

- A modern recirculation system based on well known technology

Reliable
Energy efficient
Turn-key system
Compact and integrated
Hygienic and simple cleaning



KUBE® start is a complete recirculation system based on a "moving bed" bioreactor tested and quality assured before delivery. (MBBR) as biofilter step together with other well-known methods of water treatment such as UV, ozonation, particle removal and oxygenation.

Together with KUBEhatch and CompHatch this constitutes an energy efficient and biosafetysystem from hatching to start feeding.

Recirculation technology

"Moving bed" bioreactor (MBBR)

MBBR is a common denominator for a type of biofilters that employ small moving plastic parts that are kept in constant movement in the water in that air is blown into the bottom of the bio filter tank. On the surface of this material, bacteria will grow and form a bacteria coating - a biofilm. The bacteria in the biofilm use ammonium and organic compounds dissolved in the water as feed for growth, and this may be exploited to clean the water in the fish farming facility.

A characteristic related to MBBR is that there is always good contact between the water to be cleaned and the biofilm that grows on the moving plastic elements. This is important for the bacteria to be able to exploit the dissolved compounds in the water efficiently and thus maintain stable and clean fish farming water.

Efficient airing steps before the recirculation pump

The aerator in the system is fitted in line after the biofilter and is designed to safeguard that there is equilibrium of gases in the water before it is returned to the fish tanks. The main function of the aerator is to remove CO₂. This is efficiently performed in that water and air come into contact with each other in an airing medium. Water trickles down through the airing medium while air is blown in from below and flows up in the medium. This is called counter-current airing and this is where the ratio of air and water is controlled. The volume of air that is supplied, is 5-10 times the volume of the water that passes in the same period of time. This secures very efficient airing.

It is favourable that as much air as possible is blown into the aerator in proportion to the volume of water. In order to obtain this effect, it is important that the aerator is clean and free from deposits and fouling at all times.

Partikkelfjerning

Particles in the form of excrements and remains of feed must be removed as soon as possible from a recirculation system. In KUBE® start, this is facilitated by securing good hydraulics in the fish tanks and the use of dual discharge. Excrements and feed spill are sedimented against the bottom of the tank and are discharged through a bottom strainer together with 15 % of the water in the tank. The remaining water, which is relatively particle free, passes out through a side discharge pipe. The water from the bottom strainer contains quite a lot of particles and is brought to a particle separator in which the particles are sedimented to a coat of organic sludge. The overflow water from the particle separator and the side discharge pipe is brought to a discharge pipe which directs the water to mechanical cleaning in a micro sieve with a mesh width of 40 µm.

UV treatment

UV light may be used to inactivate micro organisms and pathogenic bacteria in the water. UV light attacks the micro organisms' hereditary material (DNA and RNA) and makes them unable to reproduce.

UV lamps are available as low and medium pressure lamps. Medium pressure lamps provide a broader spectre of light than low pressure lamps and are thus more efficient in removing pathogens. By using medium pressure lamps, the micro organisms will not be able to repair the damage they sustain through UV treatment and the removal of the micro organisms will thus be permanent.

KUBE® start is equipped with a medium pressure UV system that may be employed for the whole or parts of the water flow. This unit may vary the intensity of the UV treatment depending on variations in the quality of the water and has a built-in cleaning system that makes sure the lamps are kept clean.

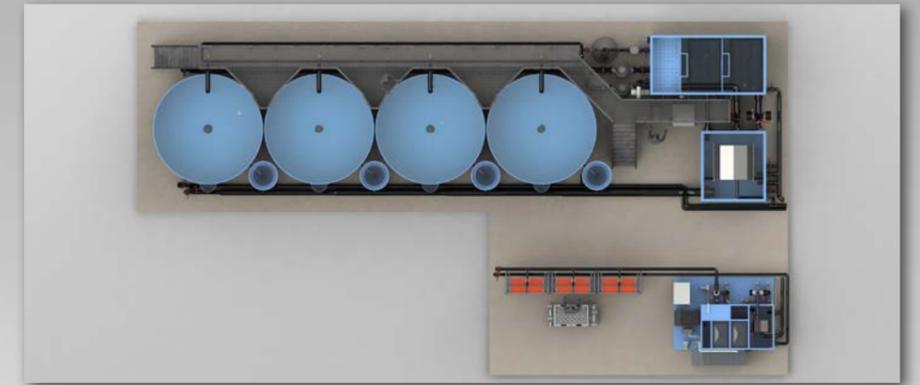
Ozone addition

In KUBE® start, you may choose to employ ozone to obtain clearer water – so-called "bleaching" of the water – and for removal of particles. In order to use ozone for disinfection, addition of greater quantities of ozone is required than if you only want to use it for "bleaching" and handling of particles. Moderate ozonation provides higher transmission, and if you use UV light, this is more efficient in that the light reaches all through the radiated volume of water.

Ozone may be added in a side flow which is also used for oxygenation (for example via oxygen cones), or it may be added before the water returns to mechanical sieving and bio filtration. The dosing of oxygen gas is regulated in proportion to the feed consumption in the fish tanks, so that the amount of oxygen used, and thereby the amount of ozone produced, is directly adjusted to the production.

Plug & Play

The KUBE® systems are made up of prefabricated modules consisting of reactor, tanks and pipelines in polypropylene, a material that has a long service life. Polypropylene is also resistant to chemicals and corrosion, as well as easy to clean and disinfect. The CompHatch® and KUBE® systems are water KUBE® start is a complete recirculation system based on a "moving bed" bioreactor tested and quality assured before delivery.



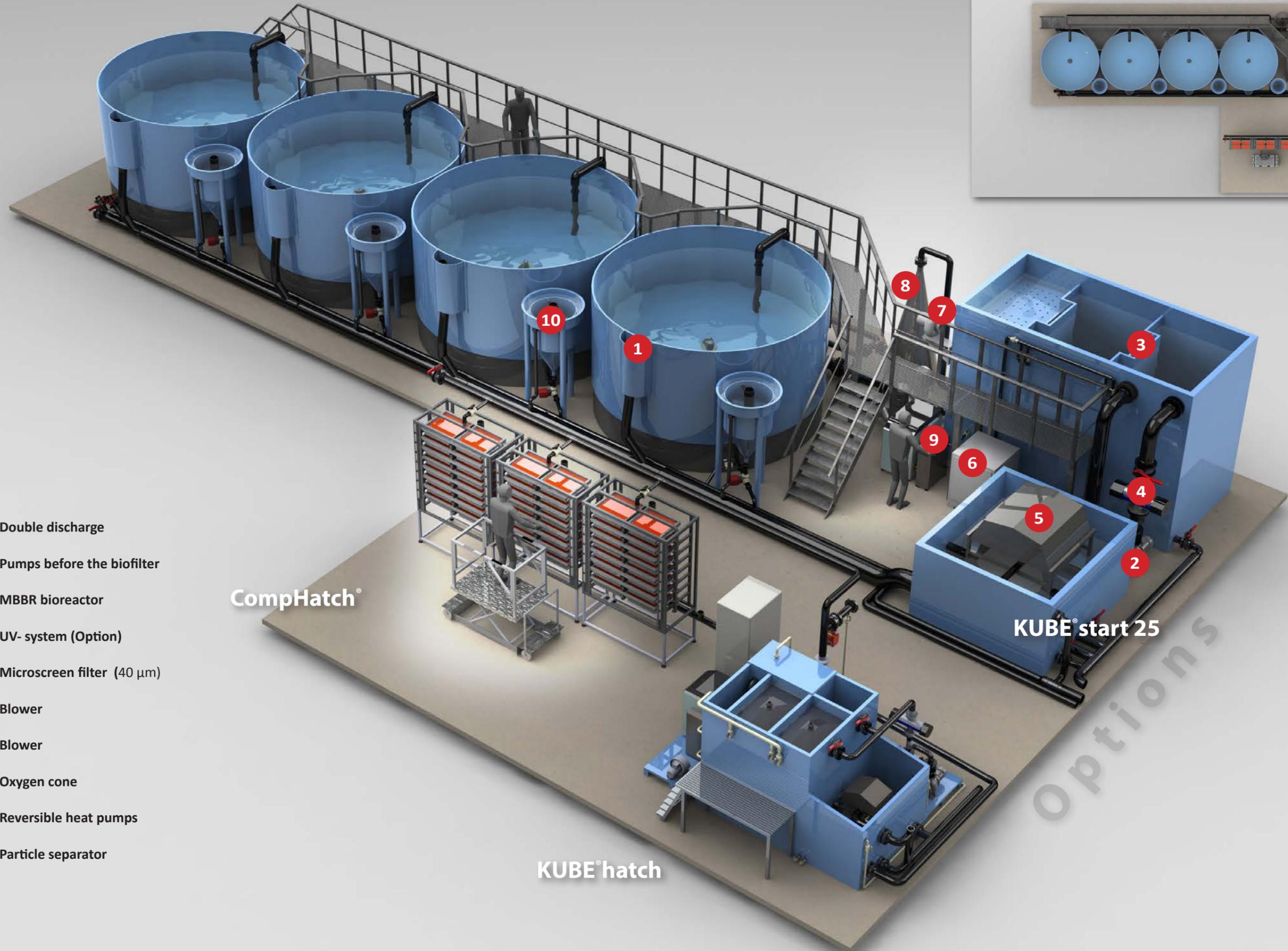
- 1. Double discharge
- 2. Pumps before the biofilter
- 3. MBBR bioreactor
- 4. UV- system (Option)
- 5. Microscreen filter (40 µm)
- 6. Blower
- 7. Blower
- 8. Oxygen cone
- 9. Reversible heat pumps
- 10. Particle separator

CompHatch®

KUBE® start 25

KUBE® hatch

Options



Advantages with KUBE® start

- «Plug and play» - **fast installation**
- Various operating capacity - **flexible**
- Integrated heat pump - **low energy use**
- MBBR - **self cleaning and secures good water quality**
- Well-known suppliers - **high quality machine components**
- Correct choice of material and design - **hygienic operation and simple cleaning**
- Dual discharge and particle trap - **efficient cleaning methods early in the system**

A stable, reliable and energy efficient system



God kontroll med partikler og avfallsmateriale på et tidlig stadium gir vekst av en sunn biofilm på biofilteret som bidrar til et stabilt miljø.



Particle separator and tank with double discharge through which 85 % of the water passes out through an auxiliary discharge and is brought to the discharge pipe. The remaining water is discharged through a centre discharge pipe in the bottom and must pass the particle separator before it is transported to the discharge pipe and cleaned in a mechanical strainer.

Cooling / heating system

KUBE®start 25 is supplied with an integrated heat pump that is fitted close to the water treatment system. The heat pumps are reversible and are able to cool/heat the water depending on the desired temperature in the fish tanks.

Control and monitoring is integrated in the PLC system. The heat pump is dimensioned for water temperatures between 1 – 21 °C, with 10 °C decrease and increase of the water temperature within 48 hours. The water's theoretical time of replacement is normally about 3 days, i.e. with a supply of 40-50 litres of fresh water per minute..

Energy saving

All electric motors in KUBE®start are frequency controlled; a fact that reduces the energy consumption by 30 - 50 %. In addition, unnecessary load and mechanical wear at start-up is avoided as the PLC provides an opportunity for soft-start of the machines. In addition, there is considerable energy saving by using the integrated heat pump which, during normal operation, only needs 4-5 kW to maintain the water temperature at a determined level.

If one assume an annual energy consumption of approximately 240 operative days and an average temperature increase of 7 °C from raw water, the energy consumption of KUBE®start 25 will be 50-55 % lower compared to a flow-through system with a heating pump.

The investment costs including installation costs will be in the same order as for KUBEstart®25 and a flow-through system fitted with a modern heat pump.

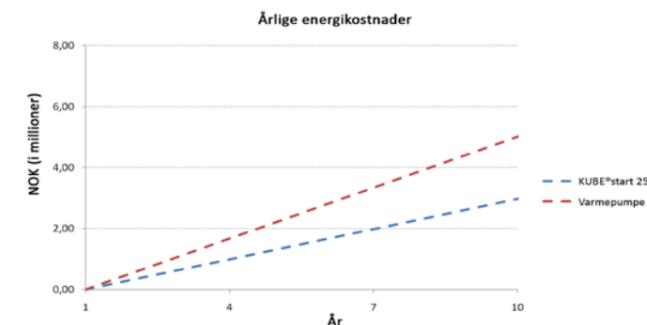


Illustration 1. Comparison of the operational costs for KUBE®start 25 and a flowthrough system with a modern heat pump in a situation where the facility has 240 operative days a year with a water consumption of 4200 litres/min and an average temperature increase of 7 °C..

The main reason of the low energy consumption in KUBE®start 25 is the low addition of new water that needs heating. Moreover, the energy used pumping water for circulation is converted into heat. Overall the energy in KUBE®start 25 is very well utilized. The low energy consumption in KUBE®start 25 will result in considerable lower operating costs compared to a facility with flow through system and heating pump (graph 1). Over a period of 5-6 years this difference will sum up to approximately 1 million NOK assuming power costs of 1.25 NOK/kWh.

Control and Security

Integrated system for optimal quality assurance

Programmable Logical Control (PLC)

To ensure that all processes and water quality parameters remain stable, a reliable monitoring and control system is needed. KUBE®hatch has an integrated system for optimal quality assurance in which all system information is transmitted to a PLC system. The PLC is connected to a touch screen in vicinity of the hatchery for daily operations. All the information is also transferred to a computer where data can be logged, and from the computer, the operator can monitor the production, control the flow, temperature and quality of the water.

The PLC controls the frequency converters and adjusts the pumping rate according to the requirements. Moreover, the PLC performs electronic logging of:

- The oxygen level, pH, and temperature before and after the hatching units.
- The flow to the bioreactor and before the hatching units.
- TGS (Total Gas Saturation) before the hatching units.
- The water level in the mechanical sieve and the buffer tank.

When the PLC detects errors in the system, an alarm goes off. The person on duty/call and/or other persons on a list will receive a call or be informed by SMS. It is then possible to operate the system from the mobile phone..

Back-up system

- In case of an electric breakdown, the PLC, the automatic sensors and alarms will receive electricity from a UPS with a battery bank so that the monitoring and control is feasible until the power supply is back.
- Each pumping operation has two sets of pumps that work in parallel at half the rate. If one of the pumps fails, the other pump will automatically be set to work at higher rate.
- A water reservoir (buffer tank) will automatically connect to the hatching units if the water flow stops. Thus the egg/fry are supplied with water for a limited time period of time while the system error is solved.