



VALVE REGULATED LEAD ACID SERIES BATTERIES

Manual of operation and maintenance

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LEOCH sealed lead acid battery is shipped with charge, handle the battery according to the following instructions before use:

1. Battery storage

- ✧ If the battery has high temperature or poor ventilation during storage and delivery, the self-discharge will be increased. So, keep good ventilation and keep away from fire, flame, heat supply etc.
- ✧ When keep the battery, take it off from the charger and load and keep it in the dry and cool place.
- ✧ After storing for a long time, please charge the batteries before use.

2. Use circumstances

- ✧ Temperature range: $-40\sim+60^{\circ}\text{C}$;
- ✧ No fire, flame and heat supply near the battery;
- ✧ Avoid the heat supply and direct sunshine place;
- ✧ Avoid the humid and soggy place;
- ✧ Avoid the obturating place.

3. Use conditions

- ✧ Parallel connection: recommend within 4 groups;
- ✧ Multilayer assembly: temperature among layers should be controlled within 3°C ;
- ✧ Heat dispersing: keep around 20mm inter cell;
- ✧ Ventilation: ensure the volume concentration of released hydrogen smaller than 0.8%;
- ✧ Best ambient temperature: $+5\sim+35^{\circ}\text{C}$.
- ✧ Float use: limited current $\leq 0.30C_{10}$, voltage $2.23\sim 2.27\text{V}/\text{cell}$;
- ✧ Cycle use: limited current $\leq 0.30C_{10}$, voltage $2.40\sim 2.50\text{V}/\text{cell}$;
- ✧ Mix use of batteries: disallow the mix use of new and old batteries, batteries from different manufacturers, if ask to mix use, please contact us.

4. Assembly of batteries

4.1 Open box and check

- ✧ Handling:
 - Forbid the force on the terminal, avoid the affect to the sealed part;
 - Avoid the upside down, throw or impact of battery;
 - Absolutely avoid metal wire such as steel rope etc. to prevent the short circuit.
- ✧ Inspection: packaging、appearance of battery——no damage;
- ✧ Count check: battery quantity、 spare parts——full;
- ✧ Reference: catalogue、 assembly drawing、 notice.

4.2 Notice before assembly

- ✧ If no abnormality after check, assemble the batteries in the designated place such as battery chamber;
- ✧ If assemble the batteries in the battery chamber, try to place them in the rock bottom of battery chamber;
- ✧ Avoid assembling the batteries near the heat supply such as transformer place;
- ✧ As battery may cause flammable gas during storage, avoid closing with the unit which produce flame such as fuse when assembly.
- ✧ Before connecting, clear the terminals to make it present metal brightness.
- ✧ Be care that conductive material and battery positive and negative terminal form short circuit.
- ✧ When multi batteries are used together, connect the batteries correctly firstly, then connect the battery with charger or load. In this circumstance, battery positive should be connected with the positive terminal of charger or load and negative connect with negative terminal. If the battery isn't connected with charger correctly, the charger will be damaged, so make sure that the connection is made correctly.
- ✧ Don't give extreme force on the terminals when connecting, every connecting nut and screw should be tighten, please refer to the torque as table 1.

Table 1 Suggested torque table

S/N	Range	Torque
1	M6	3.9~5.4 N*m(40~55kgf*cm)
2	M8	11~14.7N*m(111~150kgf*cm)

4.3 Assembly and connection

- ✧ Pack the metal assembly tool such as spanner with insulation tape;
- ✧ Connect the batteries first, then connect the battery group with charger or load;
- ✧ When multi-group batteries are parallel connected, connect in series first and then parallel connect;
- ✧ To ensure good ventilation, the batteries per row should keep around 10~20mm inter-distance;
- ✧ Before connection, clear the battery terminals to make it present metal brightness;
- ✧ Before and after connection, paste certain antirust such as Vaseline on the surface of battery post;
- ✧ After assemble batteries, test the whole voltage of the battery group and if ok, then with load.

4.4 Use of battery

4.4.1 Supplement charge

- ✧ During the delivery and storage, the battery will lose part of the capacity due to self discharge, so please supplement charge before use;
- ✧ If stop using temporarily during use, please supplement charge termly;
- ✧ Supplementary charge according to the table below before use;

Table 2 The time interval of supplementary charge and storage temperature

Storage temperature	Time interval of supplementing charge	Supplementing charge way
20°C or less	Every 9 months	a) Charging at a constant voltage of 2.23-2.27V/cell and an initial current less than 0.3C (A) for 2-3 days b) Charging at a constant current of 0.3C(A) and a constant voltage of 2.35-2.45V/cell for 10-16 hours c) Charging at a constant of 0.1C(A) for 8-10 hours 3 options for choice
20°C~30°C	Every 6 months	
30°C~40°C	Every 3 months	

Note: Current value C is rated capacity of battery.

For example: rated capacity of 12V100AH battery is 100AH, $0.1C(A) = 0.1 \times 100 = 10A$;


For example: charge voltage: 12V battery is $2.25 \times 6 = 13.50V$, 6V battery is $2.25 \times 3 = 6.75V$

4.4.2 Discharge

- ✧ The maximum allowable discharge current does not exceed the value below:
 - discharge current $I \leq 1C_{10}(A)$, continuous discharge;
 - discharge current $I = 3C_{10}(A)$, discharge time $T \leq 2min$;
 - discharge current $I = 6C_{10}(A)$, discharge time $T \leq 10s$.
- ✧ Final discharge protective voltage as below:

Table 3 Final discharge voltage

Discharge current	Final discharge voltage (V/cell)	Remark
0.2C(A) or less	1.80	(1) Current value C is rated capacity (2) Current discharge rate should be not less 0.05C(A)
0.2C~0.5C(A)	1.75	
0.5C~1C(A)	1.70	
Above 1C(A)	1.60	

 Noted:

- 1) Do not let terminal voltage drop to the above specified value
- 2) Do not storage after discharge, please supplementary charge immediately

4.4.3 Charge

4.4.3.1 Float charge

- ◆ Charge parameter
- ◇ Charge voltage: 2.23~2.27V/cell(25°C)
- ◇ The maximum charge current: 0.30C₁₀
- ◇ Temperature compensation coefficient: -3mV/°C.cell(taking 25°C as base point)
- ◇ Total variation range of charge voltage is ±0.02V/cell

📖 Note:

- 1). Every batteries voltages of a battery group have a little difference at the beginning of use, half year later they become consistent.
- 2).Effect by too high float voltage or too low float voltage as below :
 - Too high for a long time (overcharge):life shortened
 - Too low for a long time (not charge enough): Can not meet load or make battery voltages inconsistent and the battery group capacity will drop accordingly and life is shortened.

4.4.3.2 Cycle use charge

- ◆ Charge parameter
- ◇ Charge voltage: 2.40~2.50V/cell(25°C)
- ◇ The maximum charge current:0.30C₁₀
- ◇ Temperature compensation coefficient: -3mV/°C.cell(taking 25°C as base point)
- ◇ Total variation range of charge voltage:±0.02V/cell
- ◇ Supplementary charge capacity is 110%~130% of discharge capacity, ambient temperature is below5°C, if do not know how many discharge capacity, please refer to the following table to supplementary charge:

Table 4 Supplementary charge

Ambient temperature (°C)	Charge voltage(V/cell)	Charge time (h)
5	2.31	7
	2.46	4
20	2.25	7
	2.40	4
35	2.21	7
	2.34	4

📖 Note:

- 1). Charge time is the time when terminal voltage reaches value as the above table shows during charging at a constant 0.30C (A) or less.
- 2). If the charge time is over the time as above table, it will cause over charge, which will shorten the life of the batteries; if the charge time is less than the time as above table, the batteries will can not meet the normal capacity.

4.4.3.3 Equalization charge

- ◆ Charging parameter
- ◇ Charging voltage: 2.35~2.40V/cell(25°C)
- ◇ Maximal charging current: 0.30C₁₀
- ◇ Temperature equalization parameter: -3mV/°C.cell(25°C)
- ◇ Variation scope of charging voltage: ±0.02V/cell

📖 Notes:

Do not carry this operation under standard float charging. Adopt equalization charging under below situations:

- Discharging capacity is above 20% of rated capacity.
- Lay aside the battery without using it for more than 3 months.
- Float voltage of battery unit is less than 2.18V/cell
- Continuously float charging battery for 3~6 or low voltage battery appears in battery group.
- Full float charging for above one year.

4.4.4 Notes during charging

- ✧ Charging current at the end of charging is over 0.05CA, which may result in permanent damage on battery appearance and battery life, please pay more attention to charging voltage.
- ✧ The used charger should have degressive automatic constant voltage device, please contact us if use other kind of charger.

5. Battery maintenance

5.1 Cleanness

- ✧ Keep the battery surface and its working circumstance clean and dry.
- ✧ Keep battery clean and avoid static condition.
- ✧ Clean battery with wet cloth, no organic solvent such as gasoline, alcohol etc. or clothes with such substance is used to clean battery.

5.2 Inspection and maintenance

To better understand the operation of battery and equipment also to prevent battery damage during inspection, please periodically inspect the battery and record it.

5.2.1 Inspection items of each month:

Items	Contents	Standards	Maintenance
① Total float charging voltage of battery group	Measure output end voltage of positive and negative end of battery group with voltage mete.	Float voltage of battery unit X battery quantity	Adjust the departure value to the standard value.
② Battery appearance	Inspect if battery case and cover bulge, leakage or damage or not.	Battery appearance is OK	Find out the reasons if exist abnormal appearance, please change battery if it effects the normal use of battery.
	Inspect if there is dust or stain	Clean in appearance	Clean the dust and stain with wet cloth.
	Inspect if the harness and terminal etc rust or not.	No rust	Clean the rust, change the harness and paste antirust.
③ Connection Parts	Inspect if bolts/nuts loosen or not.	Fastness in connection	Tighten the loosen bolts/nuts.
④ Switch DC power supply	Cut off AC power supply and change to DC power supply	Successfully switch AC power supply to DC power supply	Correct the departure if any

5.2.2 Inspection items per quarter

Items	Contents	Standards	Maintenance
Float voltage of each battery	Measure the end voltage of each battery in battery group.	Float voltage value after temperature equalization $\pm 50\text{mV}$	If float voltage is over standard value, please equalization charge the battery group after discharging them and then float charge them for 1~2 month, please contact us if still have any departure.

5.2.3 Inspection item per year

Items	Contents	Standards	Maintenance
①Checking discharge test	Cut off AC power supply, discharge battery with load, and discharging 30%~40% rated capacity.	Battery voltage should be over 1.90V/cell after discharging.	If battery voltage is lower than standard value, please equalization charge the battery group after discharging and then float charging it for 1~2 month, please contact us if still have any departure.

6. Exchange of Batteries:

6.1 Exchange judgments:

Before the batteries are discharged 80% (refer the corresponding discharge rates, such as C10,C2 etc.) of rated capacity, the voltage is below 1.8V/cell(the discharge rate for 1 hour is 1.7V/cell). It should be exchanged.

6.2 Exchange time

The VRLA battery has the certain service life , pls replace the old battery with the new one before the end of service life so that the application can run safely and normally .

7. Cautions:

- ✧ Keep batteries in the place, which the children could not touch.
- ✧ Do not use batteries for application other than those specified in its specification.
- ✧ Do not attempt to disassemble, revised, damaged, impacted, disposed batteries, otherwise the battery would be leaked, heated, explored.
- ✧ Do not dispose of the batteries in water, fire, and do not heating the batteries.
- ✧ Do not short batteries
- ✧ If the voltage of battery back is above 45V, please be sure wear the insulated glove in working, otherwise, it may be get an electronic shock .
- ✧ Do not face to the top of batteries in a short distance, please keep a certain distance when you measuring and repairing .
- ✧ There are sulfuric acid in the battery, do not contact with sulfuric acid in skin, cloths, especially in eyes. If eyes contact with sulfuric acid , please wash with a lot of clean water , and consult a physician immediately.