



中航锂电(洛阳)有限公司

CHINA AVIATION LITHIUM BATTERY CO., LTD.

Lithium-ion Battery Manual for After Sales Service

China Aviation Lithium Battery Co., Ltd.

Lithium-ion Battery

Manual for After Sales Service

CALB-Version3.0

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This manual is only for the foreign clients who signed a contract with CALB or the overseas Representative Office abroad of CALB.

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It is really appreciated that you choose the Lithium-ion battery made by CALB. Please read this instruction carefully before using the battery. In order to make sure of using correctly, please keep this service manual carefully for future reference.

1. Attentions before Battery Using

1.1 The battery user shall carefully read the battery using guide and other explanatory materials, familiar with the charging and discharging characteristics, understand the usage of BMS and charging generator before using our products.

1.2 Dynamic monitor is necessary for OCV of individual cell at any time or condition, charging & discharging test without BMS or PCB is forbidden under any situation in case of any kind of over charge or discharge.

1.3 Battery safety valve is explosion-free designed for avoiding longtime overcharging, damageable extrusion and accidental short circuit. Screw action is not allowed under any circumstance, as illustrated in picture 1.3.



Picture 1.3



Picture 1.4

1.4 The action of twisting the pole bolts is also not allowed under any circumstance, as illustrated in picture 1.4.

1.5 New ex-factory cell usually have 60% of SOC. Do not use the battery for a long time before the



adjustment of BMS and charger completed in case of over discharge the battery.

1.6 BMS shall have cell using data storage and fault code record function, the historical data for last week or permanent data is necessary for analysis the reason of failure.

1.7 How to recognize the laser encoding of the battery.

Bar codes of the battery are 16 digits, including 3 digits of area code, 3 digits of capacity code, 6 digits of production date and 4 digits of serial number.

Specific Instructions are as follows.

a. Area Code

America	NSA
Europe	Space+EU
Asia, Africa and Australia	Space+AP

b. Capacity Code

Capacity code is the number of capacity of the battery. For example, the capacity code of 100AH is 100.

c. Production Date

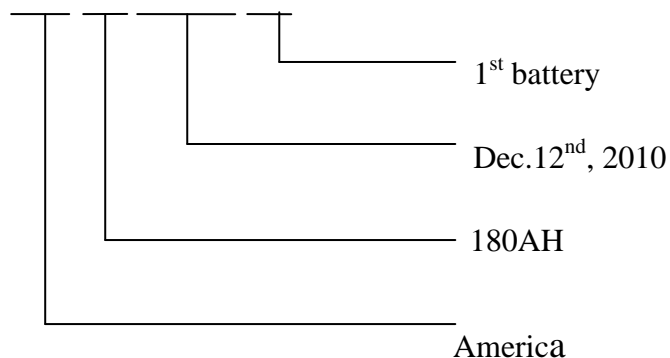
Manufacturing Department mainly confirmed the date. Same date with a batch of batteries is suggested. Date format: year/month/day

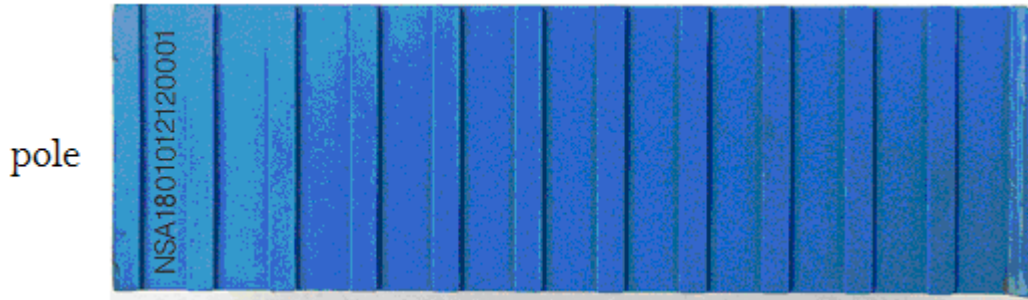
For example, Dec.2nd, 2010, that is 101202 which generally for the date of production.

d. Serial Number

Based on the amount of batteries, 4 digits in all. Such as the serial number of the 20th battery is 0020.

For example, the coding is NSA1801012120001, as illustrated in picture 1.7.





Picture1.7

2. Technical Requirements for Battery Charging & Discharging

In addition to the special description, the following is the Charging & discharging parameter.

2.1 Individual cell charging constant voltage: 3.6V (CCCV charging mode, charging voltage for the period which from CC model to CV model.)

2.2 Charging voltage for N cells connected into series: $N \times 3.60V$ (CCCV charging model, charger shall automatic convert to CCCV when individual cell voltage rise up to 3.60V.)

2.3 Trickle charge current for CCCV model: 0.05C (During CV charging period, charging process shall be regarded as over when charging current fall down to 0.05C.)

2.4 Cut-off charging voltage for individual cell: 3.90V (Charging maximum charging voltage for individual cell, charging current shall be cut-off immediately when individual cell voltage rise up to 3.9V.)

2.5 Individual cell charging float voltage: 3.40V (Charging voltage for the applications in storage power of photovoltaic energy conversion system, UPS power and automobile auxiliary power.)

2.6 Float charging voltage for N cells connected into series: $N \times 3.40V$.

2.7 Individual cell discharging alert voltage: 3.0V (dynamic value @ 0.3C)(When OCV of individual cell fall down to 3.1V, the depth of discharge has been over 85%; when OCV of individual cell fall down to 3.0V, the depth of discharge has been over 90%. Strongly recommend shallow charge and discharge the cell, if the BMS find individual cell voltage fall down to 3.0V, cell shall be charged on time.)

2.8 Individual cell discharging cut-off voltage: 2.50V (dynamic value @ 0.3C)(Minimum discharge voltage is 2.0V @ -20°C, when individual cell voltage fall down to 2.0V, output current shall be



cut-off immediately, if cell been over discharge seriously, the damage which cause by that is unrecoverable.)

2.9 Cell temperature parameters (measure the terminal temperature): BMS shall able to boot the cooling fan when cell temperature raise up to 40°C; BMS shall able to decrease the motor power when cell temperature raise up to 50°C; BMS shall able to shut down the motor when cell temperature raise up to 55°C.

2.10 Standard requirement of charging & discharging is 0.3C.

2.11 Directly charging under 0°C is not allowed. Temperature range for charging from 5°C—45°C is recommended.

3. Installation and Maintenance

3.1 Basic Requirements for Battery Installation

3.1.1 Each group of battery must be properly fixed to the battery box which shall be placed on battery pole up mode after clamping. Changing the direction of installation is not recommended, pictures are as follows.



Picture 3.1.1.1: Keeping the battery pole upward



Picture 3.1.1.2



Picture 3.1.1.3

3.1.2 When using the battery modular group fixture provided by our company, make sure to tighten flat mattress and spring mattress on the rod, assemble and tighten the nut completely to ensure the battery pack maintain clamping state during the bumping driving process, as illustrated in picture 3.1.2.1. The battery users should also obey the above principles if they connect up the cells themselves.



Picture 3.1.2.1: Four batteries connected up for a group

3.1.3 The Battery Module in the compartment should keep 30mm-50mm space at the top to facilitate the connection of a battery management system, wiring harness and repair lines also for



better heat elimination.

3.2 Basic Requirements for Battery Connection

3.2.1 It is necessary to put on insulating gloves in the process of battery connection.



Picture 3.2.1.1: Must put on insulating gloves



Picture 3.2.1.2

Picture 3.2.1.3

3.2.2 Socket wrench, fixed wrench, screwdriver and other tools have to be make strict insulated treatments, as illustrated in picture 3.2.2.1. Pay attention for the metal items carrying-on, such as keychains, watches, necklaces etc. Never contact those metal items to the pole, in case of short circuit.



Picture 3.2.2.1: Tools need to be make strict insulated treatments

3.2.3 Make sure to avoid short-circuit phenomenon, reverse connection and other possible condition, pictures are as follows.



Picture 3.2.3.1



Picture 3.2.3.2

3.2.4 Before connecting the battery and management systems, battery aluminum pole on the surface need sanding to remove the oxide layer to reduce contact resistance, as illustrated in pictures below.

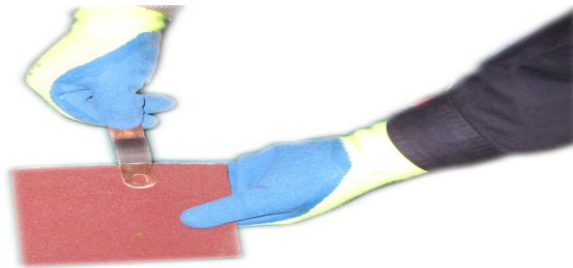


Picture 3.2.4.1: Using sandpaper



Picture 3.2.4.2: Sanding the battery

pole



Picture 3.2.4.3: Sanding the connector

3.2.5 Bolts on battery poles must be tightened so as to avoid osculate resistance increase.

3.2.6 Battery pole metal is aluminum material, do not use excessive force when tighten the bolts, so as not to strip the screw thread.

3.2.7 Please use the torque spanner of 5—30NM during tightening bolts. The specific types of torque spanners match to the specific type of batteries.

Serial Number	Battery Type	Pole Bolts	Tightened Torque (N m)	Notes
1	40AH	M6×16	9	
2	60AH	M6×16		
3	100AH	M8×16	20	Use the pneumatic
4	130AH	M8×16		



5	160AH	M8×16		wrench of 0.5KG, torque of 8NM
6	180AH	M8×16		
7	200AH	M8×16		
8	210AH	M8×16		
9	240AH	M8×16		
10	400AH	M14×16	30	
11	500AH	M14×16		
Note: All the data is artificially measured. The material of bolts is A2-70.				

3.3 Basic Requirements for Battery’s Storage and Maintenance



Picture 3.3.1: Battery’s storage

3.3.1 If not for temporarily use, the battery should be stored at temperature of 5-40 °C, dry, clean and well-ventilated warehouse.

3.3.2 Batteries, which in use or inventory, should be excluded from direct sunlight, also should be away from heat sources at a distance of no less than 2m.

3.3.3 Batteries shall be stored in boxes, or flat laid with insulated material and marked by obviously.

3.3.4 Battery inventory shall not be placed upside down or lying. Mechanical shock or stress, and cells exposed to heat and rain is strictly prohibited.

3.3.5 Formulate the tracking table of stock battery voltage, and check inventory battery voltage every two week and record the result.

3.3.6 Fully charge and discharge the cells per month @0.3C, and record the result.



4. Troubleshooting Methods



Beware of electric shock

Warning

- 4.1 Great attention must be paid on the security of repair maintenance operations and construction of high-voltage battery pack.
- 4.2 The battery pole is made from aluminum material; please use the screw tap if you accidentally damage the bolts because of excessive force using.
- 4.3 During the process of charging and discharging, in particular, high-current charge and discharge the battery, if BMS detected any certain individual battery voltage fluctuated widely, and was markedly different from other batteries, please check on it carefully.
 - 4.3.1 Whether you have tightened the bolt on the terminals, if not, please tighten it.
 - 4.3.2 Whether the oxide layer on the surface of the battery's two polarity pole has been wiped off; if not, use sand paper to clean it.
 - 4.3.3 Whether the BMS voltage acquisition line is reliable, please correct the fact connection if not .
 - 4.3.4 Whether there are problems of connection across compartment or over length of wire. Large tolerance will be caused by high voltage depreciation.
 - 4.3.5 If there is oxide layer between busbar sheets, please replace the busbar.
- 4.4 Once the battery is accidentally over-discharge, first charge the battery with lower 0.1C current and discharge the battery with normal situation after the voltage came up to 3.20V or



higher. If the voltage cannot be restored, please replace it with the backup battery.

4.5 Once you reverse charging the cells, please replace the cells with substitutions. Make sure the new cell gains the same SOC with other cells.

4.6 If you have any other technical problem, welcome to call our Customer Service Department, +86-0379-65196060.

5. Quality Assurance

5.1 The ways and conditions of quality assurance: battery sales are identified that based on its laser barcode, our company will not be responsible for after sales service if there is no laser barcode. According to the area code, the representative office which is in charge of this area will solve the problem. Head office of CALB will not be responsible for after sales service directly.

5.2 Before setting up the overseas representative office, head office of CALB is in charge of the after sales service directly.

5.3 Battery warranty period is 36 months (from the date of Shipping out of factory). If there are warranty terms in the contract, please follow the contract.

5.4 In the first 18 months, if batteries cannot be used because of the quality, and is in accord with the exchanging requirement of our company, we will exchange them for free (including the round-trip freight).

5.5 In the last 18 months, if batteries cannot be used because of the quality, and is in accord with the exchanging requirement of our company, we will exchange them timely and afford 50% cost.

5.6 Identification method: the identification must be proceeded by CALB's Customer Service Department or the third party authority admitted by CALB. The fare will be paid by customers in advance. The result of the identification shows that if batteries do have quality problems, CALB will pay the fare and send money back to customers in cash or some other ways, if not, customers will pay instead.

5.7 Methods for quality assurance

5.7.1 in the quality assurance period, if the batteries cannot be used because of its quality



problem, please first contact the technician in the nearest representative office for consultancy.

5.7.2 After the confirmation from the technicians, please send the problematic battery to the representative office. At the same time, the technicians there would give relevant feedback to the CALB's Customer Service Department.

5.7.3 After the representative office receives the abnormal battery, it will have them tested, and if it does have a problem, an email with an application for exchanging battery will be sent to Customer Service Department, and then report to the manager in Marketing Department. The problematic battery will be exchanged after the confirmation by the manager.

5.7.4 The representative office will mark, record and store these problematic batteries in certain places for future recollection.

5.7.5 The quality assurance period for newly exchanged battery is based on the date of previous ones.

5.8 Customers must fill in the Battery Quality Issue Feedback Sheet first, and also offer the photos or data of unqualified batteries.

6. Disclaimer

CALB shall not undertake any loss, cost which caused by users' inappropriate use of the products as follows:

6.1 Using and testing batteries without reliable BMS or PCB which cause part short-circuit or over discharge.

6.2 Reverting charges the cells which destroy the cells.

6.3 Not effectively controlling the charging process which over charge the cells.

6.4 Not effectively controlling the discharging process which over discharge the cells.

6.5 Not selecting appropriate cable, connector, lug and other electrical components which cause safety issues by over heat.

6.6 Not installing high voltage protection component within main loop. Damage the device by damaged and aging of the wire.



- 6.7 Adopting the connection method which affect the SOC balance of battery modules (exp. Support devices with the power from some of the cells), which cause over discharge of some cells.
- 6.8 Bad connection between cable lug and bus bar, decrease the life span by over heat which caused by loosen of the bolt.
- 6.9 Not checking and maintaining the batteries periodically, not removing the accident potential on time.
- 6.10 Any other loss because of not following this manual.

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