PERMA.BATTERIES
Solutions d'autonomie solaire

Revision 1.9 (11.2022)

NICKEL-IRON BATTERIES

PB SERIES (100-1200 Ah)

Safety instructions

Foreword

Dear customer,

Thank you for choosing Nickel-Iron batteries. This document will help you to learn how to use them safely during maintenance and commissioning operations.

Please read this manual carefully before carrying out any work or maintenance on Ni-Fe batteries.

This documentation contains important safety information. Failure to comply with these safety instructions and instructions may result in the invalidity of the warranty contract, serious personal injury, and significant material damage. PERMA-BATTERIES cannot under any circumstances be held liable for direct or indirect injury or damage resulting from improper use of this product.

PERMA-BATTERIES reserves the right to modify the content of this documentation.

PERMA-BATTERIES is not responsible for any errors that may be contained in this documentation.

PERMA-BATTERIES is not liable for direct damages arising from the use of this documentation.

Please keep this documentation readily available for anyone who needs to work on the batteries.

For further information, please contact us by email :
contact@perma-batteries.com

or by phone in case of emergency at :

0033 (0)9 77 55 22 77

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Safety notes and regulations

1.2 Chemical and electrical hazards :

Nickel-iron (NiFe) batteries contain corrosive materials. Installation, maintenance, servicing and replacement must only be carried out by trained personnel.

The electrical voltages generated by a battery bank can cause fatal injuries. The metal parts of the battery are always live, so never place objects or tools on the battery. Failure to comply with this warning may result in serious injury or death.

The electrolyte contained in nickel-iron batteries, consisting of **sodium potash** (KOH) diluted in an aqueous solution, and lithium hydroxide (LiOH), is highly caustic for skin and organic materials.

In case of accidental contact with electrolyte :

- Remove contaminated clothing immediately.
- Dab contaminated areas with absorbent cotton or paper towels; do not rub.
- Rinse affected skin thoroughly with clean water
- After rinsing, clean the area with soap.
- Avoid contact with affected skin areas.
- If necessary, contact a doctor.

If electrolyte splashes into eyes :

- Thoroughly wash the affected eye with copious amounts of water for at least 15 minutes (using running water or saline or an ion-based eye solution).
- Avoid using high water pressure.
- Always contact an ophthalmologist or call 15 or the Poison Control Center.

In case of accidental ingestion of electrolyte :

- Drink plenty of water immediately.
- Contact your nearest poison control center, or call 15 immediately.

In case of contact with clothing :

- Remove contaminated clothing.
- Wash clothes in a solution of sodium bicarbonate (baking soda).
- Rinse with clean water.

Various accessories are installed close to the battery park: eyewash, thermometer, voltmeter, protective visor.

1.3 Handling protection :

Battery maintenance and connection must be carried out by or under the direct supervision of qualified personnel familiar with good practice in handling secondary batteries.

Always wear protective clothing (insulated gloves, goggles, etc.) when installing, maintaining, servicing or replacing batteries. Wear protection against electric shock and arcing, if necessary, depending on the type of system voltage (> SELV).

Remove all metal objects from hands and neck. Before handling batteries, touch a grounded metal object to dissipate any static charge that may have developed on your body. Alternatively, wear an anti-electrostatic grounding bracelet.

Never use uninsulated tools or other conductive materials during installation or

maintenance. **Use only VDE tools with insulated handles.** Never place tools on batteries. Comply with accident prevention regulations, EN 50110-1 and IEC 62485-2 (stationary batteries).

To prevent electrostatic charging, all protective textiles, footwear and gloves worn when working with batteries must have a surface resistance <10-8 ohm and an insulation resistance ≥105 ohm (see IEC 62485-2 and DIN EN ISO 20345: 2011 Personal protective equipment - Safety footwear). If possible, wear ESD shoes.

Take particular care when connecting or adjusting battery wiring. An incorrectly connected battery cable can come into contact with a surface, creating a short-circuit and causing an electric arc, fire or unexpected explosion. Inadequate wiring (cross-section, tightening torque) can cause overheating, leading to deterioration of the battery terminals, or even a fire.

Adequate spacing between individual batteries is necessary for convection cooling. Only use the terminals supplied with the batteries to interconnect them.

1.4 Ventilation :

Batteries produce explosive gases (H^2, O^2) during operation, particularly in the event of overcharging. Never smoke near batteries, and maintain adequate ventilation at all times. Never charge batteries in a sealed environment. The technical room must be ventilated to prevent the accumulation of hazardous gases.

Installation conditions for storage batteries depend in particular on the off-gassing of the cells. Ventilation of a battery's location or enclosure is designed to keep the hydrogen concentration below 4%vol of the hydrogen explosion limit. In accordance with standard NF EN 50272-2, the minimum air flow rate for ventilation of a battery location or compartment should be calculated using the following formula :

$$Q\ (m^3/h) = 0{,}05 \times n \times I_{gaz} \times C \times 10^{-3}$$

with

n: number of battery cells
C: Battery capacity C10 in Ah
Igaz = 100 (mA/Ah) for Nickel-Iron cells

Air extracted from the battery room must be evacuated to the atmosphere outside the building. Top and bottom vents ensure ventilation to the outside, while preventing access by animals or insects.

Ventilation air should preferably be supplied by natural ventilation, otherwise by forced ventilation. Rooms or enclosures containing batteries require an air inlet and outlet with a minimum free opening area calculated using the following formula :

$$A = 28 \times Q$$

with

Q = Fresh air flow in m3/h
A = Free area of air inlet and outlet opening (cm2)

1.4.1 Installation (according to XP C-15-712-3)

There are two installation options to consider, depending on the battery's characteristics:
Discharge capacity and voltage.

A. Case where C(Ah) x U(V) is less than or equal to 1,000

The battery can be installed in a general-purpose room other than an electrical service room.
Battery terminals must be protected against short-circuiting.

B. Case where C(Ah) x U(V) is greater than 1,000

A dedicated place must be provided for the battery. This is either a specific room or an enclosure.

The following factors should be taken into account when choosing a location:

- protection against external hazards such as fire, water, shock and vibration;
- protection against battery-related risks (explosion, electrolyte, corrosion);
- protection against access by unauthorized persons ;
- protection against extreme environmental influences, e.g. temperature,

The dimensions of the room are determined by taking into account :

- number and size of battery cells to be installed;
- space required for ancillary elements (wiring, including routing and supports);
- free space around the battery, not only for safety reasons, but also to ensure that
- also to facilitate access during installation and maintenance (including any handling devices).

The following requirements must be met:

- the floor must be designed to support the weight of the battery;
- in the case of an establishment receiving workers, the door must be panic-proof and lockable only from the outside;
- ventilated air must be expelled to the atmosphere outside the building;
- when using open batteries, the floor with threshold must be watertight and chemically resistant to electrolyte (tiling or electrolyte-resistant paint), or the battery cells must be placed in suitable retention bins.

The retention device must be sized to contain at least the volume of electrolyte in a cell or monobloc.

The battery room is either independent of the residential buildings, or integrated into them.
In this case, additional safety measures must be implemented:

- access to the premises must be from the outside;
- there must be no communication between this room and the living quarters;
- cable feed-throughs must be obstructed (plaster, etc.).

Building materials must be non-combustible and impervious to off-gassing.
Electrical equipment must not be installed in the battery room except :

- if their function is to ensure safety itself (class T1 for temperature and group IIc for gases) ;
- for uninterruptible power supplies in control cabinets.

Lead-acid and alkaline batteries must not be stored in a closed container. even locally.

To protect the environment, if the maximum load power (product of the voltage charge by the end-of-charge current) is greater than 50 kW, the battery room must comply with the general requirements for installations subject to declaration [Arrêté du 29 mai 2000 relatif aux prescriptions générales applicables aux installations classées pour la protection of the environment subject to declaration under heading 2925 "Accumulators (load workshop)", heading modified by decree no. 2006-646 of May 31, 2006].
Genset starter batteries and their charging devices can be used for a variety of purposes. be installed in the generator room.

Download the UTE / AFNOR standards by clicking on the links opposite:

https://www.perma-batteries.com/wp-content/uploads/2022/10/UTEC15-712-3.pdf

https://www.perma-batteries.com/wp-content/uploads/2022/10/UTE-C15-712-2.pdf

1.4.2 Calculating the safety distance :

**There is no specific method for calculating minimum safety distance for nickel-iron batteries. By default, therefore, we use the example of a minimum safety distance calculation for open lead-acid batteries of the Hoppecke OPZ type, which generate less H2 in normal operation than NiFe batteries.*

In the vicinity of batteries, dilution of explosive gases is not always possible. Consequently, a safe distance must be maintained by a clearance, in which there must be no sparking or incandescent equipment (max. surface 300°C). Oxyhydrogen diffusion depends on gas release and ventilation close to the battery. For the following calculation of the safety distance "d", we can assume that oxyhydrogen develops in a spherical space. Figure 5-1 shows a graphical approximation of safety distance "d" as a function of battery capacity. The formula for calculating the distance is shown opposite:

The required safety distance must be calculated according to the formula given in IEC 62485-2.

Volume of a hemisphere :

$$V_h = \frac{2}{3} \times \pi \times d^3$$

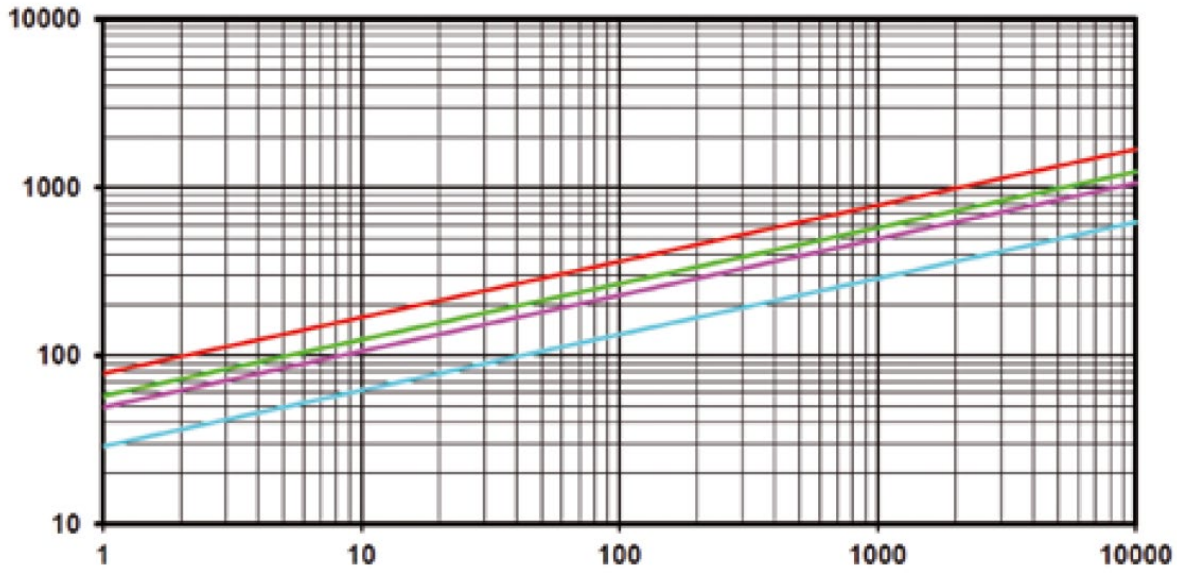
Air flow required to minimize the concentration of hydrogen H2 generated in the room to 4% maximum :

$$Q_{gas} = 0.05 \times \langle n \rangle \times I_{gas} \times C \times 10^{-3} \left(\frac{m^3}{h} \right)$$

$$Q_{gas} = \frac{V_h}{t}$$

Required hemisphere radius :

$$d = 28.8 \times (\sqrt[3]{n}) \times \sqrt[3]{I_{gas}} \times \sqrt[3]{C} \ \ (mm)$$



- ***Abscissa: battery capacity C given in Ah***
- ***On the ordinate, the distance to be respected (in mm).***

Graph and calculations taken from the **Hoppecke manual "**Installation, commissioning and operating instructions for vented stationary lead-acid batteries, 7140203152 V1.4 (09.2017)**" for OPZ lead-acid batteries.*

1.5 Precautions in the event of fire :

In the event of fire near the batteries, extinguish with water or a CO2 extinguisher only. Do not direct the extinguisher directly at the batteries, as the internal voltage may cause the battery casing to rupture. In addition, there is a risk of static charging on the battery surface. This could cause an explosion. If you are extinguishing a fire, use a breathing apparatus with a self-contained air supply. If you use water to extinguish a fire, there is a risk that the water/foam could react with the electrolyte and cause violent splashing. For this reason, wear suitable protective clothing.

Burning plastic can produce toxic fumes. If this should occur, leave the area as quickly as possible if you are not wearing the breathing apparatus described above.

1.6 Electrostatic discharges :

All nickel-iron batteries produce hydrogen and oxygen during operation, particularly during charging. These gases are released from the battery into the ambient air. When properly ventilated, it is assumed that a flammable concentration of oxyhydrogen exists only in the immediate vicinity of the battery.

An oxyhydrogen mixture always exists inside battery cells. This phenomenon is an electrochemical characteristic of the redox couple used in nickel-iron batteries, not a manufacturer-specific feature.

The energy required to ignite oxyhydrogen is fairly low, and can come from a variety of sources. Examples include sparks or glowing embers, electrical sparks from switches or fuses, hot surfaces, and electrostatic discharges from nearby power electronics.

Here is a list of preventive measures to limit the risk of explosion in a technical room containing batteries:

- **NEVER wipe the battery with a synthetic cloth**. Rubbing this type of material on plastic surfaces (the battery's plastic casing) causes static charges to build up.

- To avoid electrostatic charge build-up, **clean battery surfaces only with damp absorbent cotton**.

- When working on batteries, **do not rub your clothing (e.g. wool) on the battery**. Electrostatic charges could build up on the batteries, your body or your clothing. As a general rule, **never work near batteries when wearing synthetic clothing.**

- **Wear appropriate footwear and clothing with special surface resistance to prevent static build-up**. In this way, electrostatic charge build-up on the body and clothing can be avoided.

A. Must be displayed in the equipment room:

contact@perma-batteries.com
+1 (415) 818-0845

ASSURER UNE VENTILATION CORRECTE - REMPLIR AVEC DE L'EAU DÉIONISÉE / DÉMINÉRALISÉE UNIQUEMENT EN FIN DE CHARGE

DANGER

					
Présence de sources de tension dangereuse. Ne pas manipuler d'objets métallique à proximité des terminaux de batterie.	Toujours porter des lunettes de protection lors du remplissage des batteries.	Toujours porter des gants de protection adaptés lors du remplissage des batteries.	Présence de gaz hautement explosifs (0^2, H^20). Ne pas fumer, ne pas provoquer d' étincelles à proximité des batteries. Assurer une ventilation appropriée en toutes circonstances.	Electrolyte caustique à ~ 20 % de KOH, pouvant occasionner des brûlures chimiques sévères. Toujours porter les EPI lors de toute manipulation.	En cas de contact cutanée ou oculaire accidentel avec l'électrolyte, rincer abondamment à l'eau claire pendant 30 minutes. Ne pas neutraliser avec un acide. Consulter un médecin.

B. PPE to be provided in the battery room :

Protective visor

contact@perma-batteries.com
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*Emergency ophthalmic rinse solution (*sterile sodium chloride solution (0.9%))

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