

Professional piping with PVC tubing



AquaCare GmbH & Co. KG
Am Wiesenbusch 11 - D-45966 Gladbeck - Germany
☎ +49 - 20 43 - 37 57 58-0 • 📠 +49 - 20 43 - 37 57 58-90
www.aquacare.de • e-mail: info@aquacare.de
www.aquacare-shop.de



Advantages and disadvantage of rigid PVC piping

For long-lasting piping a rigid PVC system is better than lose hose scheme. Hoses have following disadvantages:

- Hoses may slip off if they are not fixed with extra equipment like hose clamps.
- Normally soft PVC hoses are used. But they emit softeners (phthalates are similar to hormones) and after some time the hose becomes hard.
- Often too high flows are forced through too narrow hoses – energy is lost.



Temporary hose connections induce a chaotic picture. The danger of losing track of things under the aquarium is high.

Loose hose systems are good if you rebuild your system all the time. Rigid PVC piping is only transformable with

a saw. Additionally you need a little bit craftsmanship to build a PVC piping.

⚠ Please notice the handling instruction of PVC cleaner and PVC glue.



A clear view of all components provides a safe transportation of water and air through the aquarium.

Dimensioning of PVC piping

As a matter of principle too small diameters causes a pressure loss that reduces the flow and wastes energy. Especially pipes that operated 24 hours per day and 365 days per year should not induce energy wasting to ensure

low running costs of the aquarium system. Normally you will not ear money with a coral reef tank – it is hobby.

Oversized pipe diameters has disadvantages, too. The invest is higher and you need more space. The larger the diameter the more sediments will settle inside of the tubing system and accumulating air may block a regular flow. The water quality gets worse and the function is not protected.

Outer diameter in mm*	10	12	16	20	25	32	40	50	63	75	90	110	125
Maximum flow in m ³ /h SS	0.18	0.28	0.5	0.8	1.4	2.3	3.7	6.1	10	14	21	32	41
Maximum flow in m ³ /h PS	0.27	0.42	0.8	1.2	2.0	3.4	5.5	9.1	15	21	32	47	61

Overview about the maximum flows of circulation pumps for their suktion side (SS) and pressure side (PS). Übersicht über die maximalen Volumenströme bei Kreiselpumpen für Saug- (SS) und Druckseite (DS). Conversion from m³/h to l/h: m³/h * 1000 = m³/h. For aquarium backflow pipes please look at SS.

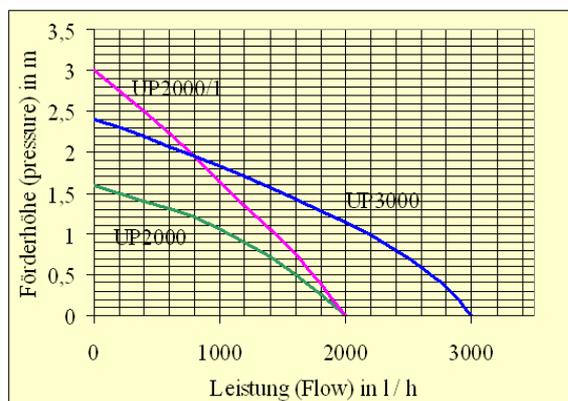
* is for thin-walled pipes (please look at www.aquacare-shop.de); for thick-walled tubes the maximum flow is a little bit lower.



Example: you want to dimension the pipes for a circulation pump for your 500 litre aquarium to create the flow between filter tanks and aquarium. As a rough guideline take a flow of 5 times the aquarium volume per hour = 2500 l/h for this example. Look for the proximate value in the table: for the suktion side diameter 40 mm is best and for the pressure side d32.

The choosen pump should reach 2.5 m³/h (2500 l/h) at a delivery head of e.g. 1.5 m: difference between water level filter tank and water level aquarium.

Look into the characteristic diagramm of the propably right pump, e.g. aquabee UP3000.

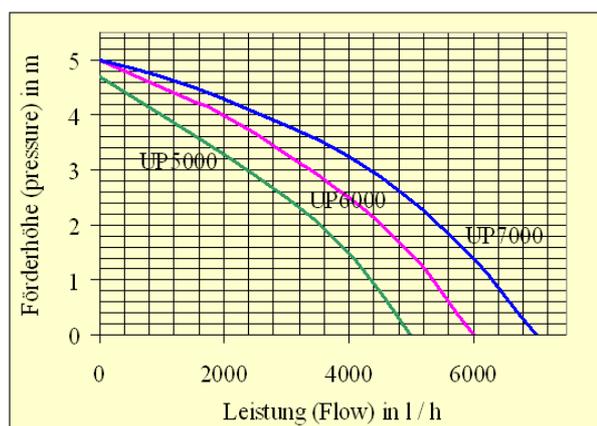


Choose at the Y-axis the effective delivery head and go horizontally to the curve of the

For circulation pumps – the main type for water flow in pipes in aquaristics – the maximum water velocity should be at about 1.0 metre per hour at the suction side of the pump. The pressure side is perfect with 1.5 m/s. Ideal air flows are about 10 m/s. The below table shows the piping size with its optimum water flows:

UP 3000. At the intersection go vertically downwards to the X-axis. The intersection at the X-axis shows the effective water flow of the pump at the delivery head of your aquarium: only 1500 l/h – the pump is a little bit too low.

Choose a stronger pump, e.g. aquabee UP 5000 and proceed in the same way.



For this example the pump would achieve 4000 l/h - more than enough. As an alternative the aquabee UP5000e is a choice. With the electronic adjustment you can throttle the flow down to 2500 l/h. In this examplet the energy consumption for 2500 l/h will be about 15 W compared to 75 W of the UP 5000. The higher invest is amortised after 1.4 years at energy costs of 0.23 €/kWh. Another

big advantage of the UP5000e is the lower noise emissions.

Be not confused about the connectors of the pump. The size has nearly nothing to do with the required piping size. In case of the UP5000(e) you have to enlarge the diameter at the sucking side to diameter 40 and at the pressure side to diameter 32 mm.

Design of a PVC piping

Before you start cutting the first pipes and glueing the fittings, draw a plan with all needed tubes with their right diameter. Following points you should care to prevent mistakes:

- All tubes should be as short as possible.
- Arrange transparent pipe section in that way that you can clean them without deinstalling the whole system.
- Pipes driven only by gravitation (for example the backflow pipe aquarium to the filter tank) never show water pockets. The tubes should go downwards all the time: no uphill tubes; no communicating tubes!
- To minimize pipe resistances use for main tubes only bends instead of elbows (alternative $2 \times 45^\circ$ elbow is better than $1 \times 90^\circ$ elbow), 45° T-pieces or Y-pieces instead of 90° T-pieces. The backflow pipe from aquarium to filter tank should be equipped with elbows (cheaper, less space).
- Important units like skimmers and filters should be integrated with unions or better with ball valves. Only so a disconnection is easy and the maintenance is done right. Design the system in that way that you can reach all units that must be maintained. Otherwise you will not do the maintenance.
- Vibrating unit like pumps should be decoupled acoustically.
- If you use pumps with the same performance they should have the same coupling to realize a fast and easy exchange.

- Closed loop systems should be equipped with large intake strainers that are removable without problems.
- Calculate closed loops with a pressure loss of about 0.3 m.
- Make your plans for the future. Auxiliary connections for additional filters are useful.

PVC Fittings

You will find at <http://www.aquacare-shop.de> following fittings:

Change of direction:

90°-elbow: best for backflow pipes or at very low water velocities or at shortage of space	
45°-elbow: good for 45° changes	
90°-bends made of tubes: best for main pipes	
90°-bends, injection moulded: good for main tubes	
S-bends: perfect for offsets	
30° and 45°-bends on request	

Abzweigungen:

T-piece: suitable if the main stream goes straight ahead	
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45°-T-piece: good if the main stream is divided into two equal streams	
Y-piece: best if the main stream is divided into two equal streams	
Y-Bogen: best if the main stream is divided into two equal streams	
Reduced T-piece: best if a sideline should be done	
Cross piece	

Coupling pieces:

Sleeve socket: for an inseperable connection	
Union: for a seperable connection	
Flange with flange bushing: for larger diameters	
Ball valve: for locking and seperating a connection; not very good for adjusting a flow	

3/2-(L-type) and 3/3-(T-type)way ball valves:	
Flex couplings: perfect transition of different pipe materials	
Flex couplings: vibration damping coupling between pipes	

Reducing:

Short reducer:	
Long reducer:	
Threated reducer:	
Threated double nipple:	
Screw socket:	

Transitions:

Transition sleeve: transition from tube to female thread	
Transition sleeve: Transition from tube to male thread	
Short reducer with female thread:	
T-piece with female thread:	
T-piece with male thread:	
Hose nozzle with socket: connection to hoses	
Hose nozzle with thread: connection to hoses	
Transition to Victaulic coupler:	

Transitions to push-fit fittings: simple and pressure resistant connections to hoses	
Transition to Eheim system:	

Closures:

Cap for glueing: permanent closure for tubes	
Cap with thread: for closing a male thread	
Screw plug: for closing a female thread	
Blind flange: for closing a flange connection	
Victaulic plug:	

Miscellaneous:

Tank adaptor: if tubes should go through an aquarium glass (back-flow from aquaria)	
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Tank adapter with flat runout: for completely emptying an aquarium	
Tank adaptor with squeeze adaptor: you can disassemble the tube	
Slot pipe with cap: usable as an intake screen	
Threaded pipe:	
Octagonal nut:	

Important armatures

Um den Wasserstrom einstellen zu können gibt es unterschiedliche Armaturen.

Check valve (spring loaded): avoids backflowing water	
Check valve, wafer type: avoids backflowing water	
Slanted seat valve: for exact adjusting a flow	

Membrane valves: for exact adjusting the water flow	
Dosing ball valve: for exact adjusting of small water flows	
Adaptor for measuring chains: suitable connector for 12 mm probes (pH, ORP)	

Handling of PVC pipes

1. Check if the PVC tube easily fits to the fitting. If the connection is too tight grind the fitting and/or the tube with sand paper to ensure mobility.
2. Work only in a good ventilated room.
 - ⚠ Cleaner and glue are inflammable and are more heavy than air.
 - ⚠ Do not smoke - do not weld - prevent spark formation and electrostatic charge - no open light and fire.
 - ⚠ Do not inhale - keep used cleaning paper in closed boxes - wear protective gloves - keep away from children.
3. Cut the tubes rectangular and bevel and trim the ends.
4. Clean the surfaces of fitting and tube with PVC cleaner. Therefore put a little bit of the cleaner onto a paper towel and wipe the places for glueing carefully. Fat and dust has to be removed totally.
5. Coat the glue on both glueing places - first in the fitting, secondly onto the tube. For tubes larger than 40 mm (1.25") choose a larger container with application brush. The following bonding should be done without delay. Diameters larger than 90 mm (3") should be executed with two persons to reduce the open time of the glue.

6. Push the tube totally into the fitting without torsion or twist. A correction is - if even possible - only feasible for a very short time depending on the tolerance of fitting and tube.
7. Wipe away surplus glue with a paper towel.
8. After about 2 hours at room temperature you may startup the operation (pressureless). After 24 hours at room temperature the full maximum pressure is achievable. Lower temperatures extend the curing time.
9. Flush the pipework before using.