

Assembly and operating manual

AquaGen



grid | AquaGen_{pro max}



grid | AquaGen_{pro}

Preamble

Dear customer,

Thank you very much for choosing a product of our company.

Before carrying out any work in connection with the AquaGen systems, please read this documentation observing and carefully. It contains important information on the safe and correct storage, installation, commissioning, operation and maintenance of AquaGen systems.

We reserve changes to the content of this documentation. HOPPECKE Batterien GmbH & Co. KG does not assume liability for possible errors in this documentation. Our products are permanently subject to further development. Therefore, there might be differences between the images in this documentation and the product you purchased.

Please keep this documentation at a place where it is always available to all persons carrying out work in connection with the batteries.

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Assembly and operating manual AquaGen

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0 Symbols and Safety Instructions Used in this Documentation

The following safety instructions must be observed. The listed safety symbols are repeatedly used for safety-relevant instructions in this documentation:



Danger!

Danger to the health of persons, to the battery (batteries) or to the environment. Non-compliance with these hazard warnings can cause severe or fatal injuries.



Danger!

Danger to the battery (batteries), objects or environment. Danger to persons is unlikely. Non-compliance can cause failures of and damages to the battery (batteries). Moreover, material damage and environmental damage might occur.



Danger due to explosion, shock waves, hot or molten flying substances. Risk of explosion and fire, avoid short circuits! Electrostatic charges or discharges/sparks must be avoided! Non-compliance with these hazard warnings can cause severe or fatal injuries.



Risk of chemical burns due to leaking electrolyte. Electrolyte is highly corrosive!



Danger to the life and health of persons due to electrical potential. Attention! Metal parts of the battery cells/blocks are always energized. Therefore, do not deposit foreign items or tools on the battery. Non-compliance with such hazard warnings can cause severe or fatal injuries.



Warning against danger due to batteries.



No smoking!
No open flame, embers or sparks near the battery: risk of explosion and fire!



General prohibition.



Observe operating instructions and install them clearly visible in the battery room! Work on batteries may only be carried out after instruction by specialist personnel.



Wear safety goggles and protective clothing when working with batteries!
Observe the accident prevention guidelines as well as IEC 62485-2 and DIN EN 50110-1!



Wear conductive footwear.



General prohibition.



Rinse off acid spatters in the eye or on the skin with plenty of clear water. Afterwards, consult a doctor immediately.
Wash acid-contaminated clothes with water.



Recycling.



Lead acid batteries which are not given to recycling have to be disposed of as hazardous waste in compliance with all regulations.



General instruction or instruction for the better understanding and the optimum use of the battery (batteries).

0.1 General Safety Instructions



Danger!

The improper use of the products described here can lead to personal or material damage. In case of improper use, HOPPECKE assumes neither responsibility nor liability for direct or indirect personal and material damage caused by the handling of the products described herein.



Risk of explosion and fire, avoid short circuits!
Attention! Metal parts of the battery (batteries) are always energized. Therefore, do not deposit items or tools on the battery (batteries)!



Electrolyte is highly corrosive! During normal operation, contact with the electrolyte is impossible. If the housing is destroyed, the released bonded electrolyte is just as corrosive as liquid electrolyte.
Leaking electrolyte is harmful to eyes and skin!



Attention!

Without proper and regular maintenance of the batteries by HOPPECKE specialist personnel (or personnel authorised by HOPPECKE), the safety and reliability of the power supply might not be ensured in case of emergency.



Danger!

Work on batteries, in particular their installation and maintenance, may only be carried out by trained HOPPECKE specialists (or personnel authorised by HOPPECKE) who are familiar with the handling of batteries and who know the required precautions.



Never clean batteries using a duster or dry cloth made of synthetic fibre. Risk of electrostatic charging and oxyhydrogen explosion! For cleaning, we recommend wet cotton cloths (without plastic components).

0.2 Safety Instructions for the Work with Lead Acid Batteries



There might be danger due to battery voltage. In case of a short circuit, extremely high currents can flow.



Risk of explosion and fire due to oxyhydrogen.
Filled lead acid batteries contain explosive oxyhydrogen (hydrogen/air mixture). Never smoke, handle open flames or create sparks in the direct vicinity of batteries. Avoid electrostatic discharges at all cost; therefore, wear cotton clothes and ground yourself if necessary.



Danger!

Take off watches, rings, necklaces, jewellery and other metal items when working with batteries.

Use only insulated tools.
Wear suitable protective clothes and safety boots (also see *chap. 1.3*).



Danger!

Never deposit tools or metal parts on batteries!



You have to wear protective goggles when working with batteries! Wear the provided personal protective equipment when working with batteries!



Never clean batteries using a duster or dry cloth made of synthetic fibre. Risk of electrostatic charging and oxyhydrogen explosion! For cleaning, we recommend water-dampened cotton cloths (without plastic components).

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1 General Information

1.1 Service

HOPPECKE has a worldwide service network you should use. The HOPPECKE service is at your disposal if you need help with the installation of your battery system, if you need parts or accessories, or if maintenance work has to be carried out on the system. Ask us or your local HOPPECKE representative.

How to contact HOPPECKE:

Phone +49(0)800 2467732

Fax +49(0)2963 61-481

Email service@hoppecke.com

1.2 Disposal/Recycling



HOPPECKE offers its customers its own return system for lead batteries. In compliance with

- the recycling management and waste management act,
- the battery ordinance,
- the transport permit ordinance

- as well as the guidelines of the general environment protection rules and our company guidelines, we are recycling all lead batteries at the secondary lead works at the location of Hoppecke.

For the disposal of AquaGen recombination systems, please contact your local HOPPECKE representative.



Attention!

AquaGen recombination systems must not be disposed of as domestic waste.

1.3 Personal Protective Equipment, Safety Clothing, Equipment



When handling lead acid batteries, at least the following equipment must be available, Whereas the list is not intended to be exhaustive:

- Insulated tools
- Suitable protective gloves
- Safety goggles
- Safety boots
- Fire extinguishers
- Emergency eyewash (recommended).



Danger!

To prevent electrostatic charges when handling batteries, a surface resistivity of $<10^8$ ohm and an insulation resistance of $>10^5$ ohm are required for textiles, safety boots and gloves (see IEC 62485-2 and DIN EN ISO 20345:2011 personal protective equipment – safety boots). If possible, wear so-called ESD shoes.



Danger!

When working with batteries, take off watches, rings, necklaces, jewellery and other metal items.
Never smoke, handle open flames or generate sparks in the direct vicinity of batteries.
Never deposit tools or metal parts on batteries!

In case of an accident, the use of proper tools and correct protective equipment can prevent injuries or soften the consequences of injuries.

1.4 Safety Precautions

1.4.1 Sulphuric Acid

Sulphuric acid can cause severe chemical burns and injuries.



First aid measures

Electrolyte on the skin:

Dab off the acid using a cotton or paper towel, do not rub it off. Rinse the affected parts under running water for a longer time. Remove soaked pieces of clothing beforehand. In doing so, preferably avoid contact with body parts that are not affected. After rinsing, wash thoroughly using soap.

Electrolyte in the eye:

Rinse the eye under running water or use the eyewash bottle. Avoid excessive water pressure. Consult an ophthalmologist immediately.

Electrolyte in the body:

Immediately consult a doctor or go to a hospital. Until the doctor arrives: depending on degree and location of the chemical burn, rinse with magnesium oxide suspension, or drink it. If available, also use water with dissolved bicarbonate (sodium carbonate).



Also see ZVEI leaflet "Safety data sheet for battery acid (diluted sulphuric acid)" in the annex.

1.4.2 Explosive Gases



An explosive mixture of hydrogen/oxygen can escape from lead acid batteries. In case of an explosion of the mixture, severe personal injuries can occur.

- Always wear the prescribed protective clothing (safety goggles, suitable protective gloves and safety boots, see *chapter 1.3*).
- Use proper tools only (not "striking sparks", with insulated handles etc.).
- Prevent any ignition sources such as sparks, flames, and electric arcs.
- **Prevent electrostatic discharge, wear cotton clothes and ground yourself if necessary if you are working directly on the batteries.**



Danger!

In case of fire, only use water or CO₂ to extinguish it!

Switch off the battery charging voltage first!

During extinguishing work, use a respirator with independent breathing air supply.

Do not point the fire extinguisher directly on the battery (batteries) to be extinguished. There is a risk that the battery housing will crack due to thermal tension.



Moreover, there is a risk of explosion due to possible static charges on the battery surface.

In order to minimise electrostatic charges on the battery surface, extinguish at short intervals. There is a risk of explosions due to possible static charges on the battery surface.

Toxic gases might occur when plastic materials are combusting. In this case, leave the fire ground as soon as possible if you are not wearing a respirator.



When using extinguishing water/foam, there is a risk of a short circuit.



When using extinguishing water, there is a risk of reactions with the electrolyte and, as a consequence, severe squirting. Therefore, wear acid-proof protective clothing.

1.4.3 Electrostatic Discharges

All lead acid batteries develop hydrogen and oxygen gas, known as oxyhydrogen, during operation but mainly during charging. These gases are escaping from the batteries into the surroundings of the battery. For the natural or technically supported ventilation which always has to be provided, you have to assume that an ignitable hydrogen-oxygen gas mixture is only present in the vicinity of the battery cell openings.

An ignitable hydrogen-oxygen gas mixture is always present inside the battery housing itself. This applies independent of the battery technology, design or manufacturer and is typical for all lead acid batteries.

The energy which is required for the ignition of oxyhydrogen is very low and can, for example, be released or introduced as follows:

Open flames or fire, smouldering sparks or flying sparks during grinding work, electrical sparks due to switches or fuses, temperature > 300 °C and – an often underestimated cause – electrostatic discharges.

Measures to prevent oxyhydrogen ignitions due to electrostatic discharges

The development of electrostatic discharges on the battery or on your body or your clothing can be prevented if you observe the following:



Do not wipe the battery with a dry cloth, in particular cloth made of synthetic materials! Rubbing on plastic surfaces (battery housings are usually made of plastic) generates electrostatic charges.



Clean the battery surfaces only with cotton cloths which are moistened with water. No charges develop when wiping with a damp cotton cloth.



When working on batteries, you must prevent your clothes (e.g. made of wool) from rubbing on the battery. This could cause the development of electrostatic charges on the battery housing or your body or clothes.



Wear suitable shoes and clothes which prevent the occurrence of electrostatic charges due to their special surface resistivity. This can prevent the development of electrostatic charges on your body or clothes.



Do not remove labels on the battery without special safety precautions. Pulling or tearing plastic labels off plastic surfaces can cause electrostatic charges which can ignite oxyhydrogen when discharging.



Before removing the label, wipe the battery with a wet cloth.

According to IEC 62485-2, the following requirements apply to the battery room:

The floor area in which a person is within arm's reach to the battery must be conductive in such a way that electrostatic charging is avoided. The leak resistance to a grounded point measured according to IEC 61340-4-1 must be less than 10 Mohm. On the other hand, the floor must be sufficiently insulated for the protection of persons. Therefore, the leak resistance of the floor against a grounded point measured according to IEC 61340-4-1 must be:

For battery voltages ≤ 500 V: 50 kohm ≤ R ≤ 10 Mohm;

For battery voltages > 500 V: 100 kohm ≤ R ≤ 10 Mohm.

2 Functional Principle of the AquaGen

When using the AquaGen recombination system, the oxyhydrogen mixture which develops during the water decomposition in the battery is led to the AquaGen recombinator. This gas is recombined by means of an integrated catalyst with water vapour developing during the process. The water vapour condenses at the walls of the AquaGen recombinator. The developing water drops flow down and are returned to the battery. Depending on the conditions, the efficiency of this recombination is up to 99%. This effectively reduces the efforts for the refilling of water. We recommend a visual inspection of the electrolyte level at least twice per year. Due to the recombination of the developing gases, the ventilation requirements according to IEC 62485-2 can be reduced significantly.



For battery cells/ blocks with a capacity of max. 500 Ah C10 or when using NiCd-battery cells at a capacity of max. 450 Ah C5, it is possible to use the **grid | AquaGen_{pro}**. For higher capacities the **grid | AquaGen_{pro max}** is the right choice.



Attention!

AquaGen recombinators may only be operated with HOPPECKE batteries (closed construction/ VLA).

3 Assembly of the AquaGen



Danger!

Before starting to work in the battery room, you must ensure that the ventilation is operative. In case of technical ventilation, it must be switched on while working on the batteries.



Danger!

Observe all aforementioned safety instructions and safety precautions, in particular with regards to the leak resistances of gloves and safety boots (see *chap. 1.3*) as well as the floor area in the battery room (see *chap. 1.4.3*).



Danger!

Before attaching the AquaGen recombinator, and if the electrolyte level has fallen to the "min." mark during the operation of the battery system, the electrolyte level has to be restored by refilling cleaned/desalinated water (DIN 43530 part 4/IEC 60993-1). Overfilling beyond the "max." mark must be avoided.

3.1 Removing the labyrinth insert using screwdriver

In order to loosen the labyrinth insert from the bayonet plug, a screwdriver gets inserted between the labyrinth insert and the bayonet plug and pulled off towards the top while pressing on the bottom edge. After the labyrinth insert is loosened from the bayonet plug, it can be picked up with the hand.



Attention!

Attention, there might be electrolyte residues on the labyrinth insert. The labyrinth inserts should be placed and later stored in a suitable container.

3.2 Inserting the AquaGen



If the AquaGen is mounted on older batteries, it is necessary to replace the old battery plugs with a bayonet plug.



Attention!

AquaGen products with visible damages caused by falling, collisions or similar must not be used.

The AquaGen is vertically inserted into the correspondingly prepared bayonet plug (*Figure 1*), and is pressed into the bayonet plug until reaching the stop by means of slight rotary movements (*Figure 2*). Now, the AquaGen is fully mounted (*Figure 3*).



Figure 1: Inserting the AquaGen I



Figure 2: Inserting the AquaGen II



Figure 3: Assembly of AquaGen

4 Removing the AquaGen



If the AquaGen has to be removed, e.g. for disposal, you have to proceed in accordance with the instructions in this chapter.



Danger!

If the battery is supposed to be operated without the AquaGen recombination system for a longer time than necessary for maintenance purposes, the ventilation has to be shifted from the possibly reduced air volume flow to the air volume flow required by IEC 62485-2.



Danger!

In case of boost charges with high currents, the surface of the AquaGen recombination system can heat up strongly. Avoid touching the AquaGen recombination system in this operating phase – risk of injuries! Moreover, dark deposits might develop on the walls in case of boost charges. These deposits do not impair the functionality of the AquaGen recombination system.

4.1 Maintenance



Normally, the AquaGen recombination system does not have to be removed from the battery cells for maintenance purposes. All current HOPPECKE lead acid battery cells in closed/VLA design are equipped with a so-called service opening (except block batteries e. g. OGi bloc or power.bloc OPzS), via which it is possible to measure the temperature and acid density, as well as to refill water. Contact your local HOPPECKE representative if you need further information about accessory products.

Before the disassembly, ensure that most of the fluid collected in the recombinator drains off downwards by slightly knocking on the housing of the AquaGen.

In order to remove the AquaGen from the battery, the AquaGen – together with its bayonet plugs – is loosened by turning it counter-clockwise and then lifted off from the cell.

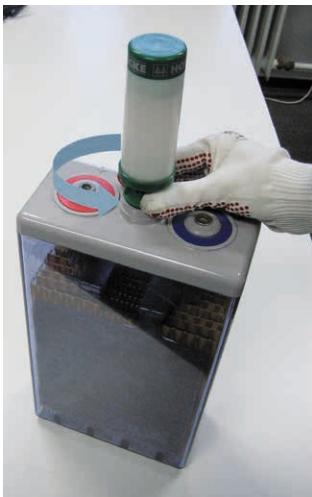


Figure 4: Loosening AquaGen

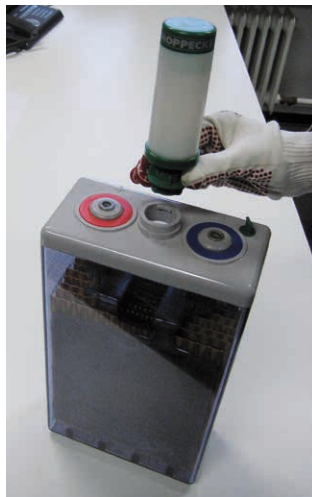


Figure 5: Lifting off AquaGen



If the bayonet plug is not directly accessible (e. g. power.bloc OPzS, OGi bloc 12V) the AquaGen recombinator can be lifted with a dedicated lifting tool Mat.-No. 7149004000.

Note: The AquaGen needs to be removed from the battery opening immediately after loosening.



Danger!

After loosening, the AquaGen must be removed from the battery opening immediately.

Deposit the AquaGen together with its bayonet plugs into a suitable container in order to collect electrolyte residues.



Attention!

The AquaGen must be stored in a vertical position so that remaining fluids can drain off without obstructions, and the active material in the AquaGen remains dry.



Danger!

During maintenance work, the AquaGen must never be placed loosely in the (battery) cell opening!



Danger!

Always carry out cleaning work before or after the replacement using only cotton cloths (without synthetic components) which were moistened with water.

For the subsequent assembly, please proceed according to *chap. 3.2 "Inserting the AquaGen"*.

4.2 Disposal

Dispose of the AquaGen according to *chapter 4.1*. At first, deposit the AquaGen in a cardboard box with an open top. Do not close the box! Because the AquaGen might contain acid residues, the legal provisions on the disposal which are applicable in the country of destination must be observed. Please also observe the recommendations regarding disposal and handling in the safety data sheet on sulphuric acid. Please contact your local HOPPECKE representative if you want HOPPECKE to dispose of the AquaGen recombinator.



Danger!

In general, do not use plastic sacks or bags in the vicinity of the battery.

5 Capacity and Service Life



AquaGen recombinators are overload-proof, i.e. there is no risk of the plastic materials of the AquaGen recombinator or the battery being damaged due to overheating for voltages up to 2.7 V/cell (boost or equalisation charges with I const). The function of the recombiner will be not restricted in this case. The AquaGen recombiner is designed for a working range up to 2.4 V charging voltage.

For cyclic applications, we therefore recommend the use of the HOPPECKE electrolyte-circulating pump sun.air instead of the AquaGen recombinator. When using the aforementioned pump, it is also possible to reduce the water consumption significantly.

Explanation:

Boost charges and equalisation charges: charges with I/U curve, voltage limitation at max. 2.4 V/cell in the constant voltage phase.

An initial charge is also a boost charge. It is realised with an I/U curve with a max. voltage of 2.4 V/cell. As an alternative, it is also possible to charge with an I- (constant current) or a W- (constant power) curve. In doing so, charging voltages of up to 2.6 V/cell are reached.



When charging with higher currents over a corresponding period of time, condensation of water vapour outside the AquaGen recombinator might occur. The water drops which will develop in this case are not an indicator of a fault or a leakage in the system.



Attention!

If AquaGen recombinators are, for whatever reason, removed from the cells/blocks, the AquaGen recombinators must be deposited in a vertical position by analogy with the operating position (do not place recombinators on the side). A corresponding tray “AquaGen Stand” is included in the scope of delivery.



Attention!

If the ambient air temperature at the installation location of the battery can drop below 5 °C, AquaGen recombinators must not be assembled or operated. Otherwise openings inside the AquaGen might freeze and hence gas can not escape from the cell anymore. In consequence the battery cell jar might be damaged due to excess pressure.

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