

# ACES

Affordable Compact  
Energy Solutions

## USER MANUAL

24V 48V 72V  
HFP HFC Series



HFP and HFC series in metal case  
LITHIUM **LiFePO<sub>4</sub>** BATTERIES



ACES ENERGY BV®

# TABLE OF CONTENTS

<b>1. Product description</b>	<b>3</b>
1.1 Introduction HFC and HFP series Batteries	3
1.2 General	3
1.3 Product features	3
1.4 Technical specifications 24V 80...400AH	4
1.5 Technical specifications 48V 72...100AH	5
1.6 Technical specifications 48V 100...300AH	6
1.7 Technical specifications 72V 60...100AH	7
1.8 Performance curves	8
1.9 Battery Management System (BMS)	9
1.10 ACES Lithium in comparison with Lead-acid battery 48V	10
1.11 ACES Lithium in comparison with Lead-acid battery 72V	11
<b>2. Safety guidelines</b>	<b>12</b>
2.1 General rules for safety	12
2.2. Explanation of the symbols on the battery	12
2.3 Battery handling precautions regarding safety	13
2.3 Transport guidelines	13
2.4 End Of Life and disposal	13
<b>3. Installation</b>	<b>14</b>
3.1 Mounting and connection instructions	14
3.2. Set to work	14
3.3 Short circuit prevention	14
3.4 Maintenance	14
<b>4. Use of the battery</b>	<b>15</b>
2.1 Charge	15
2.2. Discharge	15
2.3 Deep discharge	15
<b>5. Technical support</b>	<b>16</b>
<b>6. Warranty and liability</b>	<b>17, 18</b>
<b>7. Glossary abbreviations</b>	<b>18</b>
<b>8. CE declaration</b>	<b>19</b>

# 1. Product description

## 1.1 Introduction HFP HFC series Batteries

Reading this manual first before use of the ACES Lithium battery is very **IMPORTANT!!**

HFP batteries are based on prismatic LFP cells and HFC batteries are based on cylindrical cells.

We want you to have a battery that can last for a long time. Using the batteries according to this manual helps to achieve this. This user manual is applicable for HFP/HFC batteries delivered by ACES after August 2020.

Dependent on the application this type of battery could have a lifetime of about 10-15 years.

Wrong usage of lithium batteries in general can lead to unsafe situations or permanently defect batteries.

This manual explains clearly how to use the ACES lithium batteries in the right way.

## 1.2 General

ACES Lithium batteries are designed in the Netherlands and are built with LiFePo<sub>4</sub> or LFP cells.

The cells have a 3.2V nominal voltage.

In contrast with Lithium NMC, NCA, LMO and LCO cells these LiFePo<sub>4</sub> cells are inherently safe.

NMC, NCA, LMO and LCO cells can become unstable at high temperatures

The NMC, NCA, LMO and LCO cells are used in electric cars, phones, bicycles, tools, toys and RC-models.

LFP cells do not contain Cobalt and Manganese and do not catch spontaneously fire or can explode.

These batteries are the best replacement for lead acid batteries.

Compared to Lead-acid ACES LiFePo<sub>4</sub> batteries offer much longer life, and will accept much easier.

high charge currents, which is a big advantage for solar panels. Charging is possible at any moment.

They have a smaller volume and up to 5 times lower weight.

Where a lead acid battery has about 50-60% capacity left at 1C discharge, the ACES lithium battery

has still 100%. ACES Lithium Ion batteries can be discharged 100%, whereas leadacid 50-80%.

The ACES lithium Ion batteries are expected to have a lifespan of 10-20 years and more than 3000 cycles before the capacity reaches 80%.




AGM lead-acid batteries have 1-5 years lifetime and about 300-500 cycles to 80%.

The Built-in Battery Management System protects the battery against fault conditions.




## 1.3 Product features

- LFP (LiFePo<sub>4</sub>) chemistry using cells with high power density
- Most safe Lithium Technology
- Can be connected in parallel up to 4 batteries
- Integrated BMS (Battery Management System)
- Electronic short circuit protection and integrated fuse
- Overload protection
- Except high charge currents
- Can be fast charged in about 1 hour
- A red led indicates the battery is in protection mode
- Can be charged at all charge levels without shortening battery life
- Failsafe BMS protection functions
- Strong Stainless steel case with handgrips
- Broad range of ACES chargers available for these batteries

## 1.4 Technical specifications 24V HFP HFC series batteries (80...400AH)




			
Description	25.6V 80AH	25.6V 100AH	25.6V 400AH
Model name	AL24V80HFP	AL24V100HFP	AL24V400HFP
EAN / GTIN	4738471069023	AL24V100HFP	AL24V400HFP
Rated Capacity	80Ah / 2048WH	100Ah / 2560WH	400Ah / 10240WH
Discharge current (Imax)	80A	80A	200A
Peak discharge current	200A	200A	500A
Maximum charge current	40A	50A	100A
Recommended charge current	8...40A	10...50A	40...100A
Nominal Voltage	25.6V		
Operational Voltage range	22...27V		
BMS cutoff Voltage	20V		
Cycle Life 0.2C 80% DOD	3000		
Charge end voltage range	28...28.8V		
Charge characteristic	CC / CV		
Battery Management System	Integrated		
Serial connection	Not allowed		
Parallel connection	Up to 4 batteries		
Short circuit protection	Yes, electronic protection and fuse		
IP protection rating	IP65		
Temperature range discharge	-20°C ... +60 °C		
Temperature range charge	0°C ... +45 °C		
Temperature storage <1 month	-20°C ... +50 °C		
Temperature storage >1 month	5 °C ... +30 °C		
Connection	M8	M8	M8
Weight	18 kg	23 kg	81 kg
Dimensions (L x W x H) mm	266 x 156 x 268	266 x 156 x 310	570 x 297 x 317
Warranty	3 years		

## 1.5 Technical specifications 48V HFC HFP series batteries (72...100AH)



			
Description	48V 72AH	48V 80AH	48V 100AH
Model name	AL48V72HFC	AL48V80HFP	AL48V100HFP
EAN / GTIN	4738479545574	4738474226959	4738476131657
Rated Capacity	72Ah / 3686WH	80Ah / 4096WH	100AH / 5120Wh
Discharge current (Imax)	72A	80A	100A
Peak discharge current	240A	240A	300A
Maximum charge current	36A	40A	50A
Recommended charge current	8...36A	8...40A	10...40A
Nominal Voltage	51.2V		
Operational Voltage range	44...54V		
BMS cutoff Voltage	40V		
Cycle Life 0.2C 80% DOD	3000		
Charge end voltage range	56...57.6V (Float voltage 54V)		
Charge characteristic	CC / CV		
Battery Management System	Integrated		
Serial connection	Not allowed		
Parallel connection	Up to 4 batteries		
Short circuit protection	Yes, electronic protection and fuse		
IP protection rating	IP65		
Temperature range discharge	-20°C ... +60 °C		
Temperature range charge	0°C ... +45 °C		
Temperature storage <1 month	-20°C ... +50 °C		
Temperature storage >1 month	5 °C ... +30 °C		
Connection	M8	M8	M8
Weight	35 kg	36 kg	44 kg
Dimensions (L x W x H) mm	435 x 253 x 237	393 x 247 x 248	393 x 297 x 248
Warranty	3 years		



## 1.6 Technical specifications 48V HFC HFP series batteries (160...300AH)

			
Description	48V 160AH	48V 200AH	48V 300AH
Model name	AL48V160HFP	AL48V200HFP	AL48V300HFP
EAN / GTIN	4738478446971	4738477302087	4738472496255
Rated Capacity	160Ah / 10240WH	200Ah / 10240WH	300Ah / 15360WH
Discharge current	130A	150A	200A
Peak discharge current	400A	400A	500A
Maximum charge current	100A	100A	100A
Recommended charge current	20...60A	20...60A	20...100A
Nominal Voltage	51.2V		
Operational Voltage range	44...54V		
BMS cutoff Voltage	40V		
Cycle Life 0.2C 80% DOD	3000		
Charge end voltage range	56...57.6V (Float voltage 54V)		
Charge characteristic	CC / CV		
Battery Management System	Integrated		
Serial connection	Not allowed		
Parallel connection	Up to 4 batteries		
Short circuit protection	Yes, electronic protection and fuse		
IP protection rating	IP65		
Temperature range discharge	-20°C ... +60 °C		
Temperature range charge	0°C ... +45 °C		
Temperature storage <1 month	-20°C ... +50 °C		
Temperature storage >1 month	5 °C ... +30 °C		
Connection	M8	M8	M8
Weight	65 kg	81 kg	118 kg
Dimensions (L x W x H) mm	573 x 300 x 275	570 x 297 x 317	818 x 297 x 317
Warranty	3 years		

## 1.7 Technical specifications 72V HFC HFP series batteries (60...100AH)

		
Description	72V 60AH	72V 100AH
Model name	AL72V60HFC	AL72V100HFP
EAN / GTIN	4738470348563	4738476404171
Rated Capacity	60Ah / 4416WH	100Ah / 7360WH
Discharge current	60A	80A
Peak discharge current	180A	200A
Maximum charge current	30A	40A
Recommended charge current	8...30A	10...40A
Nominal Voltage	73.6V	
Operational Voltage range	64...78V	
BMS cutoff Voltage	60V	
Cycle Life 0.2C 80% DOD	3000	
Charge end voltage range	81...82.8V (Float voltage 78V)	
Charge characteristic	CC / CV	
Battery Management System	Integrated	
Serial connection	Not allowed	
Parallel connection	Up to 4 batteries	Special version
Synchronized protection	Yes; Connection between batteries	No
Short circuit protection	Yes, electronic protection and fuse	
IP protection rating	IP65	
Temperature range discharge	-20°C ... +60 °C	
Temperature range charge	0°C ... +45 °C	
Temperature storage <1 month	-20°C ... +50 °C	
Temperature storage >1 month	5 °C ... +30 °C	
Connection	M8	
Weight	40 kg	64 kg
Dimensions (L x W x H) mm	374 x 264 x 305	404 x 372 x 260
Warranty	3 years	

### 1.8 Performance curves of all the batteries

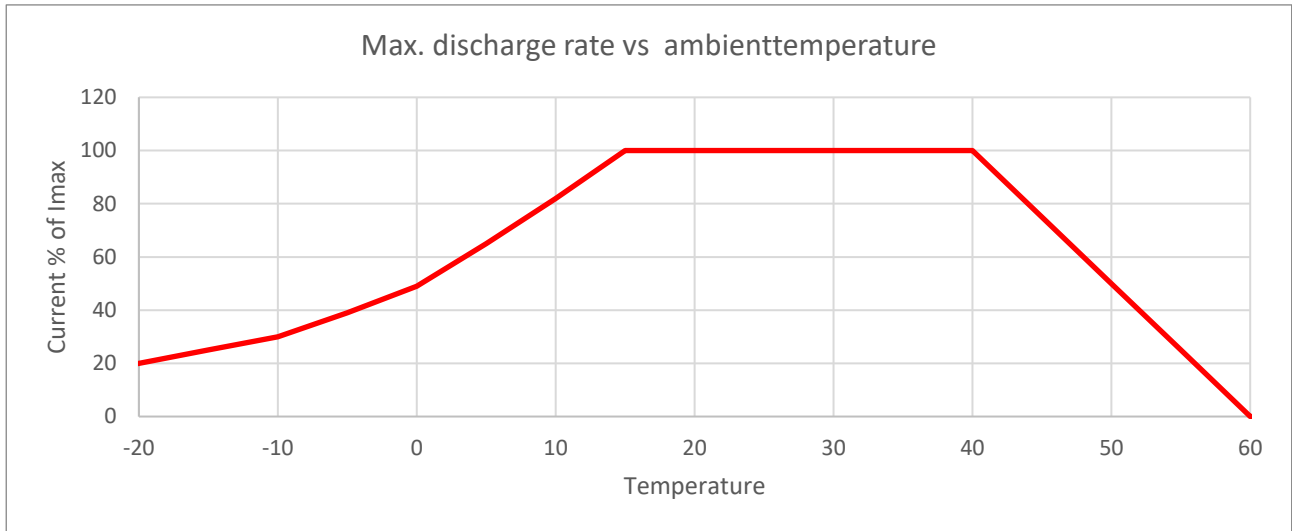


Fig. 1

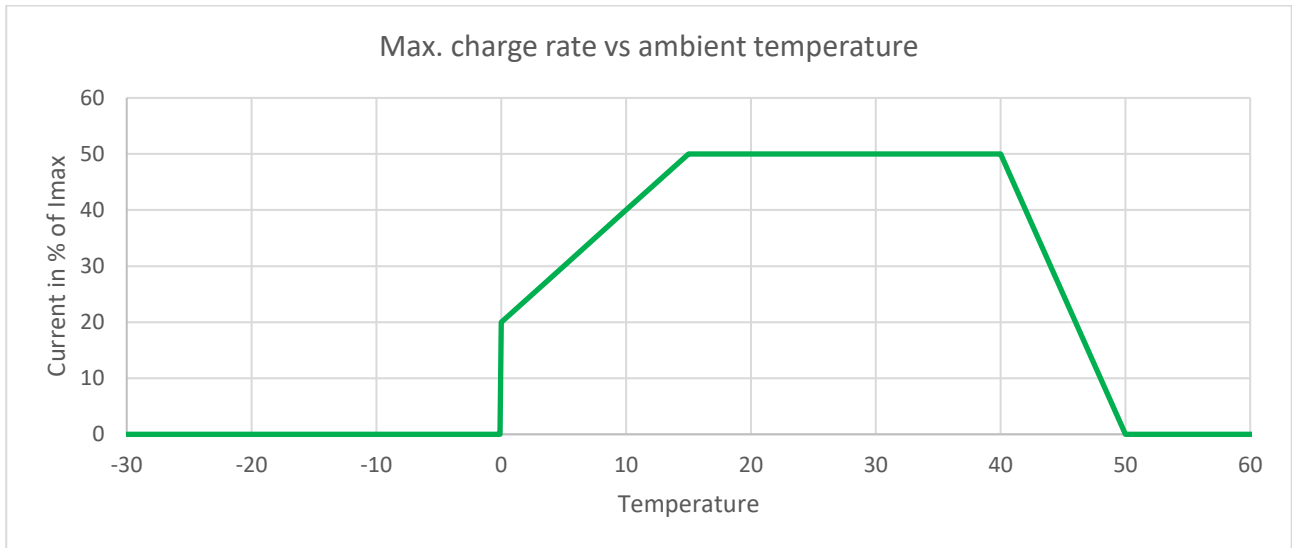


Fig. 2

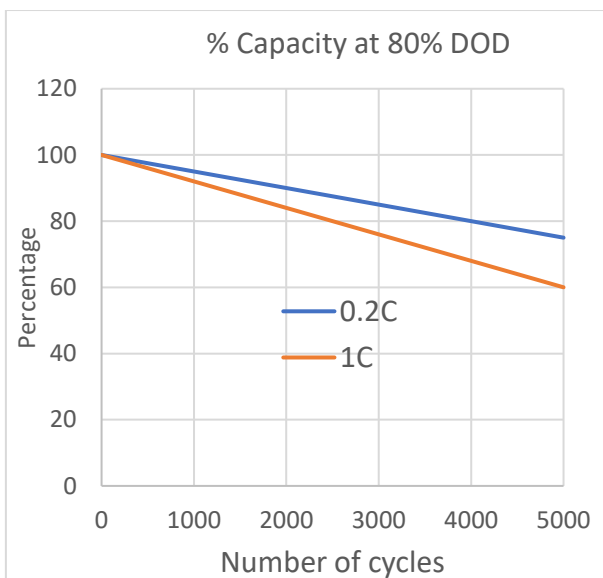


Fig. 3

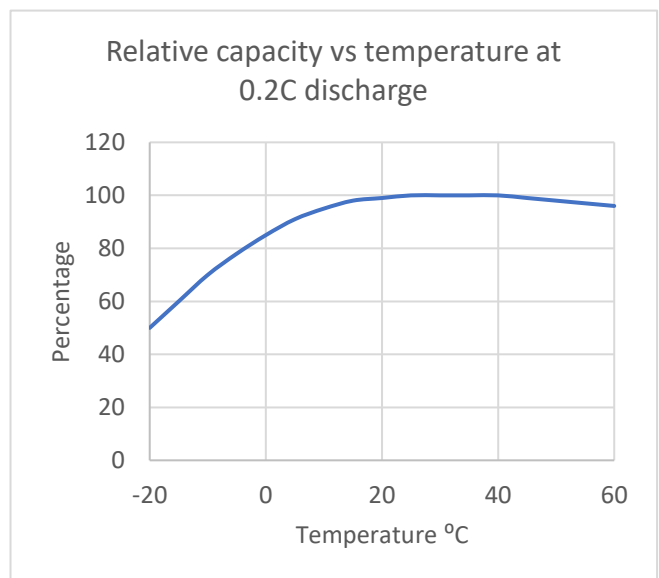


Fig. 4

Note: all values are typical values



## 1.9 Battery Management System (BMS)

The BMS will protect the battery against faults. See table below or a listing of BMS protections.

This guarantees the best safety and best functionality of the battery.

The BMS balances the cells, as a result the battery will keep its maximum capacitance during life.

### A red led indicates that the battery is in protection:

When the red led is lighting during charging the led will stop lighting after some time or when the battery is discharged. When the red led is lighting during discharging the led will stop lighting after a long time or when the battery is charged. When the red led is lighting because of a temperature protection the led will stop lighting when the temperature recovers.

During a short circuit the red led will light and stops lighting when the shortcircuit is removed.

### Synchronized protection

Only the 72V60HFC battery has a synchronized protection feature. It means when one battery goes into protection state during the discharge, other parallel connected batteries are going also into the protection state. From all batteries a cable can be connected to a junction box.

### Protection functions of the BMS:

Protection code	Protection description	Explanation of the protection	Red led light
OCP	Overtoltage Cell Protection	When a cell voltage is > OCP level then the charging is stopped. Slow automatic recovery by internal cell balancing. Or recovery by discharge the battery	yes
UVP	Under Voltage Pack protection	When battery voltage is < UVP level then the discharging is stopped Recovery by charge the battery	yes
UCP	Undervoltage Cell Protection	When a cell voltage is < UCP level then the discharging is stopped Recovery by charge the battery	yes
SCP	Short Circuit Protection active	When the SCP is active the discharging is stopped. Recovery by remove shortcircuit	yes
OCD	Over Current Discharge protection	Stops the discharging after discharge current too high; automatic recovery after about 90 seconds	yes
OTD	Over Temperature Discharge protection	Stops the discharging after temperature too high; automatic recovery when the temperature decrease by about 10gr.C	yes
OTC	Over Temperature Charge protection	Stops the charging after temperature too high; automatic recovery when the temperature decrease with about 10gr.C	yes
UTC	Under Temperature Charge protection (below zero degrees)	Stops the charging after temperature below 0 gr.C; automatic recovery when the temperature increase with about 10gr.C	yes
UTD	Under Temperature Discharge protection	Stops the discharging after temperature too below -15 gr.C; automatic recovery when the temperature increase with about 10gr.C	yes

## 1.10 ACES Lithium Ion batteries in comparison with Lead-acid batteries for 48V

<b>Application</b> 	<b>1 x LiFePO4 ACES lithium 48V 200AH AL48V200HFP</b> 	<b>4 x in series VMF AGM Accu 280Ah Deep Cycle</b> 	<b>Benefits of ACES LiFePO4</b>
Weight	82 kg	4 x 74 = 296kg	28% of the weight
Rated capacity C5	200AH	229AH	Rated capacity seems lower, but in use it is much higher
Life Cycles@80% DOD	3000	380	Much longer cycle life about 8 times more
Dimensions	570x297x317mm 53.7 Liter	4 pcs 521x269x224 124.7 Liter	57% less volume
Life Cycles@50% DOD	10000	750	Cycle life > 10 times
Capacity % @ 0°C	85%	76%	Best cold temp performance
Capacity @ C20 Capacity @ C5 Capacity @ C1	205AH 203AH 200AH	280AH 229AH 150AH	Almost 100% energy and power at any discharge rate
Max discharge level Usable capacity at C5 Usable capacity at C1	100% 203AH 200AH	80% 183AH 120AH	Fully useable discharge range, more AH/discharge
1 year storage cap.	90%	64%	Much lower self discharge
Short circuit prot.	yes	no	Electronic and fuse short prot.
Maintenance	None	Low	No maintenance
Charge all SOC levels	yes	no	All SOC without lifetime impact
Fast charging time	2 hours	6 hours	Can be charged 3 times faster.
Cost price incl TAX*	€ 6500	€ 1196	Higher initial cost
<b>Cost/cycle@50% DOD and C5 discharge</b>	<b>€ 0,65</b>	<b>€ 1,59</b>	<b>Lowest cost per cycle</b>

\*Prices are only for reference (status January 2021)

This comparison is made for a typical application for use in a boat of about 6m length

### 1.11 ACES Lithium Ion batteries in comparison with Lead-acid batteries for 72V

<b>Application</b> 	<b>2 x parallel LiFePO4 lithium 72V 60AH</b> 	<b>9 x in series AGM T875 Battery 8V 180Ah Deep Cycle</b> 	<b>Benefits of ACES LiFePO4</b>
Weight	82 kg	4 x 74 = 296kg	28% of the weight
Rated capacity C5	120AH	180AH	Rated capacity seems lower, but in use it is much higher
Life Cycles@80% DOD Life Cycles@50% DOD	4000 10000	400 750	Much longer cycle life about 10 times more
Dimensions	374x264x305 mm 30 Liter	9 pcs 261x182x275 117 Liter	65% less volume
Left cap. at 12V (0.3C)	108AH	80AH	Voltage more constant
Capacity % @ 0°C	85%	76%	Best cold temp performance
Capacity @ C20 Capacity @ C5 Capacity @ C1	125AH 123AH 120AH	180AH 144AH 96AH	Almost 100% energy and power at any discharge rate
Max discharge level Usable capacity at C1 Usable capacity at C5	100% 120AH 123AH	80% 62AH 115AH	Fully useable discharge range, more AH/discharge
1 year storage cap.	90%	64%	Much lower self-discharge
Short circuit prot.	yes	no	Electronic and fuse short prot.
Maintenance	None	Low	No maintenance
Charge at all SOC levels	yes	no	All SOC without lifetime impact
Fast charging time	1 hour	6 hours	Can be charged 6 times faster.
Cost price incl TAX*	€ 5000	€ 2994	Higher initial cost
<b>Cost/cycle@50% DOD and C5 discharge</b>	<b>€ 0,50</b>	<b>€ 3,99</b>	<b>Lowest cost per cycle</b>

\*Prices are only for reference (status Januari 2021)

This comparison is made for a typical application for use in a golfcar or UTV

## 2. Safety guidelines







### 2.1 General rules for safety

These batteries shall only be serviced by authorized personnel.

Batteries opened by non-authorized personnel can have potential hazards and ACES cannot grant warranty on the product anymore.

The lithium batteries can provide extremely high currents, therefore be careful not to place any metal parts on the battery. Be careful when wearing metallic watches or armbands.

### 2.2. Explanation of symbols on the battery

	Operational ambient temperature range -20°C ... 45°C
<b>IP 65</b>	Ingress protection rating IP65
	The battery should be kept far away from fire hazards
	Service and opening the battery is not allowed by unqualified persons
	The battery shall be disposed according local regulations
	This battery or parts of it can be recycled
	Conformity Declaration sign to EU legislation

### 2.3 Battery Handling Precautions regarding safety

- Don't immerse battery in water or allow it to get wet!
- Don't charge, use and store battery near a heat source such as fire heater!
- Don't reverse the positive and negative pole of battery!
- Don't throw the battery into fire or heat it!
- Don't short-circuit the battery with wire or other metal objects!
- Don't nail, knock or trample the battery!
- Don't disassemble the battery in any way!
- Don't put the battery into microwave oven or pressure vessel!
- If the battery gives off odor, gets very hot, has deformation, has discoloration or appearance, has abnormal behaviors, stop using it.
- Don't use battery in a very hot environment, such as under direct sunlight or in car on a hot day. The battery can overheat which will affect battery performance and shorten the battery life!
- If the battery leaks and electrolyte leakage enters into the eyes, don't rub, rinse with water immediately and seek immediate medical assistance.
- During charging process, if there is odor or unusual noise, end charging immediately.
- During discharging process, if there is odor or unusual noise, end discharging immediately.
- If there is any of above strange behavior, please contact ACES, and do not disassemble by yourself.

### 2.4 Transport guidelines

The battery must be transported in original packing

Lithium batteries are classified as dangerous goods, should be treated according category UN3480, class 9 and should be packed according UN-handbook.

For land and sea transport the batteries must be packed according packing description P903.

For air-transport (IATA) the batteries must be packed according P965.

The original packing is according these rules.

### 2.4 End of Life and disposal

ACES LiFePO<sub>4</sub> batteries are considered EOL (End Of Life) when the usable capacity drops below 70% of the initial capacity. EOL or defect lithium batteries are not allowed to put in private or industrial waste.

Therefore lithium batteries need to be disposed separately according EU standard 2002/96/CE to official Recycling places. Lithium batteries or parts of it can be recycled.

## 3. Installation

### 3.1 Mounting and connection instructions

Check the battery for damages before installation. If a battery has damages contact your reseller. A maximum of 4 batteries can be connected in Parallel. Maximum allowable current is  $I_{max} * (N-1)$ . Series connection is not allowed unless otherwise stated.

The battery can be mounted using special straps or clamps. Always put rubber foam in between.

The battery shall be connected by using M8 screws as included and cable lugs (torque of about 10-15 nm).

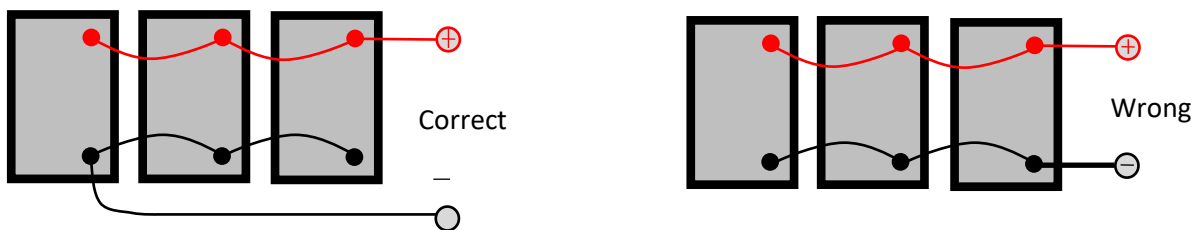
The battery shall be mounted on rubber foam or rubber blocks.

Fixing of the battery shall be strong and suitable for the application.

The cable cross section shall be suitable for the maximum continuous current.

Finally the cable connection shall be isolated by a suitable cable-boot, red for + and black for -.

### 3.2 Parallel connection of the batteries



Before parallel connection follow the instructions below:

- Make sure all the batteries are fully charged and have the same voltage (within 1%)
- Use only batteries with the same capacity and the same age
- The best is to use new batteries
- Use only short cables suitable for the amount of current
- The batteries have an electronic overcurrent protection and an internal fuse

### 3.3 Short circuit prevention

The battery is electronically protected for short-circuit. Additionally the battery contains a fuse that will not trip in normal use. The fuse only can trip at short-circuit when the electronic protection fails.

### 3.4 Maintenance

No regular maintenance is needed for the battery.

Check the connection to the battery poles regularly if the screw is fixed strongly.

Clean the battery poles when corrosion is visible.



## 4. Use of the battery

### 4.1 Charge

1. Use only appropriate CC/CV chargers suitable and designed for LiFePO<sub>4</sub> batteries with charge end-voltage and charge current within according battery specification.  
For longest cycle life use the recommended IP67 ACES charger.
2. After finishing the charge to 100% the charger shall switch-off or fall back to floating voltage.  
If the maximum charging voltage is kept for a long time battery lifetime will be shortened.
3. The battery can be charged at every SOC level without impact on lifetime
4. The battery will not accept charge current below 0°C
5. The battery can accept fast charging up to 1C. It is not recommended to do this always, because it will reduce cycle-life substantially.
6. Switch on/off the charger first before connect/disconnect to the battery.
7. Always charge the battery to 100%. When the charger is ready it is recommended to keep the charger connected for at least 3 hours. During this time the battery will finish the internal cell balance process. When the cells are fully balanced each time, there will be no loss of capacity over long time due to balance mismatch.

### 4.2 Discharge

1. Care should be taken that the battery is not discharged with currents exceeding the specification.
2. If the battery is discharged with maximum currents at high ambient temperatures it is possible BMS thermal protection will switch off the battery.
3. It is recommended to set the undervoltage protection level in the connected equipment to a level higher than the BMS UVP level. Advised for 12V battery 11.5V, 24V battery 24V, for 48V battery 48V.
4. If during discharge the BMS undervoltage protection level is exceeded, the battery will switch itself off. The battery will switch on again when a charger is connected.

### 4.3 Deep discharge

Deep discharge means that the battery is fully depleted and switched off by the BMS UVP.

This is an unwanted situation, because after longer period in UVP protection the cells can be completely deep discharged. Completely deep discharged cells means the battery is permanently defect and cannot be repaired. Warranty is not granted when batteries are used like this.

Deep discharge with permeant damage can have following reasons:

1. During long time storage, connected equipment to the battery have still current draw and finally the battery goes in UVP protection mode. Too long time in this protection mode can cause deep discharge.
2. The battery is not charged before long, e.g. a winterstop, period.
3. The battery poles are not disconnected before a long period of no usage.

Solution: Charge the battery to 100% before winterstop or long period not use and disconnect the poles.

**Important!! Charge the battery always directly after use. The battery shall be fully charged at least every 6 months to prevent deep discharge!!**

## 5. Technical support

When the battery is in protection mode a red led will light. Protection due to charging can be recovered by discharge the battery. Protection due to discharging can be recovered by charge the battery.

Following situations can apply:

Fault description	Possible cause	Solution
0V output voltage on poles	Internal fuse defect	Repair by ACES service center
Too low voltage on poles 1	BMS in protection UVP	Charge the battery
Does not charge	BMS in protection OVP	Discharge the battery
Too low voltage on poles 2	BMS in protection OTP	Wait until battery cools down
Too low voltage on poles 3	BMS in protection UTP	Use battery above -10 °C
Too low voltage on poles 4	BMS in protection OCD	Will recover within 1 minute after load disconnect
Too low voltage on poles 5	BMS in protection SCP	Will recover within 1 minute after remove short circuit
Battery does not charge 1	BMS in protection UTC	Use battery above zero °C
Battery does not charge 2	BMS in protection OTC	Wait until battery cools down
Battery has too low AH 1	Cells unbalanced	Keep charger connected at least 3 hours after 100% charge; After doing this many times the battery AH increase to normal
Battery has too low AH 2	Defect in BMS or cells	Repair by ACES service center

If the suggested solution doesn't help it is recommended to send the battery to ACES service Center.

Contact details ACES service Center:

### ACES Energy

Ambachtstraat 36

7622AP Borne

The Netherlands

Email: [support@aces-energy.nl](mailto:support@aces-energy.nl)

Tel: +31 (0) 74-7857701

## 6. Warranty and liability

### ACES ENERGY GENERAL TERMS AND CONDITIONS OF WARRANTY ON PRODUCTS.

#### 6.1 SCOPE

ACES Energy BV or ACES Energy SP BV, hereafter stated as ACES, offers manufacturer's guarantee as described in this document.

The prerequisite for a warranty claim is a defect or a malfunction that affects the intended use of the battery is no longer possible or is disproportionately restricted.

The guarantee period is not extended due to the granting of Services under this guarantee, in particular not for replacement or repair. In this case, the guarantee period does not start again.

This warranty does not limit legal provisions of the customer and are valid for all ACES lithium batteries with a purchase date from 01/01/2018. Accessories, consumables and other accessories are excluded.

The geographical scope of guarantee protection is Europe-wide and place of jurisdiction is the Netherlands.

#### 6.2 IDENTIFICATION

All batteries and chargers delivered are uniquely identified with a serial number printed on a label attached to the product.

If the label is not clearly readable or removed it causes loss of warranty on the product.

#### 6.3 PERIOD OF WARRANTY FOR ACES PRODUCTS

- The period of warranty for HP and HFA Series Lithium Battery is 60 months starting from the moment it is invoiced.
- The period of warranty for HF Series or Lithium Battery is 36 months starting from the moment it is invoiced.
- The period of warranty of custom designed LiFePO4 Batteries is 36 months starting from the moment it is invoiced.
- All other ACES products have 24 months of warranty starting from the moment it is invoiced.
- At the end of the above mentioned period, the warranty will automatically expire without any notice
- The eventual repair or substitution does not extend the period of warranty.
- For distributors and OEM customers the warranty is extended for 3 months from the date of the invoice.

#### 6.4 WARRANTY

Only manufacturing faults are covered by the warranty. The warranty is limited to the original paid purchase price. ACES liability under this guarantee is limited to the exchange, repair, reimbursement of the product. The guarantor is solely responsible for the choice of an exchange, repair or reimbursement of costs. Is this defective product no longer in the delivery program, so the guarantor reserves the right to replace it with a technically equivalent one from the current range.

Not covered by the warranty are listed below:

- Damages, defects or malfunctions caused by force majeure, like lightning, overvoltage, severe weather, flood, fire.
- Procedures described in the installation manual are not followed.
- Using the batteries or products outside the specifications and safety precautions as stated in the user manual.
- Incorrect installation or commissioning, malfunction of other devices
- Failures caused by HW or SW design of parts that are designed not under responsibility of ACES
- Changes to and/or dismantling of the battery or product

## 6.5 WARRANTY MANAGEMENT AND RETURN CONDITIONS

As soon as a problem is noticed, ACES ENERGY must be informed within 7 days.

- Provide information about the exact model of the product, the quantity, the serial number, the supplier, the date of purchase and a copy of the original invoice.
- The warranty may be not applicable if it is not possible to see how the battery battery is used.
- Customers shall arrange the return of the products at their own expenses.
- Batteries will be checked in less than 10 labor days from their arrival at ACES.
- After analysis, repair or replacement they will be shipped back to the customer.
- Defective batteries or products arriving within the warranty period and excepted for warranty, will be repaired or replaced, and shipped back to the client under warranty.

## 6.6 NO WARRANTY CHARGES

In case of batteries or products returned are not defective or out of warranty, investigation and repair cost will be offered to the customer before repair.

If products have damage, are modified or opened by non-qualified persons no warranty can be granted.

The Analysis cost of 100 Euros is always invoiced to the customer.

If repair is not possible the total cost is limited to the analysis cost.

## 6.7 TRANSPORT

The sender will be liable for the quality of the packaging.

ACES, will not be liable for damages on products during the shipping, following the shipment conditions at the expenses of the sender.

Transport damages at receival at ACES of returned products will be reported by ACES to the sender within 24 hours.

The carriage of lithium batteries is subject to special restrictions. For defective batteries special rules apply. At delivery of the returned product by ACES, the customer shall immediately check on damages and make sure to make a written note to the transporter in case of damages.

All damages at delivery must be reported to ACES ENERGY within 24 hours after delivery.

ACES ENERGY is not liable for eventual direct or indirect damages to people or things by the damage of the product or caused by the improper use or transport of the product itself.

## 6.8 RETURN ADDRESS

ACES-ENERGY B.V.

Ambachtstraat 36

7622 AP Borne, The Netherlands

Tel. +31 (0) 74-7857701

## 7. Glossary of Abbreviations

Abbreviation	Explanation
BMS	Battery Management System for battery protection and monitoring
CC/CV	Constant Current / Constant Voltage charge
Cycle	1 Cycle is use of the battery after discharge and charge
EOL	End Of Life
LiFePo4	Lithium Iron Phosphate chemistry; in short LFP
NMC	Nickel Manganese Cobalt chemistry
LCO	Nickel Cobalt Oxide chemistry
LMO	Nickel Cobalt Manganese chemistry
SOC	State Of Charge in %, means AH-used/AH-rated *100%

## 8. CE declaration

### DECLARATION OF CONFORMITY



COMPANY : ACES Energy B.V.  
ADDRESS : Ambachtstraat 36  
7622 AP Borne  
The Netherlands

Declares that the following products:

PRODUCT : Lithium Ion LiFePO4 Battery – Metal case  
BRAND : ACES Energy  
MODEL NAME : - AL12V50HF / AL12V80HF  
- AL24V80HFP / AL24V100HFP  
- AL48V72HFC / AL48V80HFP / AL48V100HFP  
- AL48V160HFP / AL48V200HFP / AL48V300HFP  
- AL72V60HFC / AL72V100HFP

Are in conformity with the requirements of the following Directives of the European Union:

#### Directive 2014/30/EU with the following harmonized standards:

EN 61000-6-3:2007/A1:2011/AC:2012  
EN 61000-6-2:2005/AC:2005

CE MARK DATE : 21-04-2020  
Signed : Wolter Buikema

Authority : Director