

USER MANUAL

Lithium Iron Phosphate Batteries

6.4V • 12.8V • 25.6V



User Manual

Dear customer,

This manual contains all relevant information necessary to install, use and maintain the HAIDI Lithium Iron Phosphate Batteries, either 6.4V, 12.8V and 25.6V batteries. Read this manual carefully before installing and using the product. In this manual, our Lithium batteries as described above, will be referred to as: Sealed Lead Acid Replacement Batteries.

This manual is meant for the installer and the user of the LiFePO₄ batteries. Only qualified, certified personnel may install and perform maintenance on the Sealed Lead Acid Replacement Batteries.

Please consult the index at the start of this manual to read information relevant to you.

This is the original manual, keep it at a safe location!

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1. Introduction

1.1. Product Description

HAIDI's Sealed Lead Acid Replacement Batteries are Lithium Iron Phosphate rechargeable batteries. Lithium Iron Phosphate (LiFePO4) technology is considered as the latest and safest lithium technology available in the market.

Potential applications of this Haidi LiFePO4 battery include: recreational vehicles/Caravans, boats, mobile homes, industrial energy storage solutions.

1.2. Glossary of Terminology

BMS:	Battery Management System
Charge cycle:	A period of use from fully charged, to fully discharged, and fully recharged again
Endurance Life-cycle:	The products maximum lifespan, achieved by following the guidelines presented in this manual
LiFePO4:	Lithium Iron Phosphate
SoC:	State of Charge
CC-CV:	Constant Current - Constant Voltage
DOD:	Depth of Discharge

2. Product Specification

2.1. Product Features & Benefits

- Replacement for sealed lead acid batteries
- Traction battery behavior
- Lithium Iron Phosphate (LiFePO4): Safe lithium technology
- High performance, even under extreme conditions
- Integrated BMS (Battery Management System)
- Fast charging and discharging
- Very efficient, no charge factor
- Maintenance free
- Adaptive cell balancing
- Low self-discharge
- 6000 cycles @ 50% DOD
- 4000 cycles @ 80% DOD
- 2000 cycles @ 100% DOD

Optional

- Smart Battery Monitoring System
- DC Disconnect by Latch Relay (external discharge protection)
- Smart battery charging by Handi/ Supreme/ Supreme Pro chargers
- Smart battery charging by DC alternator with smart regulator (ACR)
- Solar charging by WP solar + smart MPPT regulator
- LED/LCD Display

2.2. Specifications

Article Nr.	6.4V	12.8V	25.6
TECHNICAL SPECIFICATIONS			
Nominal Voltage (V)	6.4 V	12.8 V	25.6 V
Charge Cut-off Voltage	7.8V	15.6 V	31.2 V
End Charge Voltage	7.3 VDC +- 0.2 V	14.6 VDC +- 0.2 V	29.2 VDC +- 0.2 V
Cycle Life @ 1C 100% DOD	>2000 cycles	>2000 cycles	>2000 cycles
Monthly Self Discharge	<3%	<3%	<3%
Temperature Range (Charging)	0°C to 45°C	0°C to 45°C	0°C to 45°C
Temperature Range (Discharging)	-20°C to +60°C	-20°C to +60°C	-20°C to +60°C
Temperature Range (Storage)	0°C to +40°C	0°C to +40°C	0°C to +40°C
Water Dust Resistance	IP56	IP56	IP56
Cell Configuration	2S	4S	8S
Cell Size	18650/26650	18650/26650	18650/26650
Cell Chemistry	LiFePO4, Lithium Iron Phosphate Battery		
Battery Housing	ABS Plastic, UL V0-94		

2.2.1. Product List

Model No.	Nominal Voltage	Rated Capacity	Dimension(mm)			Weight(kg)	Terminal
			Length	Width	Height		
HD 6-4.5	6.4V	4.5Ah	70	47	101	0.34	F1
HD 12-4.5	12.8V	4.5Ah	90	70	101	0.75	F1
HD 12-7.5	12.8V	7.5Ah	151	65	94	1.1	F1
HD 12-10	12.8V	10Ah	151	65	94	1.5	F2
HD 12-12	12.8V	12Ah	152	99	96	1.7	F2
HD 12-18	12.8V	18Ah	181	77	167	2.7	M5
HD 12-20	12.8V	20Ah	181	77	167	3	M5
HD 12-26	12.8V	26Ah	166	175	125	4.2	M5
HD 12-33	12.8V	33Ah	195	130	180	4.8	M6
HD 12-40	12.8V	40Ah	197	165	170	5.75	M6
HD 12-45	12.8V	45Ah	197	165	170	7.52	M6
HD 12-50	12.8V	50Ah	257	132	200	8.12	M6
HD 12-55	12.8V	55Ah	228	138	228	8.12	M6
HD 12-60	12.8V	60Ah	228	138	228	8.82	M6
HD 12-65	12.8V	65Ah	259	168	208	9.3	M6
HD 12-75	12.8V	75Ah	259	168	208	10.8	M6
HD 12-80	12.8V	80Ah	259	168	208	10.8	M6
HD 12-100	12.8V	100Ah	330	173	212	13.6	M8
HD 12-120	12.8V	120Ah	330	173	212	14.7	M8
HD 12-150	12.8V	150Ah	483	170	238	16.5	M8
HD 12-200	12.8V	200Ah	522	240	224	29.6	M8
HD 12-250	12.8V	250Ah	522	240	224	30.5	M8
HD 12-300	12.8V	300Ah	522	268	224	35.0	M8
HD 24-6	25.6V	6Ah	152	99	96	1.7	F2
HD 24-10	25.6V	10Ah	181	77	167	2.8	M5
HD 24-50	25.6V	50Ah	330	173	212	13.6	M8
HD 24-75	25.6V	75Ah	483	170	238	16.5	M8
HD 24-100	25.6V	100Ah	522	240	224	29.6	M8
HD 24-125	25.6V	125Ah	522	240	224	29.6	M8
HD 24-150	25.6V	150Ah	522	268	224	29.6	M8

2.3. Environmental Conditions



Caution! Haidi's LiFePO4 batteries may only be used in conditions specified in this manual.

Exposing the LiFePO4 battery to conditions beyond the specified boundaries may lead to serious damage to the product and/or the user.

Use the LiFePO4 battery in a dry, clean, dust free, well ventilated space. Do not expose the LiFePO4 battery to fire or water or solvents.

When the batteries are placed in an enclosed environment without air circulation, it is advised to provide 2 ventilation holes of 100 mm x 100 mm each, to prevent heat built-up.

Recommended charge temperature range	0°C to +45°C*
Discharging operating temperature range	-30°C to +60°C*
Short term (<1 month) storage temperature range	-10°C to +35°C
Long term (>1 month) storage temperature range	23 ± 5°C
Relative humidity	10-90%

2.4. Product Lay-out and Connections



1. (–) Terminal to connect charger/consumer
2. (+) Terminal to connect charger/consumer
3. Handle for lifting
4. Bottom (we advise to install the bottom in position as shown on the image)

2.5. Operation Modes

Discharge mode

When the LiFePO4 battery voltage is below 2.5 V/Cell.

Deep discharge mode

For example, with 12V battery, when the LiFePO4 voltage is below 6 V. The LiFePO4 battery is not usable anymore, and cannot be repaired, only recycled. Make sure the batteries are not deeper discharged than 10 VDC.

3. Safety Guidelines and Measures

3.1. General

- Do not short-circuit Haidi LiFePO4 battery.
- Treat Haidi LiFePO4 battery as described in this manual.
- Do not dismantle, crush, puncture, open or shred Haidi LiFePO4 battery.
- Do not expose Haidi LiFePO4 battery to heat or fire. Avoid exposure to direct sunlight.
- Do not remove Haidi LiFePO4 battery from its original packaging until required for use.
- In the event of Haidi LiFePO4 battery leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- Use battery charger devices that are capable to charge Haidi LiFePO4 battery.
- Observe the plus (+) and minus (–) marks on Haidi LiFePO4 battery and equipment and ensure correct use.
- Do not use any battery which is not designed for use with Haidi LiFePO4 battery.
- Do not mix batteries of different manufacture, capacity, size or type within a device.
- Keep Haidi LiFePO4 battery clean and dry.
- Secondary batteries need to be charged before use. Always use the correct charger and refer this manual for proper charging instructions.
- Do not leave Haidi LiFePO4 battery on continuous charge when not in use.
- After extended periods of storage, it may be necessary to charge and discharge Haidi LiFePO4 battery several times to obtain maximum performance.
- Retain the original product documentation for future reference.



Warning! Keep the battery away from water, dust and contamination.

Warning! Do not crush or puncture the battery.

Warning! Never touch the battery contacts or allow (conductive) objects to touch the contacts.

3.2. Disposal



Dispose of Haidi LiFePO4 battery in accordance with local, state and federal laws and regulations.

Batteries may be returned to the sellers or Haidi Energy .

Do not mix with other (industrial) waste.

4. Installation

4.1. General Information



Warning! Never install or use a damaged LiFePO4 battery.



Caution! Do not reverse connect the power cables (polarity)

When connecting several batteries in parallel, always use batteries of the same brand, type, age, capacity and state of charge.

4.2. Unpacking

Check Haidi LiFePO4 battery for damage after unpacking. If Haidi LiFePO4 battery is damaged, contact your reseller or Haidi Energy. Do not install or use Haidi LiFePO4 battery if it is damaged!

4.3. Preparing the Battery for Use



Warning! Always remain within the limits indicated in chapter 2 during the use of Haidi LiFePO4 battery.



Caution! In case of an empty Haidi LiFePO4 battery shutdown, charge immediately.

4.3.1. Location of the LiFePO4 battery

Before it is used, the battery must be positioned in such a way that it will not move around in its compartment during use.

Use appropriate LN5 (DIN88) or alternative metal fastening brackets for mounting. Note: battery hold-down mounting brackets are not provided with Haidi LiFePO4 battery.

4.4. Connection Cables (+ and -)

Use appropriate wire for the connection wires to ensure no overheating or unnecessary losses occur. Use appropriate fuses matching the wires and load.

4.5. Connecting a Charger to the LiFePO4 Battery



Warning! Ensure you have completed all the previous steps described in chapter 4 before connecting the battery to the charger.

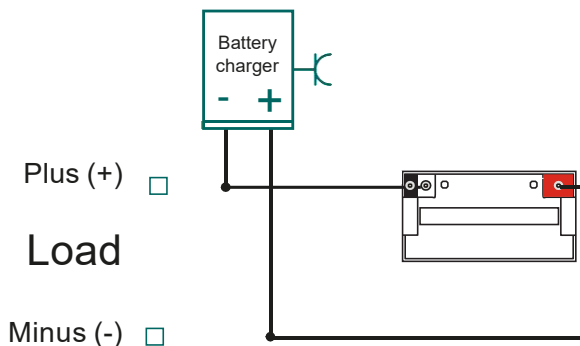


Figure 1. Connecting a charger to the battery

4.6. Connecting Batteries in Parallel to a Charger Device

The max. number of batteries in parallel is 20pcs and the max. number of batteries in series is 4pcs. To divide the current equally amongst batteries, use the schematic below:

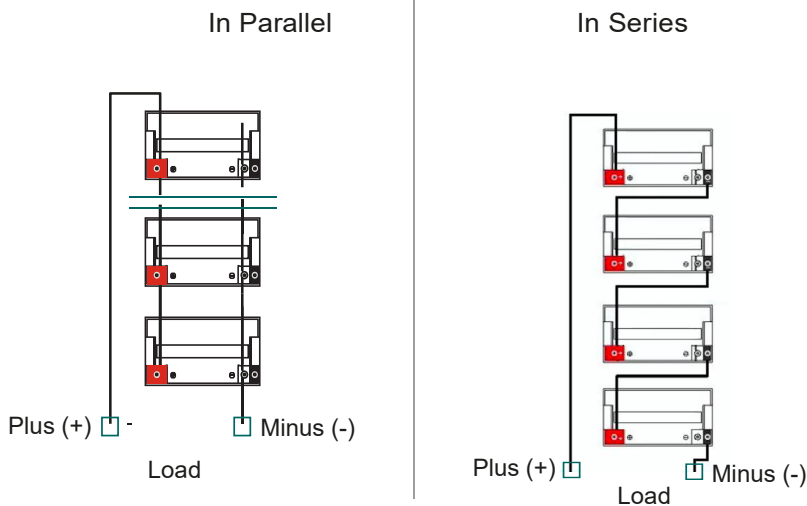


Figure 2. Connecting batteries in parallel or in series

OK: Equally divided battery current. All batteries contribute equally to the current into the load.

NOT OK: Current not equally divided.

Batteries closest to load will have the highest contribution to the current into the load.

Whereas batteries further away from load will have lesser current contribution.

Wear and tear will be higher on Haidi LiFePO4 battery close to the load.

4.7. DC Load Connected - Discharge Protection

Haidi LiFePO4 batteries are as standard equipped with a DC switch-off device which is integrated inside the battery, which is activated at 80% discharge.

However, we recommend to install a bi-stable latch relay which should be installed between the battery and the entire DC load (or inverter) as an extra security. Ask your dealer or supplier for the right device.

4.8. Parallel Battery Use

- 6V batteries can be connected in parallel up to 20 pcs;
- 12V batteries can be connected in parallel up to 20 pcs;
- 24V batteries can be connected in parallel up to 20 pcs;
- 6V batteries can be connected in series up to 20 pcs;
- 12V batteries can be connected in series up to 20 pcs;
- 24V batteries can be connected in series up to 20 pcs;



Caution! Please sort the voltage and internal resistance of the battery blocks before make the connection. To make sure the battery blocks for a battery pack have the same/similar parameters.

5. Battery Use

5.1. General Information

 **Warning!** Follow the safety guidelines and measures of chapter 3.

5.2. Charging

 **Warning!** Never charge Haidi LiFePO4 battery with a charging current larger than 1C.

 **Warning!** Stop charging in case Haidi LiFePO4 battery switches into warning mode.

 **Warning!** Never charge a battery with a charging current larger than 1C.

 **Caution!** Charge before use.

 **Caution!** Disconnect the charger from Haidi LiFePO4 battery if it is not used for a long time.

 **Caution!** To preserve the lifespan of Haidi LiFePO4 battery use a Haidi Energy charger or a charger approved by Haidi Energy.

1. Connect the charger to the battery as described in paragraph 4.6.
2. Charge Haidi LiFePO4 battery in case of an empty shutdown or if the state of charge drops below 20% to preserve the lifespan of Haidi LiFePO4 battery.

5.3. Charging Rate

Haidi Energy Lithium Iron Phosphate batteries can be charged in 1 hour. Displayed in Table are the charge times for Haidi LiFePO4 battery at different charge currents. Always use the indicated charge current and end of charge voltage during charging

Charging rate		
Parameter	Time	Charge current
Maximum	1 hour	1C (90A)
Endurance lifecycle	3 hours	C3 (30A)

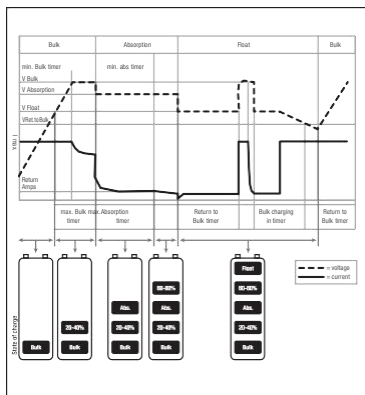
Table 1. Charging rates at different charge currents

5.3.1. Charging Method

Haidi Energy recommends using the following charging method.

A. Constant voltage, constant current, 14.6 V +/- 0.2V for a 12 V battery, 29.2 V +/- 0.2 V for a 24 VDC battery. We recommend to use Haidi Energy battery chargers with settings at “Lithium-mode” for the best result and most safe and reliable configuration.

B. Multiple or three-stage charging, see graphic at right, is allowed. Haidi Energy can supply you with a battery charger with an optimized curve. We recommend to use Haidi Energy chargers with settings at “Lithium-mode” for the best result and most safe and reliable configuration.



Bulk phase

In this phase the batteries are charged with a constant current up to the end of charge voltage (U_{bulk}). If U_{bulk} is reached the charger will automatically switch to absorption phase. The maximum charge current (I_{max}) for Haidi Energy batteries is 1C, however for endurance cycle life Haidi Energy suggests to limit the current to C3 (1C = nominal battery capacity, C3 = 1/3 of nominal capacity). On some chargers the maximum charger active time (t_0) can be programmed. Haidi Energy suggests setting t_0 to: $t_0 = 2 \cdot (BT_{cap} / Chcur)$ Example: Battery capacity = 90Ah, Charger = 45A, Set to a maximum of $2 \cdot (90/45) = 2$ hours.

Bulk Phase				
Parameter	Typical	Min	Max	Remark
I_{max}		-	-	1C (90 A)
t_0	Depends on the battery SoC	-	-	$2 \cdot (BT_{cap} / Chcur)$

Table 2. Bulk Phase

Absorption phase

In this phase the charge voltage must be maintained at $U_{Absorption}$ to fully charge Haidi Energy battery and set the SoC counter to 100%, see Table. This phase is finished when the SoC is indicating 100%.

Absorption Phase			
Parameter	Typical	Min	Max
$U_{Absorption}$	14,6V DC	14,2V DC	14,6V DC
t_1	20 minutes	10 minutes	1 hour

Table 3. Absorption Phase

Float phase

In this phase the charge voltage is set to U_{Float} .

Float Phase			
Parameter	Typical	Min	Max
U_{Float}	13,8V DC	13,6V DC	14V DC

Table 4. Float Phase

Discharge Phase			
Parameter	Typical	Min	Max
U_{Float}	13,5V DC	13.4V DC	13,6V DC

Table 5. Maintenance phase

5.3.2. Battery Balancing

The BMS automatically balances the cells if necessary. Balancing can take place during charging and idle mode and will not have an effect on the functionality of Haidi Energy battery.

6. Inspection, Cleaning and Maintenance

6.1. General information



Warning! Never attempt to open or dismantle Haidi LiFePO₄ battery! The inside of Haidi LiFePO₄ battery does not contain serviceable parts.

1. Disconnect Haidi LiFePO₄ battery from all loads and charging devices before performing cleaning and maintenance activities (see paragraph 4.8).
2. Place the enclosed protective caps over the terminals before cleaning and maintenance activities to avoid the risk of contacting the terminals.

6.2. Inspection

1. Inspect for loose and/or damaged wiring and contacts, cracks, deformations, leakage or damage of any other kind. If damage to Haidi Energy battery is found, it must be replaced by a professional. Do not attempt to charge or use a damaged Haidi Energy battery. Do not touch the liquid from a ruptured battery.
2. Regularly check the Ion Power Basic battery's state of charge. Ion Power Basic battery will slowly self-discharge when not in use or whilst in storage. (see paragraph 5.3)
3. Consider replacing the Ion Power Basic battery with a new one if you note either of the following conditions: The Ion Power Basic battery run time drops below 80% of the original run time. The Ion Power Basic battery charge time increases significantly.

6.3. Cleaning

If necessary, clean Haidi Energy battery with a soft, dry cloth. Never use liquids, solvents, or abrasives to clean the Ion Power Basic battery.

7. Storage

Follow the storage instructions in this manual to optimize the lifespan of Haidi LiFePO4 battery during storage. If these instructions are not followed and Haidi LiFePO4 battery has no charge remaining when it is checked, consider it to be damaged. Do not attempt to recharge or use it. Replace it with a new LiFePO4 battery.

See chapter 2.4 for storage temperature conditions.

The self-discharge of Haidi LiFePO4 battery is 1-2% per month.



Warning!

1. Charge Haidi LiFePO4 battery to > 80% of its capacity before storage.
2. Disconnect Haidi LiFePO4 battery from all loads and, if present, the charging device.
3. Place the terminal covers over Haidi LiFePO4 battery's terminals during storage.
4. Charge Haidi LiFePO4 battery to > 80% of its capacity every 100 days. After charging set the LiFePO4 battery in storage mode again.

8. Disposal and Recycling

8.1. General Information

Always discharge Haidi LiFePO4 battery before disposal. Use electrical tape or other approved covering over the battery connection points to prevent short circuits.

Battery recycling is encouraged. Dispose of the battery in accordance with local, state and federal laws and regulations. Batteries may be returned to the manufacturer.

USA & Canada:

Lithium Iron Phosphate batteries are subject to disposal and recycling regulations that vary by country and region. Always check and follow your applicable regulations before disposing of any battery. Contact Rechargeable Battery Recycling Corporation (www.rbrc.org) for U.S.A. and Canada, or your local battery recycling organization.

EC

Waste must be disposed of in accordance with relevant EC Directives and national, regional and local environmental control regulations. For disposal within the EC, the appropriate code according to the European Waste Catalogue (EWC) should be used.

Other

Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles.

9. Warranty and Liability

9.1 Upon delivery, the customer is obliged to immediately verify whether the products have been damaged during transport. The customer must notify the dealer of such transport damage as soon as possible, in any event no later than within three (3) days of delivery, by means of an accurate, written statement, stating the damage and where possible a photograph. Failure to inspect the products and inform the dealer within the stated time or the use of the products at any time shall be conclusive evidence that Haidi Energy has satisfactorily tendered delivery.

9.2 In the event that the customer demonstrates that any of the delivered products do not conform to the agreement, Haidi Energy (at its option, upon having received those products returned by the customer) has the option to either repair or replace such products by new products, or to refund the invoice value, exclusive of any dispatch costs.

9.3 Haidi Energy grants a five years limited warranty (PRO-RATA) for damages caused by manufacturing defects starting at the time of delivery. Damages caused by manufacturing defects do not include damage resulting from (a) general wear and tear, (b) short circuit, (c) overcharging, (d) deep discharging, (e) overheating of the products (f) installation of the product by persons unskilled to work with electro-technical devices or components, (g) any other wrongful use contrary to the Whisper Power's user manual or the safety instruction, (h) any use contrary to the product specifications of that product; (i) any acts of force majeure.

9.4 Except as specified in the clause 9.3 Haidi Energy makes no warranty, whether express or implied, including without limitation any implied warranty of merchantability and fitness for a particular purpose or any warranty arising from any course of dealing, course of performance or usage of trade and specifically disclaims any representation or warranty that the product will meet customer's requirements, perform any specific function or achieve a desired result other than expressly stated by Haidi Energy in writing.

9.5 Any liability to the customer in any case ceases to apply in the event that the customer fails to notify Haidi Energy of the existence of the defect within ten (10) days of having discovered the defect, in writing, in order to enable Haidi Energy to investigate the damage.

9.6 Any liability of Haidi Energy for damage suffered by the customer is in any case limited to the invoice amount of the relevant products, unless such damage has been caused by gross negligence or willful misconduct of Haidi Energy.

Haidi Energy can never be held liable for (a) damage caused by any of the circumstances mentioned in

clause 9.3, leading to damage to the Haidi Energy products or to any other device located near those products, or (b) consequential damage or (c) loss of profits or goodwill.

9.7 To the extent that a court determines that the limitation of liability as meant in clause 9.6 cannot be invoked against a particular claim for damages by the customer, Haidi Energy's liability for loss of property, damage to property, and bodily injury (including death) caused by the application of those particular Haidi Energy products shall in any event be limited to the amount actually paid out by Haidi Energy's insurance company to Haidi Energy in accordance with the insurance cover of that insurance policy for that particular type of damage. Haidi Energy has taken out insurance against certain risks, as described in the respective insurance policies. These policies contain a usual limitation of insurance payment to be paid out to Haidi Energy if, and to the extent that, the event is a covered event.

