

VERIFICATION STATEMENT
FOR BATTERY

Statement No:
N141N1BH

Valid for products not subject to DNV GL classification requirements.

Particulars of Product

Product Name:	Recombination system
Type designation:	grid aquagen pro und grid aquagen pro max
Application/context:	
ID/Serial/Tag no:	N.A.
The product is intended for:	STOCK
Requirements are based on:	Customer Specification - Hoppecke Standard

Deviations and limitations, if any, are stated on page 2 onwards.

Particulars of Vendor and Purchaser

Vendor:	Hoppecke Batterie Systeme GmbH
Vendor reference:	n.a.
Purchaser:	
Purchaser reference:	

Issued at **Essen** on **2018-12-07**



for **DNV GL**

This document has been digitally signed and will therefore not have handwritten signatures

Hoppe, Christian
Surveyor



Verification extent and result

Verification extent:

witnessed:

- efficiency of the Recombination system
- backfire inhibition of the Recombination system
- overload safety of the Recombination system

Verification result/comments:

see at Report

Report

1. Efficiency of the Recombination System

Three Recombination Systems grid | aquagen pro and grid | aquagen pro max were tested in the laboratory of Hoppecke Batterien GmbH & Co. KG.

Each Recombination system was mounted onto an Electrolysis Cell (with Fibre Nickel Cadmium Electrode – FNC and caustic potash solution); all Electrolysis Cell of the same gasing current were electrically connected in series (see at attachment pictures testing arrangement).

With this testing arrangement the efficiency of the Recombination System was determined as a function of the following gasing currents:

50mA, 100mA, 200mA, 500mA, 1000mA, 3000mA, 5000mA, 10000mA.

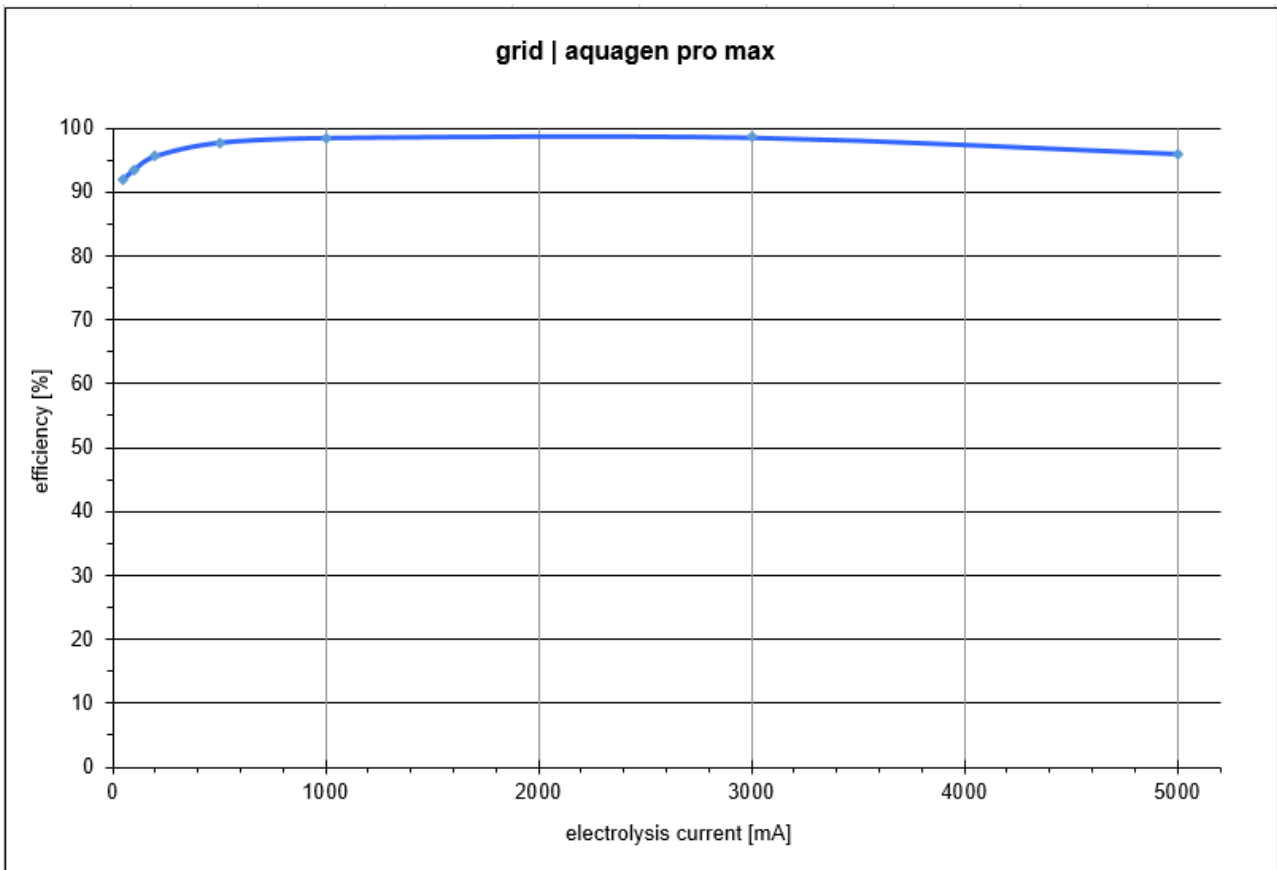
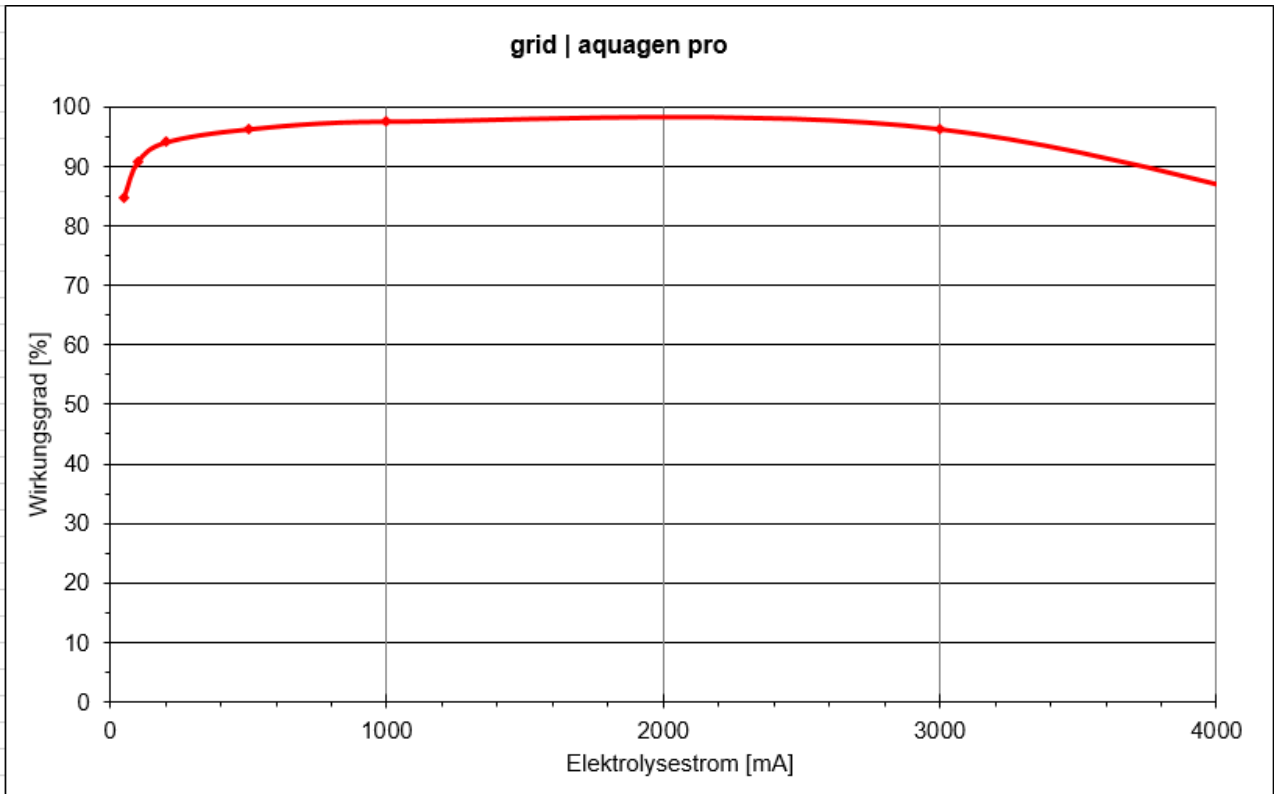
Therefor the weight of each electrolysis cell witch with attached recombination system was taken at the beginning and at the end of test.

The difference in weight represents the amount of water electrolyzed into hydrogen gas which has not been converted back into water.

The quotient of the difference in weight and the calculated weight of the totally electrolyzed water represents the efficiency of the Recombination System.

The basis for the calculation of the electrolyzed water's weight is that 53.6111Ah electrolyse 1 mole of water (= 18.153g)

Result: The following figure shows the average efficiency as a function of the gasing current:



2. Backfire inhibition of the Recombination System

One Recombination System of each type was tested in the laboratory of Hoppecke Batterien GmbH & Co. KG at a gassing current of 15A.

An Electrolysis Cell (with Fibre Nickel Cadmium Electrode – FNC and caustic potash solution) was connected by a detachable hose to a water filled cell, which served as a liquid barrier to avoid backfire into the cell,

The Recombination System was mounted onto the water filled cell (see at attachment picture testing arrangement).

At an overload of the Recombination System with gassing current of 15A the non converted oxyhydrogen gas escapes via a frit.

After an initial five minutes waiting time and subsequent one minute waiting time, the escaped gas was ignited by a spark plug.

Result: At each spark the escaped oxyhydrogen was ignited, neither a permanent flame nor a backfire arose.

3. Overload safety of the Recombination System

One Recombination System of each type was tested in the laboratory of Hoppecke Batterien GmbH & Co. KG at a gassing current of 50A.

One Battery type 20OpzS 2500 (2V; 2500Ah) each was connected by a detachable hose to an empty cell, the Recombination System was mounted onto the empty cell (see attachment picture testing arrangement).

At a battery charging current of 50 A the developed oxyhydrogen gas emerges exclusively into the empty cell and from there into the Recombination System.

At an overload of the Recombination System with oxyhydrogen gas developed at a battery charging of 50 A the non converted gas escapes via a frit.

Result: The Recombination Systems were not damaged by the flow of oxyhydrogen gas.

Attachment N141N1BH

1 Picture testing arrangement Efficiency of the Recombination System



2 Picture testing arrangement Backfire inhibition of the Recombination System



3 Picture testing arrangement Overload safety of the Recombination System

