

Statement of Verification

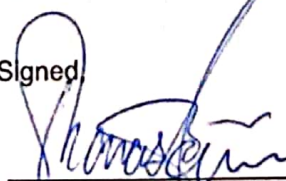


EU Environmental Technology
Verification pilot programme



Technology:	Alpha Line System (ALS)
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Verification Body		Proposer	
Name:	ETA-Danmark A/S	Name:	Alpha Aqua A/S
Contact:	Thomas Bruun	Contact:	Ramon Perez
Address:	Göteborg Plads 1 DK-2150 Nordhavn	Address:	Laessevejen 2, DK-6700 Esbjerg
Telephone:	+45 72 24 59 00	Telephone:	+45 9320 1033
E-mail:	tb@etadanmark.dk	E-mail:	rap@es.alpha-aqua.com
Web:	www.etadanmark.dk	Web:	www.alpha-aqua.com/

Signed

Verification Body


Proposer

This Statement of Verification summarises the main results from the verification of Alpha Line System for water cleaning (ALS).

The verification was performed under the EU Environmental Technology Verification (ETV) Pilot Programme. The EU ETV Pilot Programme was established to help innovative environmental technologies reach the market by providing a framework for independent evaluation of the performance of such technologies.

This verification was undertaken by the Danish verification body, ETA-Danmark A/S. ETA-Danmark is accredited by the Danish Accreditation Body, DANAK, according to EN 17020 for performing environmental technology verifications. This Statement of Verification is available on the website of the EU ETV Pilot Programme: <http://iet.jrc.ec.europa.eu/etv/verified-technologies>

1. Technology description

The Alpha Line system is a water cleaning system for removing of TSS and CO₂, addition of O₂ and finally conversion of ammonia to nitrate. Such features may be applicable in various systems including Recirculating Aquaculture Systems (RAS).

The Alpha Line facilitates water cleaning by three processes:

1. **Drum filter:** Removing suspended solids
2. **Gas balancing filter:** Reducing water CO₂ level, Increasing water O₂ level
3. **Biofilters:** Ammonia and Nitrite are oxidized to nitrate as this compound is much less toxic to fish

This verification report is focused on the gas balancing filter for CO₂ reduction.

Alpha Line is a modular system which may be added to any system. The modular concept enables the Alpha Line to be added in incremental steps.

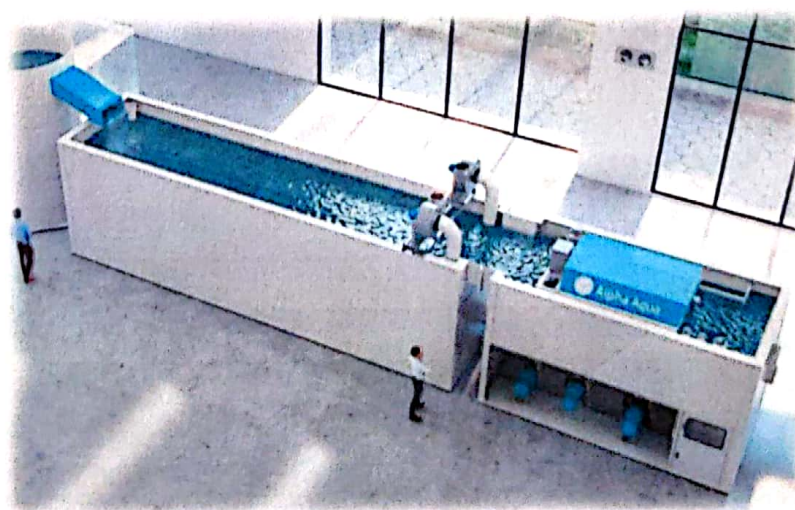


Figure 1. Alpha Line setup

The Alpha Line is based on a mechanical filter, a gas balance filter, a biofilter in specialized bio towers including an electronegative micro particle trap, a pump sump, the pump room including 3 pumps plus the options of adding a high-pressure oxygen supply, and the MCC (motor control cabinet) including a PLC controlled SCADA system to supervise and control the whole operation through a different set of sensors.

2. Application

2.1. Matrix

The matrix is process water with high content of suspended solid, CO₂ and ammonia. An example of such processes is Recirculating Aquaculture Systems (RAS).

2.2. Purpose

The purpose of the Alpha Line is to: remove total suspended solid, aerate water, strip CO₂ and oxidize ammonia to nitrate.

2.3. Conditions of operation and use

The system was tested in a full-scale setup in an artificial environment created specifically for the ETV test. The test conditions were designed with CO₂ and ammonia levels simulating conditions in RAS systems.

2.4. Verification parameters definition summary

The Verification parameters definition is shown in Table 1

Parameter	Definition
Reduction of CO ₂ level	CO ₂ level at the system outlet.
Flow Capacity	Inlet flow level during test.

Table 1 Verification parameters definition

3. Test and analysis design

3.1. Existing and new data

The Alpha Line system was setup on site for the ETV test and no additional data was included.

3.2. Laboratory or field conditions

The tests were performed at a full-scale production facility with the Alpha Line Technology in Esbjerg, Denmark

3.3. Matrix compositions

The matrix is process water with high content of suspended solid (TSS), CO₂ and ammonia which was simulated by producing artificial process water by adding fish feed at regular intervals, ammonium chloride as an extra ammonia source and CO₂ by a CO₂ dispenser.

The concentrations of CO₂, Ammonia and TSS in the artificial process water were

CO₂: 19.1 mg/l (range 18-21 mg/l)
 Ammonia: Approximately 230 mg/l
 TSS: Approximately 25 g/l

3.4. Test and analysis parameters

The test and analysis parameters include the parameters in Table 2

Parameter	Method
Flow	Measurement of increase in level in tank with known dimensions
CO ₂	Oxyguard CO ₂ Portable Analyzer calibrated instrument used onsite

Table 2 Verification parameters definition

3.5. Tests and analysis methods summary

The tests were performed at a full-scale production facility with the Alpha Line Technology in Esbjerg, Denmark with participation of test staff from DTI.

Artificial process water was produced by adding fish feed at regular intervals, ammonium chloride as an extra ammonia source and CO₂ by a CO₂ dispenser.

The used flow was measured in a separate test with 90 and 100% pump intensity.

The tests were performed 3 times (triplicate test) using 3 separate analyses on each of the 3 test days.

3.6. Parameters measured

The CO₂ was measured at inlet and outlet.

4. Verification results

4.1. Performance parameters

The verification results are shown in Table 3

Parameter	Claim	Verified Performance
Reduction of CO ₂ level (at system outlet)	Reduction of CO ₂ levels to 3-6 mg/L	The Alfa Line system can reduce CO ₂ levels from 18-21 mg/L to 5-9 mg/L. at 90% pump intensity
Flow Capacity	950-1000 m ³ /h	986,61 m ³ /hour at 90 % pump intensity.

Table 3 Performance parameters

4.2. Operational parameters

The main operational parameter is the flow which is kept constant. Further the concentration of CO₂ is kept approximately constant by continuously addition.

4.3. Environmental parameters

None

5. Additional information, including additional parameters.

Additional information is found in the verification report

6. Quality Assurance and Deviation

The verification protocol, test plan, test report and verification report were reviewed by internal and external experts according to the EU-ETV quality plan for verifications.

A test system audit was performed by ETA-Danmark during the tests in Esbjerg, Denmark at the Alpha Aqua production facility.