash the clay pebbles thoroughly to remove dust or debris. This ensures a clean environment for your plants.
2. **Prepare the Seeds:** Place one seed into each rockwool cube and lightly press them in.
3. **Add Nutrient Solution:** Prepare your hydroponic nutrient solution, but remember to dilute it for the seeds rather than following the package instructions. Place the rockwool cubes in a shallow container and carefully pour the solution over them until they are moist, but not overly saturated.
4. **Wait for Roots:** Let the seeds sprout and grow small roots, which usually takes a few days to 2 weeks.
5. **Transfer to Hydroponic Cups:** When the roots are established, place the rockwool cubes into the 3D-printed hydroponic cups. Surround them with clay pebbles, ensuring space for the roots to grow.
6. **Place in Hydroponic Station:** Finally, insert the cups into your Hydroponic Station. Your station will now do the work of circulating water, nutrients, and oxygen to keep your plants growing strong!

Transplanting Store-Bought or Soil-Grown Plants:

1. **Prepare the Plant:** Gently remove the plant from the soil, being careful not to damage the roots.
2. **Rinse the Roots:** Wash off any soil from the roots using lukewarm water. It's important to clean the roots thoroughly to prevent introducing contaminants into your hydroponic system.
3. **Place in Hydroponic Cup:** Place the cleaned roots into a hydroponic cup with rockwool or directly into clay pebbles, ensuring the plant sits comfortably and the roots have room to grow.
4. **Add Nutrient Solution:** Prepare the hydroponic nutrient solution.
5. **Place in Hydroponic Station:** Insert the hydroponic cup with your transplanted plant into the station. The automated system will take care of watering, oxygenating, and feeding your plant.

Stir, Shake, and Savour - Herbs for Cooking and Cocktails!

Do you know what pizza, gin basil smash, shrimp skewers, broth, paella, steaks, and mojitos have in common? My homegrown herbs! That's right—whether you're cooking up a storm or mixing your favourite cocktail, these herbs can do it all:

- **Basil:** The hero of pesto and star of gin basil smash.
- **Cilantro:** Perfect for tacos, salads, or that zesty shrimp dish.
- **Mint:** Your mojitos or larb will never be the same.
- **Thyme:** A must for roasts, and steaks.
- **Oregano:** Your secret weapon for the best homemade pizza ever.
- **Parsley:** From garnish to flavour booster, parsley has your back.
- **Love:** The secret ingredient for your grandma's broth recipe.

Your Hydroponic Station isn't picky, so feel free to plant whatever you want! 🌱

VI. Keep It Growing!

To keep your herbs happy and healthy, a little regular maintenance goes a long way. Follow these simple tips to ensure your plants continue to thrive in your HydroForge:

1. **Top Off the Water:**

Fill the water tower reservoir every 1-2 weeks and top it off with fresh, cold, nutrient-rich water. Keeping the water level stable helps the plants absorb nutrients properly.

2. **Clean the Station:**

Every few months, it's a good idea to give the station a full clean. Empty the water, clean out the reservoir, and wipe down all surfaces to prevent algae buildup.

3. **Adjust the Light:**

Keep an eye on your plants' growth. If they seem leggy or pale, they may need more light. Adjust the timer settings or move the light source closer to plants.

4. **Prune Regularly:**

Harvest your herbs often to encourage new growth. Don't be shy—regular pruning keeps them bushy and productive.

By following these simple maintenance steps, your hydroponic garden will keep producing fresh, flavorful herbs all year round!

VII. Thank You & Pricing Information

I hope you enjoy building and using your HydroForge as much as I do! To make this project accessible to as many people as possible, I'm offering it as a **"Pay What You Want"** download. You can choose to contribute whatever amount feels right to you—or simply download it for free. If you're not satisfied, you wouldn't print it anyway!

Find Me on These Platforms:

- [Thingiverse](#)
- [Cults3D](#)

Support the Project:

If you'd like to support the project, you can donate using the options below:

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I believe in the power of sharing knowledge, and if this design brings you joy or helps you cultivate something amazing, your support is greatly appreciated.

Happy growing, everyone!