

Water change - Level

A guid for water change and level control



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Why water change?

In the system aquarium there is less water for the fish compared with the natural biotopes. Therefore you must take the necessary precautions to keep the water quality optimal for fish and other organisms. Filtersystems, heater (or chillers), currents, CO₂ nutrition (fresh water), nitrate and phosphate filters and the sea water techniques calcium reactor and skimmers are important instruments to keep the water clean. But some substances are not or only inadequate removable with these techniques – even activated carbon is not able to remove all substances. We know very less about these persistent substances, only that they will affect or destroy a aquatic system in the long term.

All non-degradable (persitent) or heavily biodegradable substances and some salts enrich over the months and you have to remove them regularly. With ozone or catalytic induced UV treatment is it possible to crack persistent substances. The end products are degraded by common bio filters. But without this treatment these unwanted substances will accumulate.

Especially the sea water hobbyists are discussing the theme “ion-shifting”. This effect may occur in systems with any water change (see: carbon circle). But we have not found scientific research results about this theme.

To supply adequate amouts of trace elements a water change with a good sea salt is important. For fresh water it is not applicable, because tap water contains too less trace elements – you have to dose them additionally.

There are some trace element solutions on the market (see AquaCare Trace elements) that feed important

substances into the aquarium, but each aquarium needs it own dosing and combination of these essential micro-elements. A regularly water change compensates the differences.

Consequently the water change is important for supply and for disposal, too, and contributes to the stability of an aquatic system.

How much water change?

This is a question with many answers. The opinions vary from no water change to a daily water change. In general there are some rules:

- The higher the aquarium is polluted the more water change is necessary.
- In fresh water system you need more water change than in sea water systems.
- The more periodically the change the more consistent the water quality.

The recommendation of AquaCare is:

Fresh water community	20...30% every 1...2 weeks
Fresh water cichlids	5...10% every 1...4 weeks
Fresh water breeding tank	nearly 100% may stimulate spawning
Fresh water subadult tank	30...50% every 1...7 days
Sea water tanks	1...10% per month, at high organic loads more than 25% per months

How to make a water change - how to refill evaporated water?

Water change has to be done very carefully (except you want to stimulate spawning for some fresh water fishes). The water for change must have the same temperature and the chemical parameter should be nearly equal: e.g. hardness, humic substances, salinity.

Pollutants like chlorine, pesticides, and too high hardness should not be within the water.

For sea water tanks the fresh sea water has to moved (pump) for some days to make sure that the chemical balance is reached and the concentration of radicals (chlorine and oxygen) is low.

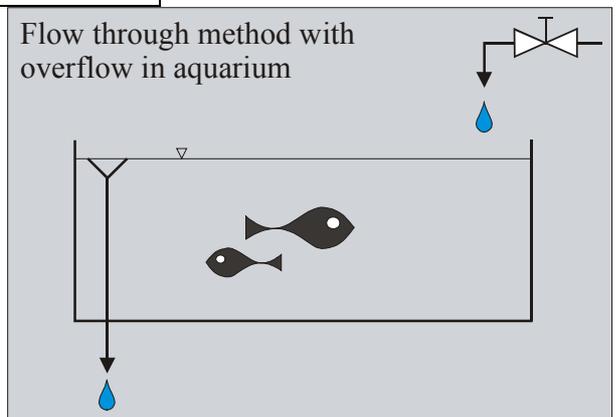
The most simplest method to change water is the manual drain of the old water and after it the fill up with fresh water. During the whole action it is important that any heater will overheat and pumps will not run dry – this is very imporatant with all automatic solutions, too!

Depending on the water level evaporated water has to be filled regularly. In any case you must use use water with a very low salt content to prevent accumulation of salts. You may use reverse osmosis water (R.O.) or de-ionized water (DI).

The following passages deals with some methodes for automatically filling water and methodes for water change.

The flow-through method

For fresh water tanks (or large quantities of sea water are available, e.g. near the sea side) the flow-through method is easy to handle. Certainly the aquarium must have an overflow to prevent flooding the living room.



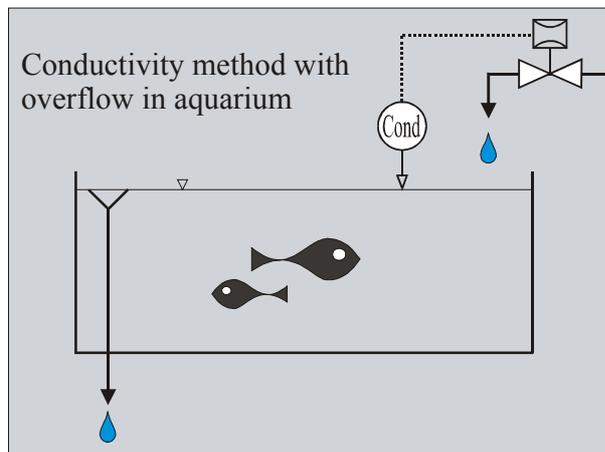
The inlet water flow is adjusted in that way, that the wished water quality (e.g. nitrate or phosphate) is reached.

If you use tap water it is possible to reduce the inlet water flow with a simple adjusting valve.

If you take reverse osmosis water you cannot reduce the water flow. The R.O. unit must have the right dimension. If it is too large the only way is to use a timer with a solenoid valve. It is important to run the R.O. unit once a day (preferably at day time if the organic load is high) with the recommended flow. Do not switch the unit more than two time per day.

If you need water that contains a little bit hardness you may use a mineral filter. To supply your system with trace elements or other nutrients you can use a dosing pump.

The conductivity method

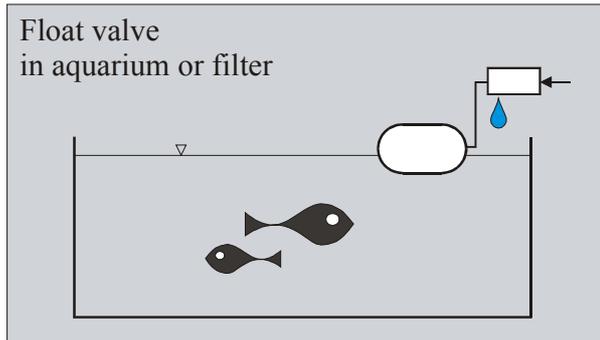


As well for the fresh water domain is the conductivity method. All animals cause pollution that is involved with the raise of the electrical conductivity of the water. If you measure the conductivity of the tank water you will see that it raises from day to day. Using a conductivity meter with solenoid valve it is possible to run the system automatically. If the upper conductivity limit is reached, the controller activates the solenoid the fresh water dilutes the aquarium water. Of course the aquarium needs a water overflow.

It is important that the conductivity sensor is cleaned and calibrated regularly. The fresh water may be sourced directly from the tap water net or from a storing tank. Equally you can use a reverse osmosis unit and possibly a mineral filter. But it is important that the switch frequency of the R.O. unit is not too high – maximum two time per day. Program the controller with the proper hysteresis.

The float valve

A simple and cheap method to fill up evaporated water is a mechanically



working float valve. You have to mount it in the filter tank (in the aquarium is possible, too). If the float sinks its valve is opening and water flows into the filter tank.

In sea water tanks the float valve has to be deactivated if the water change take a longer time. Otherwise the salinity of the aquarium water decreases.

The valve is only working if you take clean water – free of particles larger than 0.5 mm. Otherwise the valve opening may block.

If you fill up reverse osmosis water the float valves are working very good –

even in sea water aquaria. The float never should be hindered in its mobility (e.g. caused by plants, salt or chalk crusts, fibres). The valves need a very small pressure (some cm water pressure are enough), but will work at some bar pressure, too.

Generally (e.g. AquaCare float valves) the storing tank must be only some cm higher than the valve. Never connect a reverse osmosis unit directly to a float valve. You need a pressure tank or a pressure-less storing tank that is filled by the R.O. unit. But it is possible to use a float valve as a safety system. If the storing tank is completely filled the permeate water flow of the R.O. unit will stop (the membrane pressure of the R.O. unit may never exceed the maximum pressure of the float valve). But the R.O. unit is still producing concentrate!

The better way to fill up a pressure-less storing tank is a reverse osmosis control (see below).

The float valve is best suited to fill several aquaria from one storing tank.

The electrical level control

Level controls are available in two versions. The first (simple level control) is using only one level switch (sensor). If the float of the level switch is below the maximum level the

connected pump will start or a solenoid will open until the level is reached again. It is important that the control reacts with a short time delay to prevent juddering (frequently switching on and off) of the pump or solenoid. A level control is suitable best for the operation of a calcium hydroxid mixer (chalk water reactor). It is not possible to operate a reverse osmosis with this type of control (except at very large tanks).

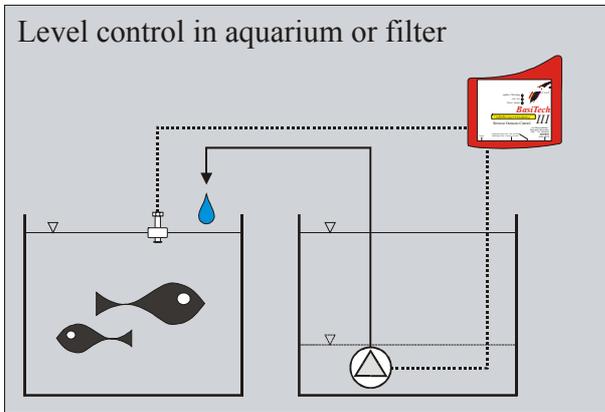
The second version of level controls (R.O. control) has two level switches. If the water level is below the minimum sensor the R.O. starts and produces water. The water level increases and if it is above the maximum level the R.O. system stops. With this control the water is oscillating between minimum and maximum level. The advantage of this system is, that the R.O. unit will produce water for a longer time to get better water quality. The R.O. unit should run for minimum 1 hour before it stops again. Choose the distance between the minimum and maximum level in that manner.

Level control in both versions are available at AquaCare.

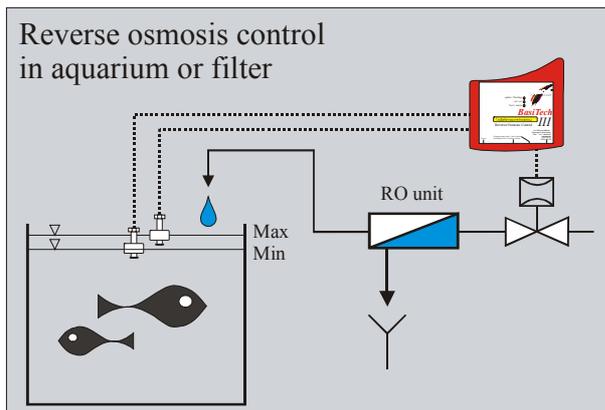
It is important to use in ultra pure water ($<10 \mu\text{S}/\text{cm}$) and sea water mechanical level switches or ultrasonic switches. Conductivity sensors fail at too low electrical conductivities. In sea water systems it is possible that salt crusts avoid a proper function.

In fresh water or R.O. water the conductivity systems will work without problems.

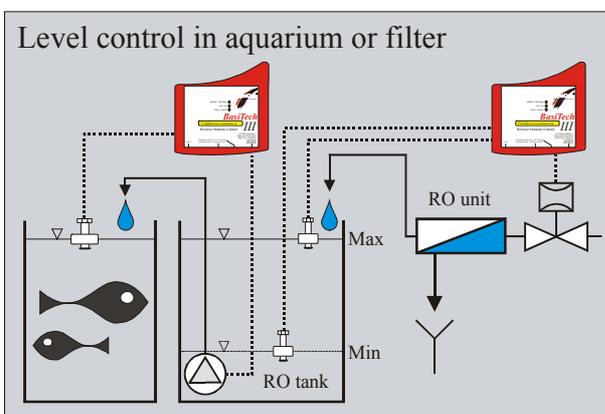
Please clean mechanical and conductivity sensors regularly to prevent failures.



Level control that fills up water from a storing tank into an aquarium or filter tank. The storing tank is filled manually with e.g. reverse osmosis water.



Only at very large aquaria it is possible to fill up the aquarium directly by an R.O. unit. Choose the distance between minimum and maximum level it that way, that the R.O. unit will run for minimum 1 hour before it stops.



At small aquaria you need a pressure-less storing tank between R.O. unit and aquarium – otherwise the R.O. unit has a too less operation time and produces too bad water or the salinity oscillation in the aquarium are too high.

Safety systems for level controls

Each technique may fail. In particular if water should flow automatically it is important to implement an ac-

tion. Water discharge at the wrong place may cause large and expensive damages. If one of the following points applies you should install a safety system:

- Costly floor covers like parquet, valuable carpets,

ship boards or marble of other stones.

- Expensive furniture that suffer damages by water contact.
- The aquarium stands not in the basement and leaking water is able to destroy rooms below the aquarium room.

To prevent or detect general leakage you may install one of the below methods. Some of them are very costly if installed supplementary:

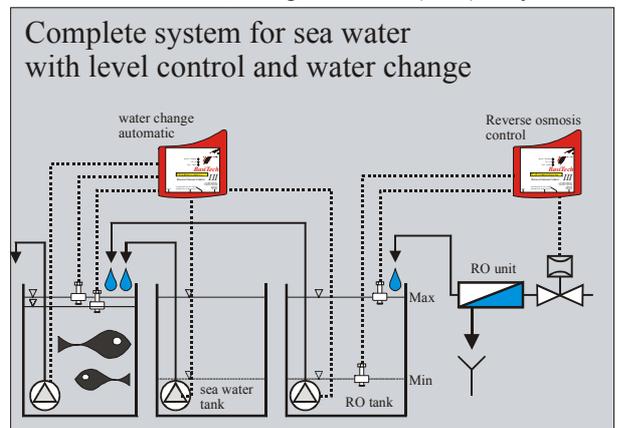
- Emergency overflows at aquarium and filter tank connected with the sewage system.
- The complete aquarium system stands in a collection tray (plastic or concrete) equipped with an overflow that is connected with the sewage system.
- Installation of moisture sensor that gives alarm at water contact.

There are system, that send SMS or email in case of an alarm.

It is possible to protect level controls and water change automatics against malfunction with one or more of the below methods:

- A second level control is installed in series. The level switch of the safety control should be installed higher than the normal level switch. If R.O. water of tap water is filled directly into the aquarium system a second solenoid (connected in series) is useful.
- A second level switch is installed additionally. Depending on the used model of level control it has to be connected parallell (e.g. AquaCare) or in series.
- Adjust the water flow of the refill water at a very low flow. The operation time of the refill pump or solenoid will be longer, but it takes a longer time to flood the floor at a malfunction. – A connected calcium hydroxid mixer is working better at low flows, too.

It is very important: mechanical and conductivity sensor should be cleaned regularly. Plant parts, bacteria, inorganic crust (lime) may block



the mechanical parts or produce transfer resistances. Otherwise a malfunction is only a matter of time.

A system with an automatic water change and refill system. The water change automatic pumps periodically water out of the aquarium system and fills up with fresh sea water. If water is lost by evaporation it fills R.O. water to the aquarium system. The R.O. tank is automatically filled by the R.O. control.