

# LONGWAY BATTERY

Valve-regulated Sealed Lead Acid battery

## User Manual



**Quanzhou Kaiying Power Supply & Electrical Equip Co., Ltd**



LONGWAY Battery is dedicated to innovation and invests heavily in research and development to ensure top-quality products. Our focus on quality control at all levels of production results in an impressive average defect rate of only 1/8 of the industry average defect rate. Our products are known for their high energy density, durability, and eco-friendliness. Our batteries exceed international standards for performance and safety. LONGWAY Battery is proud to have earned a solid reputation in various industries, including medical wheelchairs, electric scooters, and children's toy cars.

This User's manual was written by LONGWAY Battery (Kaiying Power Supply & Electrical Equip Co., Ltd) staff and contains informative suggestions regarding proper care and maintenance of your LONGWAY Batteries. Please read and understand this manual in detail

**If you have any concerns or questions feel free to contact us:**

[www.batterylongway.com](http://www.batterylongway.com)

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# 1. BEFORE YOU START

## 1.1 SAFETY

- **Electrical energy**

When the positive and negative battery posts are accidentally shorted by metal conductors (e.g. metal tools, metal wires, metal fittings, etc.), i.e. the external short circuit of the battery occurs, which generates an electric arc causing the posts to melt and cause the molten lead alloy to splash; and in serious cases, generating a large amount of heat causing combustion.

Prevention: Avoid direct short-circuiting of positive and negative battery posts when using metal tools for battery assembly or wires for troubleshooting.

Emergency treatment: When burning, use a live wrench or other tools to disconnect the external short-circuited metal conductor of the battery immediately. Please do not touch it with bare hands and use fire extinguishing materials to extinguish fire.

- **Sulfuric acid**

If the battery is dropped or overcharged, resulting in a rupture of the case, sulfuric acid may seep out of the rupture.

Prevention: Handle with care; place vertically upward; follow the manufacturer's specified charging procedures for recharging.

Emergent treatment: When skin comes into contact with sulfuric acid, immediately flush the skin surface with plenty of water and remove contaminated clothing; when eyes come into contact with sulfuric acid, immediately flush with clean water for at least 10 minutes. Seek medical attention if necessary.

- **Emitted gas**

During charging and testing of the battery, trace amounts of oxygen and hydrogen gas mixture may be discharged from the exhaust hole. During abnormal charging, if the concentration of hydrogen gas in the environment exceeds 4%, it will explode when it encounters open flame, spark, or high heat.

Prevention: Keep the charging place ventilated. The order of connecting the battery wiring harness: connect the positive wire first, then the negative wire. The order of disconnecting the battery wiring harness: disconnect the negative battery wire first, then the positive battery wire.

## 1.2 EQUIPMENT NEEDED

Recommended equipment to maintain or install your batteries is the following:

- Insulating gloves
- Goggles
- Voltmeter
- Torque wrench
- Insulated tools
- Terminal protector spray

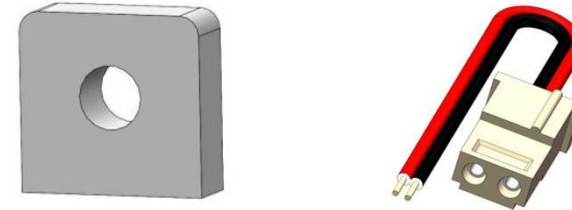
## 1.3 SAFETY DATA SHEETS (MSDS)

Longway Battery has safety data sheets for all products, please contact our sales to acquire the newest MSDS.

# 2. INSTALLATION

## 2.1 TERMINAL CLEANING AND PROTECTION

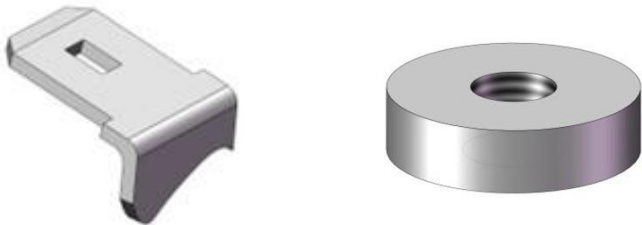
All terminals should be cleaned before installation and be cleaned as regular maintenance periodically. Brush the terminals with a metal bristle brush until the metal shines again. Install cables and hardware properly, then spray both with terminal protection spray. The protective coating will protect the terminals from the electrolyte in the battery.



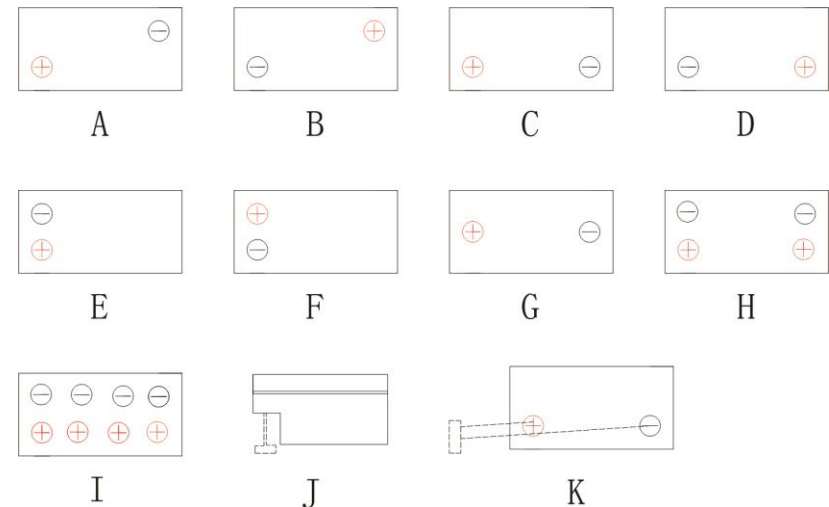
## 2.2 INSTALLATION TOOL AND REQUIREMENTS

- Do not mix batteries that are different models, have different capacities, have different manufacturers, or are in a different state of charge.
- The battery should not be installed near heat sources or equipment that could produce sparks (such as switches and fuses).

### TERMINAL TYPES ILLUSTRATION



### TERMINAL LOCATION ILLUSTRATION



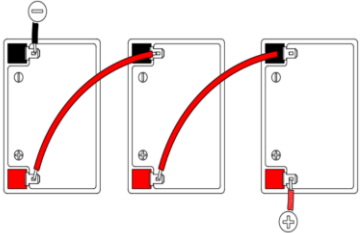
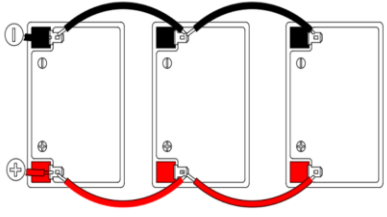
## 2.3 BATTERY ORIENTATION

- Batteries with a capacity of less than 24Ah can be placed in any direction and are recommended to be placed in an upright position.
- Batteries with a capacity of greater than 24Ah are recommended to

be placed in an upright position.

## 2.4 BATTERY BANK CONNECTION

### Battery Bank Connection illustration

SERIES	PARALLEL
	
To increase voltage without increasing capacity	To increase capacity without increasing voltage
Two pcs 6FM7 (12V 7Ah) each connected in series	Two pcs 6FM7 (12V 7Ah) each connected in parallel
system voltage: 24V system capacity: 7Ah	system voltage: 12V system capacity: 14Ah

As we can see from the Battery Bank Connection Image shown above, you can increase the voltage and/or capacity depending on how your battery systems are connected.

## 2.5 BATTERY ENVIRONMENT

- Battery charging must be done in a well-ventilated area.
- Batteries should be installed or stored in a clean, cool, and dry place. Keep water, oil, and dust away from the batteries as leakage can occur if these substances are allowed to accumulate on the batteries, leading to self-discharge and possible short circuits. For the same reason, relative humidity should be kept below 90%.
- The recommended temperature range for charging a deep cycle battery is 32°F to 122°F (0°C to 50°C).
- The recommended temperature range for discharging is -4°F to 140°F (-20°C to 60°C).
- Batteries discharged at temperatures below 32°F should be recharged immediately to avoid freezing. Batteries discharged at temperatures above 120°F should be cooled before recharging. Temperature has a significant effect on the use of batteries. A hot battery will deliver more capacity but with diminished cycle life. Cold batteries deliver less capacity and are harder to recharge. Temperature disparity between cells can also exert a negative effect on battery capacity and life cycle
- Place the batteries at least 0.5 inches (12.7mm) apart to avoid restricting air circulation.

# 3. CARE AND MAINTENANCE

The following information will help prevent the majority of operational issues that would cause premature failure. Please follow these instructions carefully to ensure the performance and increase the durability of your LONGWAY batteries.

- After the battery is installed, check the open-circuit voltage of the charged battery regularly, e.g. monthly or quarterly, and replace the battery with a new one if it is lower than the rated voltage.
- After the battery is installed, periodically, such as monthly or quarterly, check to make sure the connections at the battery terminals are securely connected.
- Periodically check the total voltage during operation. If the voltage is unstable, check the charging equipment or test the voltage of a single battery. If the voltage of a single battery is abnormally low or high, the battery should be replaced immediately and troubleshoot the problem in time, otherwise, the service life of the battery will be affected.
- Regularly check the appearance of the battery, and if there are cracks, deformation, liquid leakage, or other abnormalities, please immediately notify our company (As long as the battery is still within the warranty period) and replace it with a new battery.
- Clean the surface of the battery regularly, when cleaning, please use a warm and moist anti-static cloth to wipe the surface of the battery, do not use alcohol or similar organic solvents.
- Keep the battery surface and terminal connections clean and free of debris (especially metal debris) during monthly or quarterly routine inspections.
- Open the door regularly for ventilation to ensure that the battery

pack is used in a dry and ventilated environment for a long time.

- If loaded work is not performed for a long time after installation, 50% DOD discharge and equalization charging should also be controlled every 3-6 months to keep the battery active
- For safety precautions, the surface of battery cabinets and supports should be treated with good insulation and acid-resistant coating. It is strictly forbidden to carry batteries directly without any insulation treatment on battery cabinets and battery brackets made of metal materials.
- For the sake of safety, an insulating layer may be placed on the bottom of the battery cabinet and battery bracket before installation to isolate the electrical connection between the battery body and the battery cabinet and battery bracket. The insulating layer can also play the following risk prevention role: battery shell rupture will occur sulfuric acid leakage, acid corrosion cabinet, bracket, resulting in metal cabinets, brackets, and battery leakage circuit between the formation of fire accidents, the insulating layer of the pad system, can greatly avoid the risk. Insulation layer materials should be selected that will not corrode the battery case. At the same time, it should be heat-resistant, acid-resistant, and have a certain mechanical strength (will not be broken due to long-term battery pressure) such as an insulated sheet or insulated tray.

# 4. CHARGING AND EQUALIZING

## 4.1 BEFORE CHARGING

- Lead acid batteries should be charged before first usage due to self-discharging.
- The battery should be fully charged at the first opportunity after each use.
- Charge under well-ventilated circumstances
- Check that all vent caps are properly secured to the battery before charging. Removing the covers while charging (or during charging) is very dangerous and poses a risk of explosion.
- Avoid charging at temperatures above 120°F (49°C).
- Do not charge frozen batteries.

## 4.2 CHARGING RECOMMENDATION

When charging the battery, the company's battery charging requirements should be strictly followed.

Charging Method	Voltage Setting	Maximum Charging Current, A
Standby Use	2.25~2.30V/cell	0.25C
Cycle Use	2.40~2.50V/cell	0.25C

## 4.3 TEMPERATURE COMPENSATION

If frequently used at below 20°C or above 30°C, when setting the voltage, temperature compensation should be applied (with 20°C as the center point):

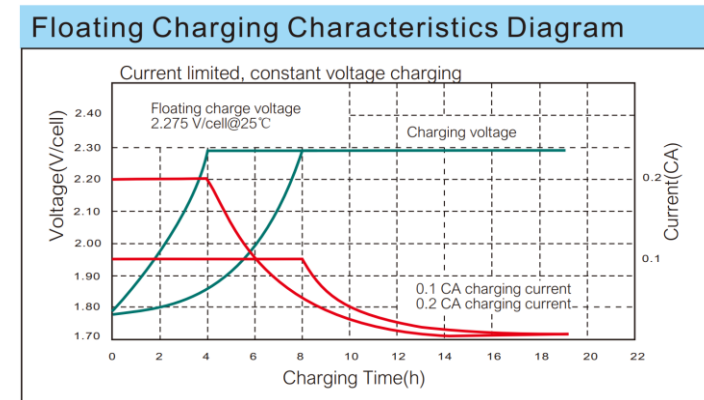
Standby use: -3mV/°C/cell

Cycle Use: -4mV/°C/cell

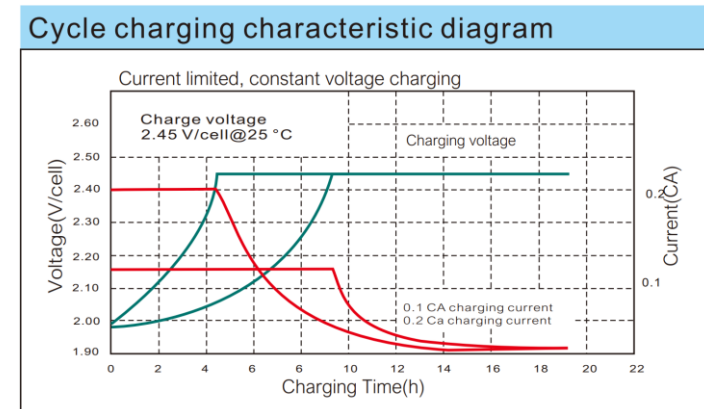
Charging time for a completely discharged battery is 16-20 hours. Continuous charging time for cycle-use batteries should not exceed 24 hours to avoid overcharging the battery.

## 4.4 CHARGING CHARACTERISTICS

**Floating charging characteristics diagram:**



**Cycle charging characteristic diagram:**



# 5. STORAGE

## 5.1 STORAGE REQUIREMENTS

The tips below will help you keep your LONGWAY batteries in good condition during storage.

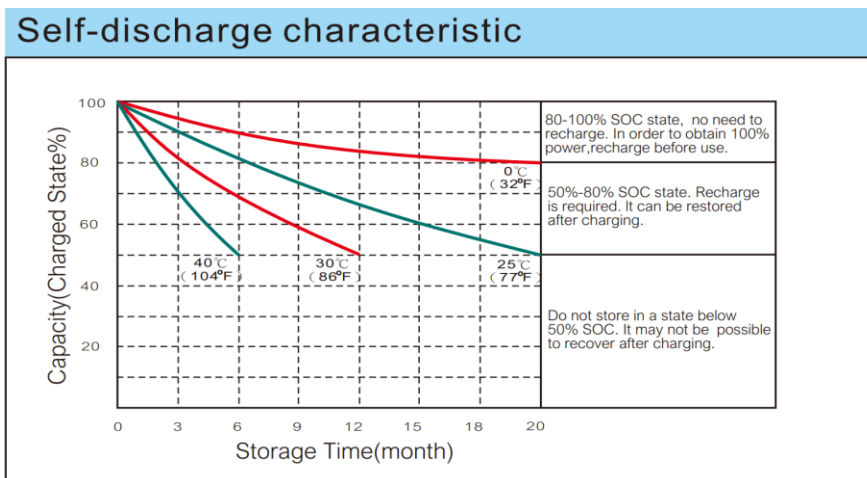
- Fully charge the battery before storage.
- If the battery is stored at an ambient temperature of 25°C, it should be charged at least every six months.
- If the battery is stored at an ambient temperature of 30°C, it should be charged at least every three months.
- The battery should not be exposed to moisture or rain during storage.
- The battery should not be placed near heat sources.

## 5.2 SELF-DISCHARGE AND REPLENISH-CHARGE

Avoid storage environments where freezing temperatures are expected. Batteries would freeze in cold temperatures if not fully charged. Hence, if batteries are stored during winter or other cold locations, they must be fully charged.

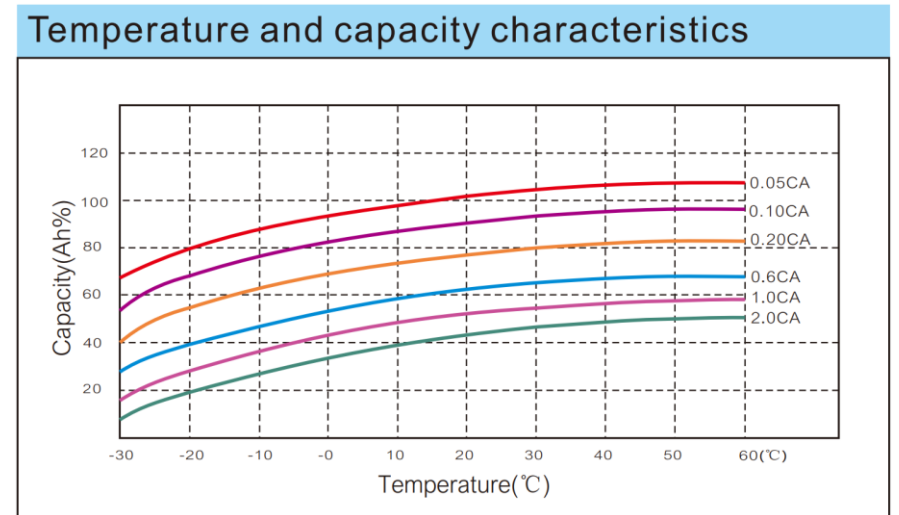
Batteries usually self-discharge faster under higher temperature conditions, thus it is recommended to store batteries in an adequate environment. Experimental data has confirmed that the LONGWAY battery's average one-month self-discharge rate is approximately below 2.5%. Refer to the self-discharge curve line below for more info about the relationships between self-discharge and storage time in different temperatures.

**Self-discharge curve line:**



Temperature will also affect the capacity of batteries. Being stored at high temperatures will lead to higher actual capacity than rated capacity. For more info please read the temperature and capacity characteristics diagram below:

**Temperature and capacity characteristics diagram:**



Methods of replenishing electricity

The method of replenishing electricity due to self-discharge is the same as the Cycle Use Charge Method:

Charging Method	Voltage Setting	Maximum Charge Current, A
Cycle Use	2.40-2.50V/cell	0.25C

## 5.3 TRANSPORTATION

- Be careful when handling the battery to avoid injury or damage to the battery;
- Avoid exposure to moisture or rain;
- Avoid prolonged sun exposure;
- Avoid shocks and vibration



# 6. PERFORMANCE OPTIMIZATION

## 6.1 OPPORTUNITY CHARGING

Opportunity charging is charging a battery pack outside of the normal charging cycle, between uses. For example, charging a machine during lunchtime, charging a golf cart between shots, or charging a machine between jobs. LONGWAY BATTERY recommends opportunity charging for all applications. This is because it ensures that the battery is always at its highest state of charge (SOC) to maximize performance and range, and minimizes the battery's depth of discharge (hereafter referred to as DOD) to optimize performance and longevity.

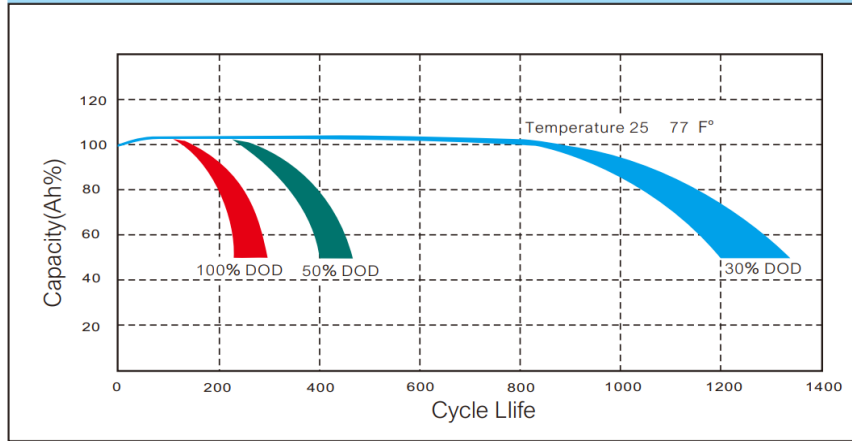
Opportunity charging can extend the life of a battery by limiting its regular depth of discharge. DOD is the percentage of total capacity that a battery discharges. Batteries with shallower depths of discharge have a much longer cycle life than batteries with deeper depths of discharge. By limiting the discharge to a shallower level, the energy output of the battery can be increased throughout its life. For more info, refer to the Cycle Life curve line in the next sector 6.2.

For instance, the operator usually depletes the battery to 60% of its rated capacity. Lunch is taken for two hours and then the battery is depleted to 30%. If the battery pack has a chance to recharge during the two hours at lunch, the battery pack can recover 20% of its charge, so it is only 50% discharged at the end of the shift. While this 20% may seem insignificant, it extends the life of the battery pack and reduces the charging time between uses.

## 6.2 CYCLE LIFE

As shown in the graph below (especially for deep cycle series batteries), if the battery is discharged to 100% of its rated capacity for 20 hours at a time, only about 50% of the battery capacity remains after 200 cycles. If the battery is discharged to 50% of its rated capacity for 20 hours at a time, only about 50% of the battery capacity remains after 400 cycles. If the battery is discharged to 30% of its rated capacity for 20 hours at a time, it will take 1,200 cycles for the battery capacity to decay to 50%.

## Cycle Life



## 6.3 DISCHARGE VOLTAGE CUTOFF

Discharge Rate	Discharge Current	End Voltage (V/cell)
20h	0.05 C <sub>20</sub> A (I <sub>20</sub> )	1.75
10h	0.09 C <sub>20</sub> A (I <sub>10</sub> )	1.75
3h	0.25 C <sub>20</sub> A (I <sub>3</sub> )	1.70
1C	1 C <sub>20</sub> A (I <sub>1</sub> )	1.60

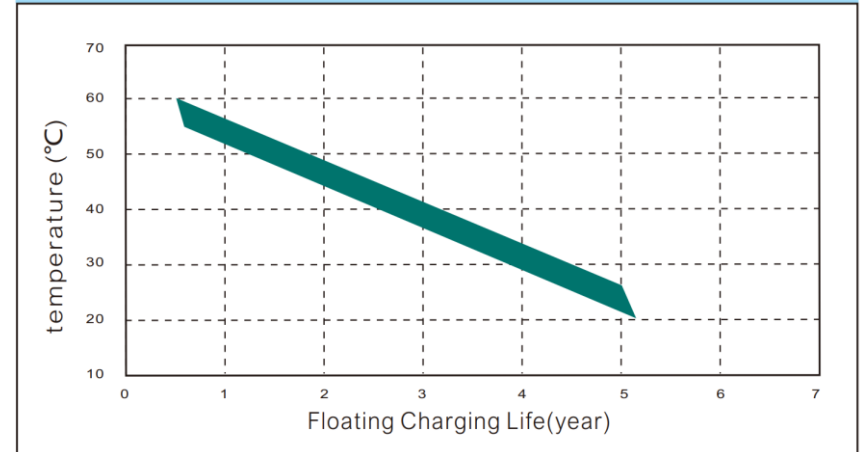
The diagram above shows the relationship between the discharge current and discharge voltage cutoff.

## 6.4 FLOAT CHARGE

Float charging of batteries is done to overcome the self-discharge rate. Batteries should be float-charged while in storage and when fully charged.

**Float charging life VS temperature diagram:**

## Floating Charging Life VS Temperature



## 7.1 TEST PREPARATION

- Check that all vent caps are securely installed on the battery.
- Clean the top of the battery, terminals, and connections properly with a wire brush.
- Fully charge the battery before testing.

## 7.2 DISCHARGE TESTING

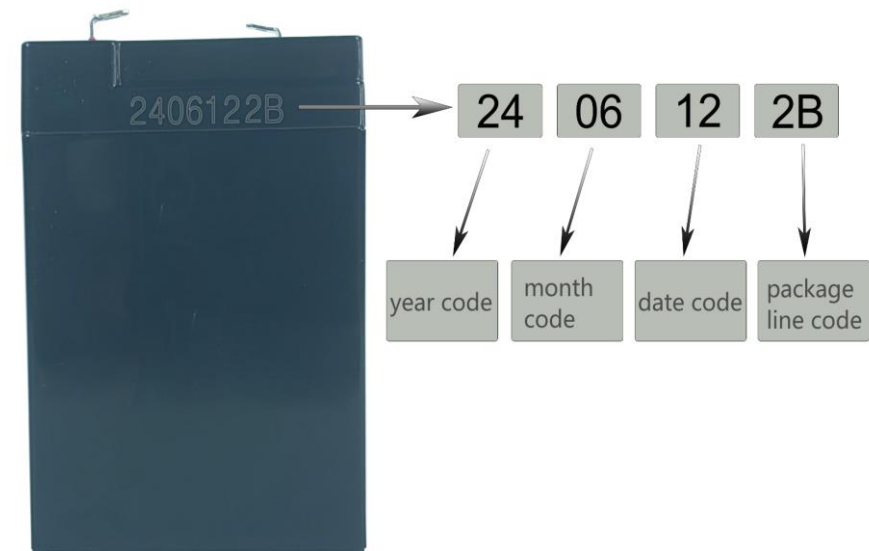
- Make sure all loads are disconnected from the battery.
- Connect the discharger at the desired discharge rate.
- Record the run time at the end of the discharge.
- Discharge time must be corrected for temperature because the ratings used for comparison are determined at 80°F. Temperatures above or below 80°F will affect the total discharge time.
- If the discharged capacity is lower than 50%, follow the standard charging procedure to charge and then carry out a discharge test fully, if it is still lower than 50%, the battery is not usable

## 7.3 OPEN-CIRCUIT VOLTAGE TESTING

- Due to the misleading nature of open circuit voltage, this is the least desirable method of assessing the condition of a battery.
- To obtain accurate voltage readings, batteries should be left idle for at least 24 hours before measuring the voltage of individual cells.
- If any of the recorded voltages differ by more than 0.3V from the voltages of the other batteries in the group, the battery may be defective.
- If abnormalities such as cracks, deformation, bulging, or strange odor are observed when using the batteries, replace them with other batteries.

## 8.1 DATE CODE DESCRIPTION

Battery production date code consists of two year codes, two month codes, two date codes + line (packaging line respectively 123...) number + capacity code. For example, if the date code were to be 2406122B, the battery would be manufactured on June 6<sup>th</sup>, 2024 in packaging line 2. When the customer has special requirements for branding, it is made according to the customer's requirements.



# 9. FREQUENT SCENARIOS

Listed below are frequently asked questions (FAQs) about system setup, battery charging, and maintenance procedures. Please use them as a general guide. For further assistance with specific system setups, please contact our staff.

**The battery cannot be discharged. When start charging, the voltage will quickly rise to the limit value, the current quickly drops to a very small or even close to zero, or directly end charging.**

This may indicate that the battery is sulfated, and the likely cause is a prolonged time without replenishment in an undercharged or over-discharged condition.

## **BATTERY TERMINAL HAS MELTED**

The most common causes of melted terminals are as follows, which lead to a great increase in resistance, which in turn leads to heat buildup and melting of the terminals:

- Loose connections
- Corrosion of the connection
- Discharge rate higher than recommended

## **BATTERY(S) TEMPERATURES ARE VERY HIGH.**

If the battery temperature is at or near 50°C (120°F), turn off charging and allow the battery to cool to 32°C (90°F).

If a single cell in the string becomes hot, it may indicate a faulty or shorted battery.

Check for any loose terminal connections that could cause overheating.

## **BATTERY CASES ARE BULGING ON THE SIDES**

As the battery ages, it is normal for its sidewalls and end walls to slightly bulge due to internal component growth.

- Excessive bulging can be caused by operating at higher than recommended temperatures (>120°F or 49°C) or by prolonged overcharging resulting in significant water loss. This can result in the end of battery life.

## WHY HAS THE CAPACITY (RUNTIME) OF THE BATTERY BANK DECREASED

### -Persistent undercharging

Check if the charger's charging regime complies with the manufacturer's recommended charging method to ensure that the battery is fully charged.

### -Battery aging

Late in the life of the battery, the battery capacity will decay to less than 50%, it is recommended to replace the battery with a new one as soon as possible.

## MY BATTERIES ARE LEAKING

Leaking is not normal and is caused by excessive overcharging. This will result in permanent capacity loss if not rectified. Refer to the watering and charging sections for guidelines.

- Used lead-acid batteries are toxic and hazardous waste, so please comply with environmental regulations.
- Used lead-acid batteries are hazardous waste, please do not dispose of them.
- As lead-acid batteries are recyclable, you can contact a recycling organization with environmental qualifications to recycle them or check with your local environmental protection department.

