

INDUSTRIAL BATTERIES



USER'S MANUAL

SLC – GHL – FAT – DCEV – OpzV – CL

SEALED LEAD ACID BATTERIES



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1 GENERAL

The purpose of this manual is to provide a quick guide for the storage, installation and use of the batteries both supplied loose and in the cabinet.

Before starting any activity it is **very important** to carefully read the safety procedures.

In normal use, SEALED batteries do not generate or emit hydrogen, do not emit acid mist and do not leak acid. However, there is a possibility that under abnormal service conditions, or as a result of damage, misuse and / or abuse, hydrogen gasification, acid mist and electrolyte loss may occur. For this reason ENERPOWER recommends reading the instructions below entitled "SAFETY PRECAUTIONS".

2 FEATURES

2.1 Construction features

The construction features of the SEALED batteries mean that during their life they do not require any topping up or maintenance. They can therefore be installed with maximum safety in the same environments where you live and work.

They are easy to transport and install and are shipped already charged with electrolyte. They can be installed directly in the system, inside cabinets, or on appropriate shelving.

2.2 Functional features

Voltage - The open circuit voltage of a charged element is approximately 2.14 V / element and it linearly decreases with its state of charge. When the voltage drops below the value of about 2.07 ÷ 2.09 V / element, equal to about 75% of the charge, it is advisable to recharge the battery.

Capacity – The capacity of a lead battery also depends on the discharge rate. With the same discharge rate, the capacity depends on the temperature and, within certain limits, increases if the temperature exceeds the reference temperature by 20° C and decreases for lower temperatures.

Gas development – SEALED batteries can be installed in rooms or cabinets containing electrical equipment without causing any danger of explosions in them as long as the CEI / EIC 896-2 standards are respected.

Charge – The batteries represent a reserve of energy but to preserve this characteristic it is necessary that they are constantly kept charged by a conservation charge. After a discharge, it is necessary to proceed immediately to recharge.

The storage charge must be carried out by applying a constant voltage to the terminals at a value of 2.25 ÷ 2.27 V / cell. ± 1%, referred to a temperature of 20° C ÷ 25° C.

Sealed batteries can be recharged at a single voltage level and therefore do not require two-level charging systems.

For temperatures beyond the above-mentioned limits, the voltage must be varied as a function of the temperature with a compensation factor equal to - 4mV per element and per ° C.

3 SAFETY PROVISIONS

All workers must:










- a) *Observe the provisions ordered by the employer for the purposes of individual and collective safety.*
- b) *Make sure the room is suitably ventilated.*
- c) *Make sure there is a first aid kit.*
- d) *Identify the escape routes existing in the room, reporting any shortcomings and absolutely avoiding obstructing their passage.*
- e) *Make use of tools, shelters and other personal means of protection provided by the Company (for the purpose of accident prevention) such as: Clothing made of antistatic and antacid material - Gloves (dielectric and / or portorage) - Safety and / or insulating shoes - Protective glasses with neutral glasses and side shields*
- f) *Immediately report to the employer, the manager or the persons in charge of the deficiencies in devices and safety and protection means, as well as any other dangerous conditions of which they become aware, acting directly, in case of urgency or in the context of their skills and possibilities, to eliminate or reduce deficiencies or dangers.*
- g) *Check that all operators are scrupulously observing all accident prevention regulations aimed at avoiding specific risks.*
- h) *Remind that: it is forbidden to smoke and use open flames.*
- i) *Avoid the removal of the protections and safety devices of the cabinets unless for work purposes.*
- j) *Forbid the approach and transit of people by: signs, barriers, chains or tapes of impassability, barriers.*

4 GENERAL SAFETY RULES





The installation and commissioning operations of the Batteries or BATTERY CABINETS must be carried out by specialized personnel following all the safety procedures.

The notes below are intended as a guide to the necessary safety precautions which must be strictly observed.

Symbols used

 Information	 Danger of short circuit	 General danger
 Note	 Generic ban	 Important notice
 Danger of explosion	 No smoking	 Very important notice

Warning

-  When the signal [] appears in the manual, respect the safety message to avoid personal harm.
-  The batteries (be they simple elements or monoblocks) are constantly under tension. Even if damaged or discharged, they can deliver high intensity short circuit currents.
Every single element has a tension, which if considered individually, is absolutely tolerated by the human body and is therefore not to be considered dangerous. If the same element is connected in series to other elements at its ends, it is possible to detect voltages of even a few hundred volts and therefore extremely dangerous.
-  Before proceeding with the unpacking, handling, installation and commissioning of sealed lead acid batteries, please read the following general information carefully along with the recommended safety precautions.

4.1 Type of works

- * Installation
- * Testing on site
- * Disassembly
- * Corrective maintenance
- * Preventive maintenance

4.1.1 Possible risks []

The installation, testing, disassembly, maintenance etc ..., of the batteries, involves risks associated with the particular characteristics of the work, the equipment and materials used, which can generally be specified as the following:



4.1.1.1 **Electrical risks. Especially in systems with high voltages, the utmost attention must be paid when installing the batteries to avoid the risk of:**

- * *Short circuit*
- * *Electrocutions*
- * *Electric Shock (High Voltages)*

[i] *Loose or dirty connectors / connections can cause a battery fire. Keep all connectors / connections clean and tightened to the appropriate value. Keep the outside of the batteries clean and dry. If necessary, neutralize the acid corrosion with a rag soaked in a solution of sodium bicarbonate and water, and then clean up all traces of bicarbonate.*

Do not move the shelves or cabinets after installation without first disconnecting the load from the shelf / cabinet and all inter-cabinet / shelf connections. Refer to the wiring diagram for the location of these connections.

Do not lift the cells by the terminals. Do not tamper with the end seals, protective covers, overpressure drains or other battery components.

Safety Precautions

- * *Ensure that personnel understand the hazards of working with batteries, and are prepared and equipped to comply with the necessary safety precautions. You must understand and follow these installation and service instructions. Make sure you have all the necessary equipment for the job, including insulated tools, rubber gloves, rubber aprons, safety goggles, and face shield.*
- * *Remove watches, rings or any other metal objects before performing any operation on a battery cabinet.*
- * *Check the location and efficiency of the disconnecting devices of the Energy System both on the mains and on the battery side.*
- * *Make sure there are no live parts and / or use **only** specific means (gloves, shoes, etc.) and insulated tools.*
- * *Never work alone, but always ensure the presence of a person capable of providing first aid in the event of an accident.*
- * *Never place tools or other metal objects on the battery elements (single cells or monoblocks), to avoid short circuits, explosions and personal damage.*

What to do in an emergency

Persons affected by electric shock - Before touching the injured person:

- * *Immediately disconnect any energy sources.*
- * *Isolate the injured person from any active electrical conductor using a dry insulating material.*
- * *Provide artificial respiration if necessary.*
- * *Cover the injured parts with sterile gauze.*
- * *Seek immediate medical help.*

4.1.1.2 **Various risks associated with the handling of batteries**

- * *Abrasions*
- * *Crushing injuries*
- * *Bruises*



Safety Precautions

- * Check that the fire prevention devices are present and signaled in the premises
- * Check that there are no loose or dirty connectors / connections as these can cause the battery to fire.
- * Make use of tools, shelters and other personal means of protection such as: hard hat - gloves for portorage - safety shoes - safety glasses with neutral glasses and side shields - Protective screen

What to do in an emergency

- * In relation to the severity proceed to the medication.
- * If needed, seek the help of a doctor.

4.1.1.3 Risks arising from battery electrolyte - Batteries contain a dilute solution of sulfuric acid which is highly corrosive.

The SEALED Batteries are dry and, in the absence of breakages, no liquid comes out of the container. In case of breakage of the container, even if in modest quantities, the electrolyte may leak and consequently the risk of:

- * Eye damage
- * Inhalation and / or ingestion of sulfuric acid
- * Skin contact burns



What to do in an emergency

- * Offenses to the eyes (contact) - Wash them with a saline water solution (boric water) or with plenty of running water for at least 10 minutes.
- * Inhalation and / or ingestion of sulfuric acid - Do not induce vomiting, but drink plenty of water or milk.
- * Burns from contact with the skin - Wash immediately and abundantly with water, remove contaminated clothes, cover burns with dry sterile gauze.
- * Seek immediate medical help.

4.1.1.4 Risks from Explosive Gases - In the event of an anomaly, the batteries can generate gas which, if emitted in large quantities and not disposed of from the environment, can explode and cause:

- * Blindness
- * Damages/Injuries.

Safety Precautions

- * Before starting any activity, check that there is a first aid kit and a sink complete with a working tap.
- * Make sure that the room is suitably ventilated (in the case of loads with voltage ≥ 2.4 V / cell)
- * Identify the existing escape routes in the room, reporting any shortcomings and absolutely avoiding obstructing their passage.
- *   Keep sparks, flames, and cigarettes away from the area of batteries and explosive gases



- * **[⚡]** All tools must be properly protected with a plastic tape to decrease the possibility of shorts across connections.
- * Never leave tools and other metal objects on the modules as they could cause short circuits, explosions and damage.

What to do in an emergency

- * In relation to the severity, proceed with the medication and / or seek medical attention.

CAUTION

[⚠] If you do not fully understand the previous precautions, ask the ENERPOWER technical service for explanations. Local conditions can introduce situations not covered by these safety precautions. In this case, contact ENERPOWER to obtain information for your particular safety problem before proceeding with the installation and maintenance of these batteries.

5 Receiving the goods

5.1 Inspection upon delivery

All the material has been checked by ENERPOWER, both mechanically and electrically before being packed and shipped.

Upon reception, it is therefore essential to carry out a visual inspection of the conditions of both the packaging and its contents in order to highlight any damage due to the transportation or its positioning in the case of a delivery at the work site.

Material damage to the packaging may indicate careless handling. Write a description on the delivery receipt before signing it. In the event of damage to cells or units, request an inspection from the carrier and fill in the damage report immediately. Any batteries with damage to the terminals and seals must be replaced.

5.2 Hidden damages

Within 15 days from reception, examine all batteries for hidden damage. In case of damage, immediately request the carrier's inspection and fill out the hidden damage report.

A delay in notifying the carrier may result in a loss of the right to reimbursement for damages.

5.3 Removing the packaging

Use great caution when removing the packaging in order to avoid damaging the contents.

Inspect the packaging very carefully before discarding it in order to avoid the loss of part of the supply and / or documentation.

Be especially careful if the packaging material shows electrolyte damage or coloring.

5.4 Batteries in cabinet

After the reception of the goods, remove the packaging from the cabinets and carry out a careful internal and external inspection of each cabinet and the batteries inside each cabinet.



Some batteries are supplied already wired in a cabinet for which an intercell interconnection is deliberately removed in order to interrupt the continuity of the series and reduce the danger. In any case, when opening, pay close attention to the danger of short circuits [⚡] the high voltage of the battery.

5.5 Handling

Do not move and / or lift the batteries / cells by grasping them by the terminals. Do not tamper with the end seals, protective covers, overpressure drains or other battery components.

Pay the utmost attention if you have to move cabinets already complete with batteries in order to avoid both damaging them (bumps) and overturning them (always remember that batteries, even if disconnected, are always energy accumulators and therefore at high risk in case of breaks and / or short circuits).

6 STORAGE

6.1 Storage rooms [🏠]

If the battery is not to be installed at reception, it is recommended to store it inside a covered room in a dry, clean location with temperatures from 15 ° C to 25 ° C. Do not stack the pallets to avoid damage to the batteries. Any storage temperature above 25 ° C will give rise to a shorter interval between the moment of receipt and the initial charge.

6.2 Storage period

The storage period between the date of shipment and the date of the initial charge must not exceed six (6) months. Before the end of the storage period defined above, if the battery has not been put into operation, it is necessary to carry out a recharging cycle (initial charge).

Storage at high temperatures will result in accelerated self-discharge. As a general rule, for every 10 ° C temperature increase above 25 ° C, the time interval before the initial charge should be halved. For example, if a battery has been stored at 35 ° C, the time before initial charge will be 3 months. If the battery has been stored at 30 ° C, the time before initial charging will be 4.5 months.

Storage beyond these times without an appropriate charge can give rise to excessive sulphation of the plates which is harmful to the performance and the life of the battery.

Failure to comply with these characteristics may void the battery warranty.

7 **INSTALLATION**

7.1 **General observations**

The valve-regulated lead-acid batteries can be installed in shelves with multiple rows and floors or in cabinets.

- * When installing the battery, place the monoblocks in their correct position, taking care to start from the lowest part of the shelf or cabinet for stability reasons.
- * Connect the positive and negative terminals of the monoblocs in sequence
- * Flexible cable connections must be made last
- * In order to ensure a good electrical contact between the various monoblocs, and to avoid damages to the terminals, use a torque wrench with a tightening torque of $8 \div 10\text{Nm}$

7.2 **Required spaces**

It is important to know exactly the spaces made available for positioning the battery. There must always be a corridor in front of each battery to allow initial installation and maintenance or surveillance.

After installation, no other equipment should impair access to the battery.

7.3 **Minimum characteristics of the room / battery cabinet**

The room must be clean, cool and dry.

The floor must be sufficiently leveled and able to support the weight of the battery.

An environment with a temperature of 20° C (however within a temperature range between 15° C and 25° C) will give the best results and battery life.

With temperatures below 20°C the performance of the batteries is reduced, while with temperatures above 20°C there are phenomena that lead to a reduction in battery life.

Do not enclose batteries in watertight containers that prevent ventilation and keep the battery temperature at recommended values.

7.4 **Ventilation**

The SEALED battery is a maintenance-free battery that does not emit any gas under normal operating conditions.

The same battery, if subjected to a prolonged overload, could release hydrogen and oxygen into the atmosphere.

For this reason, all precautions must be taken to avoid excessive overloads. In the battery compartment, in compliance with current regulations, there must in any case be an air exchange to ensure in any condition a gas concentration level below the dangerous threshold.

Any environment deemed habitable is sufficient to make the room suitable for the installation of these batteries.

Under normal service conditions, neither special ventilation nor a battery room is required.

7.5 Temperature variations

Sources of heat or direct cooling on portions of the battery can cause temperature variations in the series that give rise to differences in cell voltage and also to variations in battery performance.

These temperature changes can be caused by heat sources, such as heaters, direct sunlight, or connected equipment.

Likewise, air conditioning systems or external air vents must not directly affect the temperature of any part of the cell array. Strive to keep temperature changes to a minimum.

7.6 Load on floor

The floor of the area where the battery system is to be installed must have the capability to support the weight of the batteries and any auxiliary equipment.

The total weight of the battery will depend on the size of the cell, the number of units, and also the expected configuration of the modules.

Before installation, it must be ensured that the floor conditions are adequate for the positioning of the battery system.

7.7 Fixing to the floor

Where seismic conditions are foreseen, a fixing to the floor must be provided. This fixing is a responsibility of the user.

7.8 Checking the voltage with open circuit

Check that the voltage of the monoblocks is higher than 12.6 V; otherwise contact ENERPOWER.

Do not move the shelves or cabinets after installation without first disconnecting the load and removing all inter-cabinet / shelf connections. Refer to the wiring diagram to locate these connections.

8 INSTALLING THE BATTERIES IN THE CABINET

Depending on the total weight of the battery, the cabinets can be pre-wired in the factory with the batteries already installed inside each cabinet. For this reason, great care must be taken to place the cabinets in the designed installation area. Since these systems are pre-wired, the only connections required after installation are:

- * Intercell connection, removed for safe shipment of the cabinet
 - * Interconnection connections with any other cabinets
 - * Connections between the positive and negative terminals of the battery and the equipment
- Refer to the wiring diagram for details. Do not drill or turn the cabinets on the side. Positioning should only be done in the vertical position.

9 INSTALLING THE BATTERIES ON THE SHELF

9.1 Shelf Assembly

Check the component parts received referring to the nomenclature. Contact ENERPOWER if the supply does not appear complete. Identify the missing pieces with the part number and description. Do not carry out the assembly if the material is not available in its entirety or if the parts do not correspond to the drawings.

Assembly Steps:

- * Place a stand and fix the rails on it
- * Repeat the operation with the second support.
- * Fasten the rails of the second shelf
- * Tighten all the bolts to 34-40 Nm

9.2 Positioning of the batteries

Study the battery layout drawings to choose the proper position of the positive and negative battery terminals and to establish the correct arrangement of the units on the shelf.

From the drawings of the battery arrangement, establish the number of monoblocs to be placed on each row. If a row of monoblocs does not completely fill the length of the shelf, pay attention in the distribution of the weights to avoid unbalancing the shelf.

When installing the monoblocs on a shelf, start from the bottom row for safety and stability reasons. Place the monoblocks on the shelf so that the positive (+) of one monoblock can be connected to the negative (-) of the next monoblock in accordance with the battery layout drawings. If rigid interconnection bars are used, pay attention to their length (by carrying out a preliminary check) in order to avoid having to move all the monoblocs in a subsequent phase.

9.3 Connecting cables from batteries to equipment

Battery performance refers to its terminal output. For this reason, in order to obtain the best performance of the total system, the shortest possible electrical connections must be made between the battery system and the equipment.

Do not choose the cable section based only on the current carrying capacity.

The choice of cable cross section should provide the lowest voltage drop between the battery system and the equipment. Excessive voltage drop will shorten the operating time of the battery system.

9.4 Parallel

When it is necessary to connect several batteries in parallel to increase the total capacity, the direct connection from the bars / load to each of the series in parallel is preferable to other solutions.

The cables, with a section such as to minimize the voltage drop in relation to the current carrying capacity, must be as short as possible. However, the path of the cables for all the systems to be put in parallel, up to the load, must be identical in length and section in order to guarantee a correct distribution of the load during discharge and a satisfactory recharge with the same buffer voltage per series. Care should be taken to ensure that the total resistance of the connections between the batteries and the equipment bars are consistent across series.

9.5 Tightening the connections

Batteries in cabinet - Although the batteries inside the cabinet systems are factory fitted, all connections inside the cabinet must be checked and tightened to approximately $8 \div 10$ Nm

Use well insulated tools.

Warning, do not connect the battery to the load at this time.

Tighten all connections annually.

Battery on shelf - After cleaning the contact surfaces, install all tight connections to allow final alignment of the unit.

When the final alignment has been carried out, all connections must be tightened to approximately 8-10 Nm. Finish the connection of the units by installing the cables between rows and the terminal connections.

Warning, do not make connections to the load at this time.

9.5.1 Terminals

Battery terminals and cell connections must be corrosion free and tight for trouble free service. Periodically inspect these connections to ensure cleanliness and integrity.

Do not work on connections with the battery connected to the load or charger.

The tightness of all intercell connections must be checked at least once a year.

10 CONNECTION

10.1 Checking the connections

Visually check to make sure all units are connected positive to negative for the entire battery range. Measure the open circuit voltage from the positive series terminal to the negative series terminal.

For fully charged batteries the voltage should be ~ 2.14 volts / cell.

With values lower than 2.09 volts / element it is necessary to recharge the battery.

10.2 Battery connection with load

- * The positive (+) terminal of the battery must be connected to the positive (+) terminal of the battery charger
- * The negative (-) terminal of the battery must be connected to the negative (-) terminal of the battery charger.

Before connecting the battery to the equipment, make sure that there is consistency between:

- * the battery charging voltage and the stabilized output voltage of the battery charger
- * the polarities of the battery and that of the charging system

11 LOAD

11.1 Constant voltage and limited current method [CVCF]

Most modern battery chargers are of the constant voltage type.

The table, below, gives an indication on the charging times according to the recommended charging voltage for the initial charge at a temperature of 25 ° C. For temperatures from 13° C to 20° C, double the number of hours.

For temperatures other than 25° C it is necessary to compensate the voltage as a function of the temperature according to the following formula:

$$V \text{ corrected} = V \text{ 25 } ^\circ \text{C} - (\text{ambient T} - 25 ^\circ \text{C}) \times (K = 0.004\text{V} / \text{C } ^\circ)$$

Example for an ambient temperature of 35 ° C: corrected V = 2.35 - 0.04 = 2.31 Volt / element

Room Temperature	Cell Voltage	Charging time
25°C	2,27	100
	2,35	24

Take the voltage to the maximum value allowed by the equipment, but do not exceed the maximum voltage indicated for a given temperature. When the charging current has stabilized (asymptote) (the current has been kept constant for at least 3 hours) charge for the hours indicated in the table above until the voltage of all the battery packs have also reached the same level (charge equalization)

Correct the charging time for the temperature at the time of stabilization. To determine the lowest voltage unit, a check should be made during the final 10% of the charge time.

12 SERVICE

12.1 Buffer Charge

In this type of service, the batteries are connected in parallel with a constant voltage battery charger and with the load circuits. The battery charger must be able to maintain the constant voltage required at the battery terminals and also to supply current to the normal load.

This keeps the battery in a fully charged condition and makes it available to withstand emergency demands in the event of a mains (AC) outage or charger failure.

12.1.1 Buffer Voltage []

Below is the recommended voltage range for Sealed battery systems

Reference ambient temperature 25 ° C = Voltage from 2.25 VPC to 2.27 VPC

For temperatures other than 25 ° C it is necessary to compensate the voltage as a function of the temperature according to the following formula:

$$V \text{ corrected} = V_{25^\circ\text{C}} - (\text{ambient } T - 25^\circ\text{C}) \times (K = 0.004\text{V} / \text{C}^\circ)$$

Example for an ambient temperature of 35 ° C: corrected V = 2.35 - 0.04 = 2.31 Volt / element

For the buffer charging of Sealed batteries, they recommend modern battery chargers with constant voltage output. This type of battery charger, suitably adjusted to the recommended buffer value and following the recommended control procedures, will allow for optimal life and adequate service.

After the battery has been given initial charge, the rectifier will need to be adjusted to provide the recommended buffer voltages at the BATTERY TERMINALS.

Do not use buffer voltages higher or lower than recommended. This would result in reduced capacity or a decrease in battery life.

12.1.2 Recharge

All batteries should be recharged, as soon as possible after a discharge, with a constant voltage battery charger. However, to recharge in the shortest possible time, raise the battery charger output voltage to the highest value allowed by the connected system. Do not exceed 2.35 VPC. In any case, this method is no longer used by the manufacturers of the apparatus as it has been seen that the gain in terms of time to reach at least 90% of the charge has proved to be of little significance, on the other hand it has proved extremely dangerous to insist on maintaining high recharges during the terminal phase of recharging the batteries.

The charger used must be equipped with a current limitation. The maximum current recommended for Sealed batteries is indicated in the plate data.

12.2 Equalization Charge

Under normal service conditions the equalization charge is not required. The equalization charge is a special charge that is given to a battery when a voltage non-uniformity has occurred between the units. It is provided to bring all units to the fully charged condition.

Use a charge voltage higher than the normal buffer voltage for the specified number of hours, depending on the voltage used.

The voltage parameters used for the initial charge also apply to this section.

Non-uniformity of the units can be caused by a low buffer voltage due to incorrect regulation of the battery charger. Variations in unit temperature higher than 3° C in a series at a certain time, due to environmental conditions or battery arrangements, can also result in lower voltage cells.

12.3 Equalization frequency

The equalizing charge must be applied when the following conditions exist:

- * The buffer voltage of the pilot cell (or of any unit for quarterly readings) is less than 2.20 VPC for the number of elements in the unit.
- * A very short time recharge of the battery is required after an emergency discharge.
- * After prolonged storage

13 **PILOT UNIT AND RECORDINGS**

A pilot unit is chosen in a series to determine the general condition of all units in a battery. By measuring the voltage of the unit, this serves as an indicator of the condition of the battery over a period in between to the scheduled readings of all units.

A complete recorded history of battery service is desirable and will aid in achieving satisfactory performance. Good records will also show when corrective action is needed to eliminate charging, maintenance or environmental issues.

Supervisory personnel must read and record the following data:

- * At the end of the initial charge and with the battery in buffer charge at the correct voltage for one week, read and record the following:
 - a. Single cell / battery voltage - emergency lights
 - b. Voltage at the battery series terminals
 - c. Room temperature
- * Every 12 months, a complete set of readings as specified in paragraph A must be made and all connections must be re-tightened.
- * When an equalization charge is applied to the battery, an additional set of readings must be taken as specified in paragraph A.
- * The suggested registration frequency is an absolute minimum to protect the warranty. For system protection and local conditions or regulations, shorter (quarterly) frequencies may be desirable.

14 **PARTIAL CONNECTIONS**

Partial links must not be used on a battery. This results in overcharging of unused cells and underloading of those cells that power the load, thereby reducing battery life.

15 **NOT TEMPORARY USE**

An installed battery that is expected to remain inactive for 6 months should be treated as follows:

- * Give the battery an equalizing charge. After the equalization charge open the connections to the battery terminals to disconnect the battery charger.
- * Every six months, temporarily connect the battery to the charger and give an equalization charge.
- * To return the battery to normal service, re-tighten all connections as in Section 8.3 and then reconnect the battery to the charger and return the battery to backup service.
- * If the battery is at a high temperature, corrections to the equalization charge time should be applied

16 **CLEANING THE UNIT** [👉👉]

Periodically clean the unit covers to remove accumulated dust. If any units or parts appear stained with electrolyte or show signs of corrosion, clean with a solution of baking soda and water and re-examine the battery within 30 days to determine if the condition reappears.

WARNING

Do not clean the plastic parts with solvents, detergents, mineral oils or spray cleaners as they can cause cracks or breakage of the plastic materials.

17 **PRECAUTIONS DURING THE USE**

17.1 **Accidental Deep Discharge**

This condition occurs when the battery is subjected to prolonged discharge different from that foreseen in the sizing of the battery.

Example: discharge on pilot light, discharge at a weaker regime than that initially calculated, failure of the charging system, battery discharged and not charged immediately.

This type of discharge results in a premature deterioration of the battery and a significant impact on the life span of the accumulator. In order to avoid the occurrence of phenomena of the type described above, the equipment powered by the batteries must be equipped with devices capable of interrupting the supply at the following voltage values:

- * 1,80 V /el for 10 h autonomy
- * 1,75 V /el for 5 h autonomy
- * 1,70 V /el for 1 h autonomy
- * 1,65 V /el for 5-30 minutes autonomy

17.2 **Controls**

Check the total buffer voltage every month

Annually: check the voltage of all individual elements or monoblocks; a voltage variation with respect to the average of $\pm 2\%$ is allowed

Every six months: discharge the battery by checking the autonomy and efficiency of the battery.

18 **Disposal of the exhausted batteries**

Exhausted accumulators fall into the category of “**toxic and harmful waste**” and therefore must be disposed of in compliance with current legislation.

Contact the COBAT Consortium or specialized companies for disposal.



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