



Battery Installation,
Operation and
Maintenance Manual



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Important

Please read this manual immediately on receipt of the battery before unpacking and installing. Failure to comply with these instructions will render any warranties null and void.

Care for your safety

	No smoking, no naked flames, no sparks		Shield eyes		Read instructions
	Electrical hazard		Danger		Re-cycle scrap batteries. Contains lead
	Electrolyte is highly corrosive!		Clean all acid splash in eyes or on skin with plenty of clean water. Then seek medical help. Acid on clothing is to be washed with water		Warning: Risk of fire, explosion, or burns. Do not disassemble, heat above 60°C, or incinerate. Avoid any short circuit. Metallic parts under voltage on the battery, do not place tools or items on top of the battery

Handling

DataSafe® HX+ batteries are supplied in a charged condition and are capable of extremely high short circuit currents. Take care to avoid short-circuiting terminals of opposite polarity.

Use caution when handling and moving batteries. Appropriate lifting equipment must be used.

Keep flames away

In case of accidental overcharge a flammable gas can leak off the safety vent.

Discharge any possible static electricity from clothes by touching an earth connected part.

Tools

Use tools with insulated handles.

Do not place or drop metal objects on the battery.

Remove rings, wristwatch and articles of clothing with metal parts that may come into contact with the battery terminals.

California Proposition 65 Warning - Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

1. Receiving

1.1. In-Transit Damage or Short Shipments

Upon receipt of the shipment, check the contents for damage and completeness against the packing slip. Immediately inform EnerSys® of any damaged or missing items. EnerSys is not responsible for shipment damage or shortages that the receiver does not report to the carrier.

1.2. Shipment Damage or Shortages

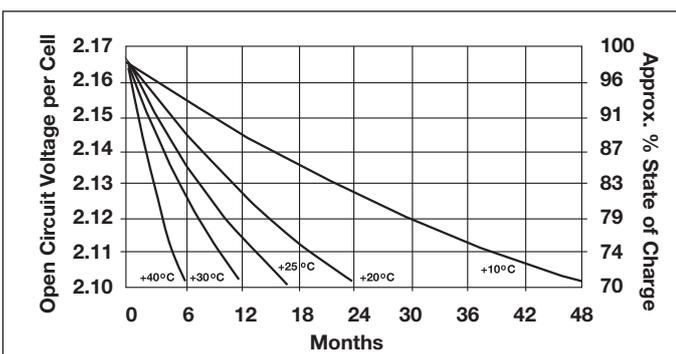
Open the shipping containers and check the contents for damage and against the packing slip. Immediately inform EnerSys of any damaged or missing items. EnerSys is not responsible for damaged or missing items after a shipment has been in storage.

2. Storage

2.1. Storage Conditions and Time

If a battery cannot be installed immediately, it should be stored in a clean, cool and dry area. During storage monoblocs lose capacity through self-discharge. High temperatures increase the rate of self-discharge and reduce the storage life.

The chart below shows the relationship between open-circuit voltage (OCV) and storage time at various temperatures.



The maximum storage times before a refresh charge is required and recommended open circuit voltage audit intervals are:

Temperature (°C / °F)	Storage Time (Months)	OCV Audit Intervals (Months)
+10 / +50	48	12
+15 / +59	34	12
+20 / +68	24	12
+25 / +77	17	6
+30 / +86	12	6
+35 / +95	8.5	3
+40 / +104	6	3

Monoblocs must be given a refresh charge when bloc voltages approach the equivalent of 2.10 Volts per cell or when the maximum storage time is reached, whichever occurs first.

2.2. Refresh Charge

Charge the monoblocs or strings at a constant voltage equivalent to 2.29 - 2.40Vpc with 0.1C₁₀ current available for a period of 24 hours.

2.3. Commissioning Charge

Before commencing operation, the battery must be given a commissioning charge.

- The batteries should be charged using constant voltage with a minimum charge current of 0.1C₁₀ with no load connected to the battery.
- Charge for 48 hours at the charge voltage of 2.30Vpc at 20°C/68°F to 25°C/77°F.

3. Battery Location

The battery compartment/room must have adequate ventilation to limit hydrogen accumulation. Batteries must be installed in accordance with prevailing standards and any other local/national laws and regulations.

4. Installation

Install in a clean and dry area. DataSafe® HX+ batteries release minimal amounts of gas during normal operation (gas recombination efficiency $\geq 95\%$). They can be installed near the main equipment. Batteries must be installed in accordance with local, national and international regulations and manufacturer's instructions.

Temperature

Avoid placing the battery in areas of high temperature or in direct sunlight. The battery will give the best performance and service life when working at a temperature between 20°C and 25°C. The maximum operating temperature range is -30°C to +45°C.

Ventilation

Under normal conditions gas release is very low and natural ventilation is sufficient for cooling purposes and inadvertent overcharge, enabling DataSafe HX+ batteries to be used safely in offices and with main equipment. However care must be taken to ensure adequate ventilation when placed in cabinets. Batteries must not be placed in sealed cabinets.

Security

All installation and ventilation must comply with the current local, national and international regulations.

Mounting

Battery racks or cabinets, supplied by EnerSys, are recommended for proper installation. Assemble the rack according to instructions. Place the monoblocs or cells on the rack and arrange the positive and the negative terminals for connection according to the wiring diagram. Check that all contact surfaces are clean and apply the bloc or cell connectors and the terminal screws. Tighten the screws securely. Follow the polarity to avoid short circuiting of cell groups. Finally connect the battery terminals. It is important that the battery is mounted firmly.

Installation of High Voltage Batteries

A battery consisting of 10 or more blocs connected in series presents additional hazards and the following notes on installation should be employed.

- During installation process, limit the battery voltage by omitting inter-cell connectors to give a maximum section voltage of 120V or 10 blocs.
- The omitted inter-cell connectors should be chosen such that they are in an easily accessible position. These connectors should only be fitted with the load and charger isolated and when the rest of the installation is complete.
- Never work alone on high voltage batteries.
- Always use insulated tools and wear approved high voltage insulating gloves.
- When supplied, fit the "high voltage battery" warning labels in a prominent position.

Torque

Tighten the nuts or bolts to the recommended levels of fastening torque indicated on the product label (if applicable). A loose connector can cause problems in charger adjustment, erratic battery performance, possible damage to the battery, and/or personal injury.

Blocs in Parallel Strings

When using constant voltage chargers, ensure that the connections between the charger and the end of each string within the battery have the same electrical resistance. Parallel strings should be limited to five strings except with an expressed written consent from EnerSys. Parallel strings of five or more require a battery monitoring system that records both voltage and current by string.

5. Operation

5.1. Float Voltage

Constant voltage chargers are recommended. The charging voltage should be set at the equivalent of 2.29Vpc at 20°C/68°F or 2.27Vpc at 25°C/77°F. The minimum charging voltage, at any temperature, is 2.21Vpc. The recommended float voltage temperature compensation is as follows:

	Temperature (°C/°F)						
	10/50	15/59	20/68	25/77	30/86	35/95	40/104
Recommended	2.33	2.31	2.29	2.27	2.25	2.23	2.21
Minimum	2.31	2.29	2.27	2.25	2.23	2.21	2.21

Due to the phenomena of gas recombination, it is not uncommon to note a variation in individual block float voltages of 2% (or up to 5% for relatively new batteries). However the total voltage of the battery shall be within the limits stated above.

5.2. Charging Current

Utilising a constant voltage charger results in a charging current that is self limiting. The minimum rectifier current available should be the load plus 0.1C₁₀ Amps.

5.3. Fast Recharge

Occasionally (4 to 5 times per year) the battery may be recharged at 2.40Vpc at 20°C, with the rectifier current limit set to a minimum of 0.1C₁₀ A. Fast charge should be stopped and reverted to float voltage after approximately 10 to 15 hours.

5.4. Periodic Boost Charge

In normal operation a periodic boost charge is not required. However, in some cases such as when extended or repeated line power outages result in the battery experiencing extended periods of undercharging, a boost charge equivalent to 2.40Vpc at 20°C for a maximum of 15 hours can be applied.

5.5 Ripple Current

Unacceptable levels of ripple current from the charger or the load can cause permanent damage and a reduction in service life. It is recommended to limit the continuous ripple current to 0.05C₁₀A.

5.6 Discharging

For maximum battery life, the end of discharge voltage should be limited to 1.60Vpc. Failure to protect batteries from discharges exceeding this level may impact the warranty.

In order to protect the battery it is advisable to have system monitoring and low voltage cut-out. Deep discharge will produce a premature deterioration of the battery and a noticeable reduction in the life expectancy of the battery.

Discharged Monoblocs

DataSafe HX+ batteries must not be left in a discharged condition after supplying the load, but must be immediately returned to float recharge mode. Failure to observe these conditions may result in greatly reduced service life and unreliability.

Accidental Deep Discharge

When the battery is completely discharged, the sulphuric acid is completely absorbed and the remaining electrolyte consists only of water. At this point, the sulphation of the plates is at its maximum, considerably increasing the cell's internal resistance.

Important notice: this type of deep discharge will provoke a premature deterioration of the battery and a noticeable effect on life expectancy.

6. Maintenance and Records

In practice, the user usually specifies the maintenance schedule based on site criticality, location and manpower. However, the following may be used as a suggested maintenance schedule.

• Monthly (record all readings)

- Measure the battery string voltage. If necessary, adjust the float voltage to the correct value.

• **Every six months (record all readings)**

- Measure the battery string voltage. If necessary, adjust the float voltage to the correct value.
- Measure individual bloc voltages.
- Bloc to bloc connection resistance (Ohms)
- Terminal Connection Resistance (Ohms)
- Ambient temperature in the immediate environment

Inspect for contamination by dust, loose or corroded connections. If necessary, isolate the string/bloc and clean with a damp soft cloth. Warning: Do NOT use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the battery containers or lids. These materials will cause permanent damage to the battery container and lid and will invalidate the warranty.

Keep a logbook to record values, power outages, discharge tests, etc.

An autonomy check can be carried out once or twice a year.

The above record taking is the absolute minimum to protect the warranty.

This data will be required for any warranty claim made on the battery.

Contact EnerSys® if you have any questions regarding maintenance.

7. Disposal

DataSafe® HX+ batteries are recyclable. Scrap batteries must be packaged and transported in accordance with prevailing transportation rules and regulations.

Scrap batteries must be disposed of in compliance with local and national laws by a licensed or certified lead acid battery.



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