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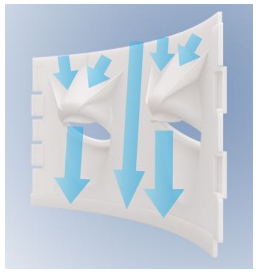

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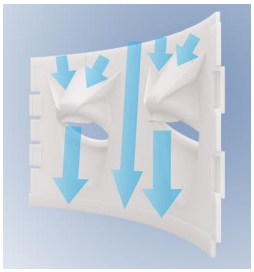


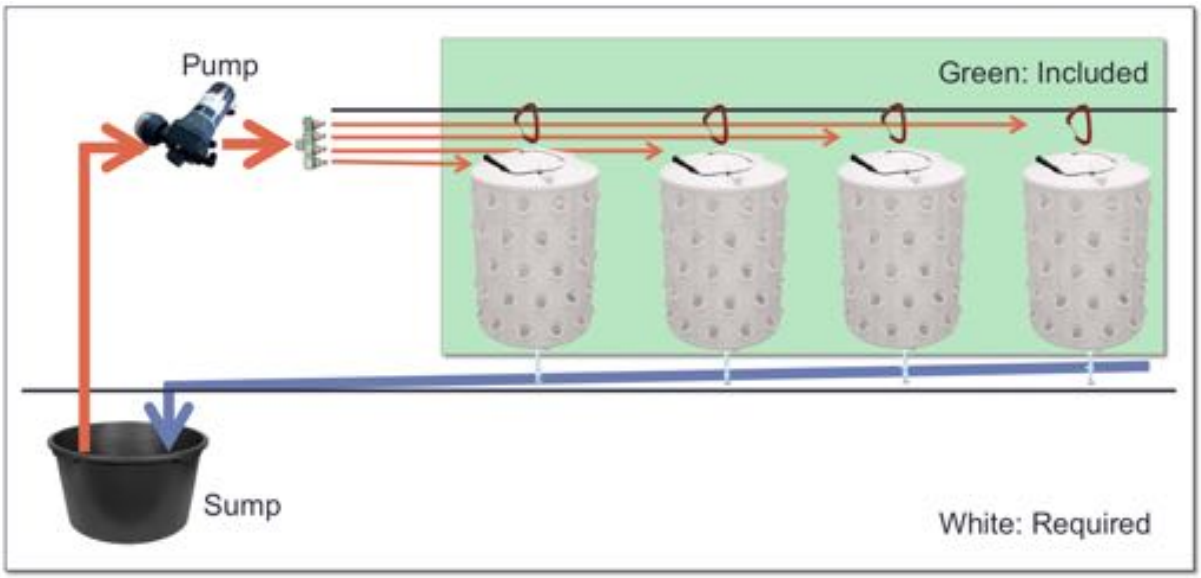
Prerequisites to running one or many vertical barrels

The vertical barrel in this manual is meant to be integrated into an existing circulation system or facility. Which means, it can not be run independently. In the following we describe the required prerequisites in to integrate one or more vertical barrels into an existing circulation system.

Required...

- ... is an existing nutrient cycle either using hydroponics (with mineral fertilizer) or aquaponics (using organic fertilizer from fish).
- ... is a suitable pressure pump (see chapter ‚Dimensioning of the right pressure pump') to power the included inverted sprinkler in your vertical barrels delivering the nutrient solution with a pressure of 3 bar.
- ... is a suitable lighting situation for your plants to thrive either using natural sunlight or artificial plant lighting.
- ... are all other surrounding conditions for optimal plant growth, depending on your crop like air and root temperature, humidity, availability of CO2, sufficient aeration, shading if necessary etc.
- ... is a solution to return the liquid to your cycle exiting at the bottom of the barrels to your sump or reservoir preferably just by using gravity.

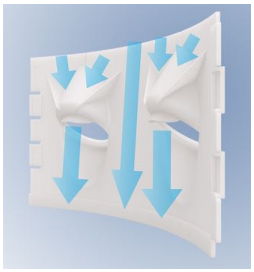
The mentioned vertical barrel can be utilized as planting equipment to set up many grow spaces quickly in your existing circulation system.

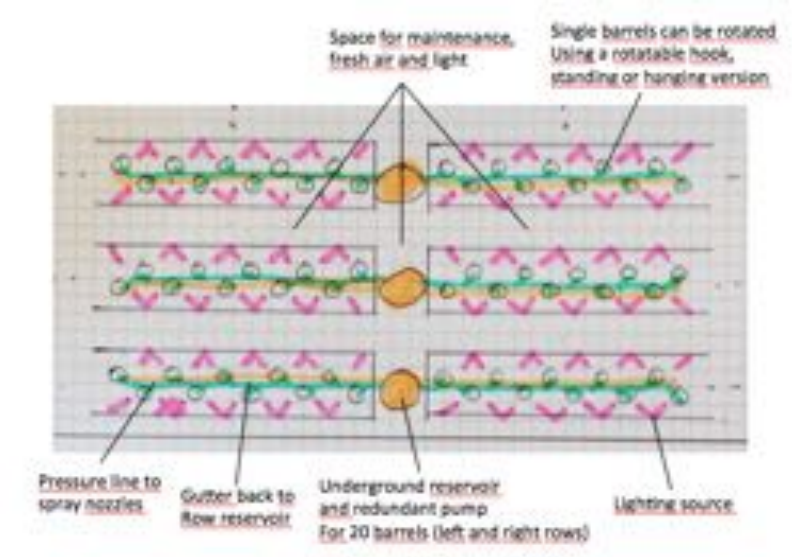


One example for a possible facility design

The net density of plants in your cultivation area that can be achieved using our vertical barrel is depending on the design of your facility. It depends on the planned height of the barrels your production setup and the actual production process. One example:

Quick MANUAL
Aponix Vertical Barrel



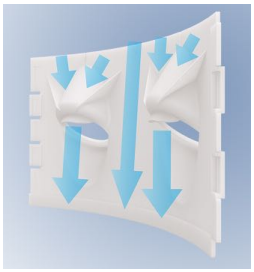


Grow spaces

One grow space is an insert for a 2” net pot (diameter 5cm or 2 Inches). As a growing medium to keep the inserted seedlings in its grow space as it grows, we recommend simple rock wool as shreds or cubes. You can insert seedlings which already have a small root and first leaves (same like in other systems like NFT). Net pots are not included and can be purchased in bulk.

The vertical barrel is suitable to grow small vegetable crops, herbs, lettuce and even strawberries. Each grow space provides a vertical space of 30cm and 15cm horizontally for fruits and leaves.

Hint: The more light can shine through the grow spaces into the inside of the barrel, the more algae can grow on the inside of your barrel. We recommend to seal the net pots with your seedlings with a simple piece of filter foam like in the following picture. The filter foam can also serve as medium at the same time:



Irrigation and pump

Depending on the selected pump and capacity of your growing medium spraying can be permanent or on interval. According to the atmospheric conditions, the chosen intervals should ensure, that the plant's medium never dries out. Example: 15min spraying, 15min pause in a closed underground situation without direct sunlight would be sufficient to avoid a permanently running pump.

Positioning of barrels in your production facility and height of the barrels

Each barrel has a diameter of 57cm and should have at least 40cm (rather 80cm) of space to the next barrel, so your plants can get enough light and ventilation. The number of grow spaces increases with the height of your barrel.

The weight of a barrel with out plants or fruit with 10 ring segments for the hanging version is 12kg and for the standing version 15kg.

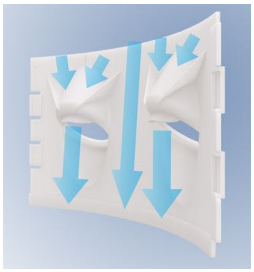
Each ring segment of a barrel has a height of 15cm and provides 12 grow spaces. Calculate with additional 15cm for each bottom and top lid and the some space for the hook. A barrel with 9 ring segments provides 108 grow spaces and needs around 1,75m of space over ground. An ideal height is using 12 ring segments with a height of 2,10m for the standing version and 10 ring segments for the hanging version. Both can be maintained by hand by a person without any climbing aid.

The liquid nutrient solution exits the barrel in the center of the bottom. Generally the water is returned just by gravity to your sump tank or reservoir. Ideal would be an underground reservoir in order to maximize the height and the number of grow spaces of the used barrels.

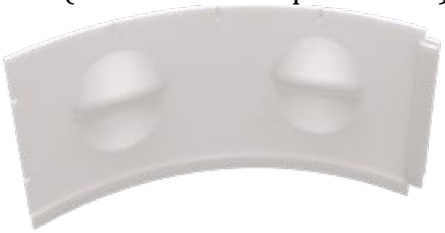
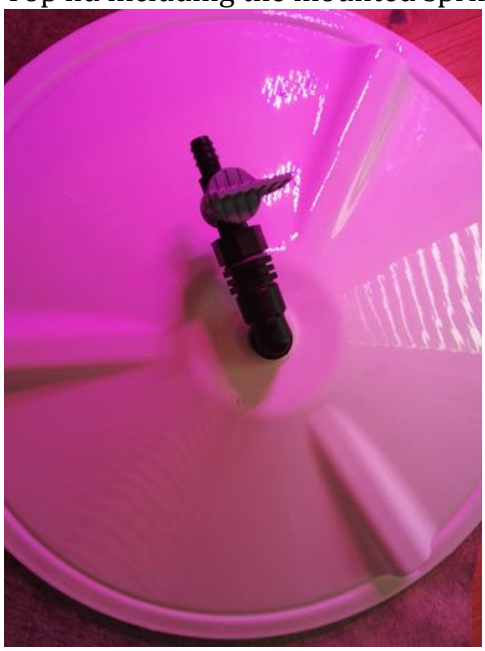
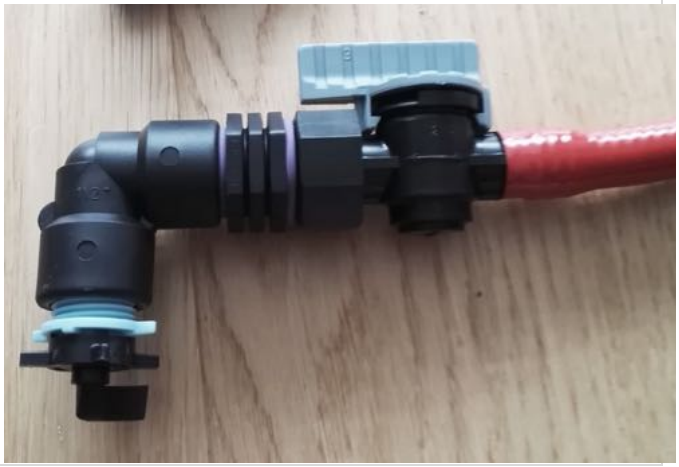
Please consider, that it could be necessary to rotate the barrels due to you individual lighting situation. Please arrange your barrels in a way, that you can reach your grow spaces conveniently for inserting new seedlings and for harvesting and cleaning the barrels regularly.

Connecting a barrel to your system

Each barrel provides one connection to its own sprinkler attached to the top lid. Each sprinkler has an individual switch to fine-tune the pressure, connect and disconnect it to and from the nutrient pressure line. This will be handy if a certain barrel in a row of barrels has no plants or are under maintenance.



Scope of delivery

1/6th part, regardless of the adapter used (here two 2” net pot inserts) 	One ring segment is assembled using 6 of the 1/6th parts 
Stand for standing version with liquid exit in the lowest spot. 	Top lid including the mounted sprinkler. 
Sprinkler and liquid exit might be delivered as separate pieces and need to be mounted:	

Assembly of a barrel

Step 1 – Assemble ring segments from 1/6th parts

Two parts can be pushed together at the zip-connection.

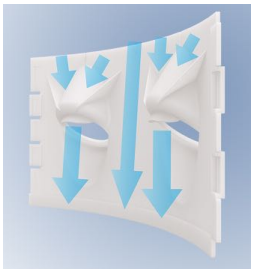
The connection clicks at the end.

Connect 6 of the 1/6th parts together.

If you have different adapters, please chose the configuration – one closed part and one part with only one grow space for example. This will define the configuration of the plant density.

Close your ring segment after the sixth part.

Repeat this step until you have assembled as many ring segments you need to assemble your next barrel.



Step 2 – Mount standing base and top lid

Tighten the threaded tank connector to the bottom. Use the rubber sealing from the inside (top). The connector will serve as exit for the liquid from the barrel during operation.

From this liquid exit on, it is up to you how you manage to drain the liquid back to your sump tank or reservoir by using a gutter or connect a hose. The scope of delivery ends at the liquid exit.

For irrigation the barrel uses an inverted sprinkler mounted to the center of the top lid. In order to operate with the sprinkler you will need the (new) lid shape, which has a circular barrier for the water.

The sprinkler can be screwed to the hole in the lid. The hose that needs to be attached has a diameter of ½ an inch.

We recommend you secure the hose with an additional clamp.

Depending on the incoming pressure for the sprinkler (it can be operated starting from 1.5bar but we recommend at least 3bar) you will need to adjust the flow through using the tap. The flow rate needs to be adjusted that no water pushes through the barrel and runs down the outside oft he barrel during operation to harm your plants. You need to adjust the pressure applied to the sprinkler that the water reaches the inside surface of the barrel where it is supposed to irrigate your plants by simply running down the

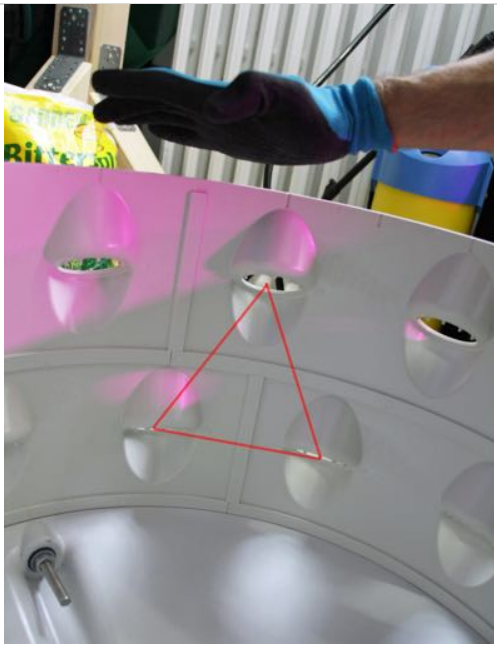
inside starting on the top-most ring segments and zig-zag down through the internal wing structure to the root zones of your plants.

Step 3 – Stack ring segments on to the standing base

Put your standing base roughly where you will operate it later.

Ideally you already have set up your gutter solution to direct the liquid for each of your barrels back to your reservoir.

This image shows where the liquid will exit and needs to be caught and transported back to your circulation/reservoir.	
The standing base provides small dimples in the outer ring. The ring segments have the analog noses to fit into them. Put the first bottom ring segment on standing base and rotate it until the noses find the dimples. This is important for the overall stability of the barrel. Please repeat the same procedure with every subsequent ring segment.	

Stack the other ring segments. Please note that the noses and dimples fit together that way the grow spaces are distributed evenly, meaning no grow space is exactly underneath or above any other grow space. This way your plants will have the maximum available space to thrive into each direction.	
Stacking rings works easiest, when you align a dimple and a nose exactly on one side of the ring segment and tap the ring on the other side to push the whole ring into place. Stack ring segments until you have reached the desired height for your system design.	

Step 4 – Add the top lid

As soon as you have correctly stacked all the your ring segments you can add the top lid. To rotate a standing barrel you can hold	

two opposite grows spaces of the lowest ring segment tightly and push gently into rotating the barrel so the dimple and nose get lose and let the barrel rotate freely inside the stand until it finds the next dimple. Rotating the barrel might be a useful feature to ensure even lighting of your plants. Please ensure that the top lid with the attached irrigation has enough space to move with the rotation.

Optional feature: Attach the nylon ribbons to secure a barrel

In the standard edition there are no predrilled holes to attach additional stainless steel ring hooks used to secure the barrels using vertical nylon ribbons.

This is just to demonstrate the feature that might be useful if you use the hanging version of the barrels (just use another top lid with the liquid exit instead of the sprinkler instead of the standing base) or you are using the standing barrels outside and expect wind.

You will need 3 nylon ribbons for each barrel and you need to have 3 sealed stainless steele ring hooks like show in the picture. Each nylon ribbon is attached by a knot to the bottom ring hook first. You can use a bowline knot – a sling that does not close even under pressure.

Attach the nylon ribbons to the top lid:

Loop the end of a nylon ribbon two times around the ring hook coming from the bottom of the barrel.

Do not make a fixed knot to the top ring hook! As the weight of the barrel pulls down and plants and water are added, the nylon ribbons will expand a little and need to be tightened a little more from the top ring hooks later.

The hanging barrel is best set up using a swivel hook.

Maintenance and cleaning

In order to clean your vertical barrel please remove all plants and detach it completely from your circulation system closing the valve on your sprinkler.

It is possible to a) clean the barrel still standing with a high pressure torch just opening the top lid. In this case make sure, the waste water from the cleaning procedure does not contaminate your circulation.

Normally you would rather go for a more thorough procedure detach your barrel completely and clean it in a maintenance area separate from your production using high pressure water. Depending on how much algae and roots you have in your barrel you could leave some ring segments stacked together while cleaning. We recommend you leave the net pots in the grow spaces, they probably need to be cleaned too. Turn the ring segments, during cleaning to clean it from different angles.

Notice: You do not need to disassemble your ring segments for the cleaning procedure. You should also clean the rest of your equipment regularly, like your hoses and the spray nozzles and other tubing.

Storing unused barrel parts

If barrels are not in use for a longer time, you can always deconstruct them completely. Please clean the barrel parts after using them. Just disassemble in opposite order as described in this manual. You can also disassemble all your ring segments into single 1/6th parts to save a lot of storing space. Lids and stands can also be stacked in a very compact way. Small parts like the liquid exits and sprinklers can also be disassembled, cleaned and stored best in a small box.

Dimensioning of the right pressure pump

You need to ensure, that every sprinkler (=barrel) gets its nutrient solution delivered with 2-3bar of pressure in order to have even irrigation inside each connected barrel. Your choice for the right pump for your operation depends on the number of maximum connected barrels/sprinklers during operation, distance, diameter of your line, how many bends you have and how high your barrels are. Please consider all factors in order to ensure at least 2bar at each spray nozzle. Each barrel uses one spray nozzle (Lechler), which reduced the pressure in your line while spraying. Please calculate with a flowrate of 1-1,2 liters per minute at 2-3bar for each spray nozzle. The capacity of the chosen pump must exceed the total added flow rate in liters per minute of all your barrels. Smallest pumps could be self regulating membrane pumps like they are used in mobile homes.

Example – Using 4 to max 6 barrels the required pressure capacity should be:
6 barrels times 1,5 liters/minute equals = 9 liter/minute flow rate in total at least at 2 bar. Sufficient in this case would be a ‚SHURflo WhisperKing LS061'pump with a maximum flow rate of 10 liters/minute.

Example: Shurflo WhisperKing und Reservoir

On bigger setups more professional pumps are recommended like the ones that provide pressure lines in buildings and are capable of a permanent operation.

Please consider, that most small 12V membrane pumps are not built for permanent operation. In this case you will need to irrigate in intervals like 15min on, 15min off.

Recommendation: Please always have at least one spare pump of the same type at hand. If irrigation stops for a longer period, it will cause a lot of stress on your plants. When using rockwool as a medium you could lose your crop after ½ or 1 day of no irrigation.

Materials of the parts

All thermoplastics used can optionally be manufactured with materials specifically certified 'food-safe' if required. In general the quality of the materials used are very similar if not the same even without explicit food grade certificate.

1/6 part

As of January 2017 all 1/6th parts are made from ASA (Acrylester-Styrol-Acrylnitril).

Properties: Highest possible UV-resistant, Antistatic, dirt-repellent, long-living, inherently stable, shatter-proof, heat-resisting, having a stable color.

Lids and stands

PVC sheets vacuum molded.

Development status as of January 2017: The vertical barrel is in its first large series produces, manufactured in Germany. We did our best to select the most durable and suitable materials available. The aponix.eu vertical barrel is patented in Germany so far.