



FMJ SERIES

TECHNICAL MANUAL



contents











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Security Instruction

Please read these instructions carefully in order to make correct, safe, and effective operation. This manual provides you with very important installation and operation guidelines, which will guarantee your equipment an optimal performance and longer service life.

- ▲ For your safety, please do not open battery by yourself, only professionals shall be allowed to open and maintain the battery;
- ▲ Due to battery be potential harmful to the environment and health, battery shall be replaced by manufacturer s service center. If there is need to replace and maintain, please contact after-sale service center.
- ▲ Used battery is recyclable, and improper disposal of battery may be great harmful to the environment and health. So, used battery shall be proper disposed following relative regulations and law or shall be returned to our company for disposal.
- ▲ Please choose the batteries of the same model for replacement, and batteries produced by different manufacturers shall be strictly forbidden for connecting in one system.

Notices

| | | | | |
|---|---|--|---|---|
|  |  |  |  |  |
| Warning | Electricity shock | Protecting eyes | With adults custody | No short circuit |
|  |  |  |  |  |
| No flame and spark | Recycled | Proper disposal | Read instructions | UL certificate |

Chapter One Product Introduction

Product Characteristics

02

⊗ Floating design life

Floating design life is 10 years

⊗ Gel electrolyte

High purity gas phase SiO₂ used for Gel electrolyte ensuring even distribution inside battery and no acid stratification. Extra electrolyte acid filling system which ensure quantity of gel electrolyte is correctly filled over the plates and separators, perfect heat dispersion, prevents thermal runaway caused by water loss under high temperature and over discharged conditions.

⊗ Special separator

micro-porous separator for gel battery ensures low internal resistance, high porosity, intense absorption of gel electrolyte and long cycle life.

⊗ Patent safety valve

Patent labyrinth type two-layer and explosion-proof acid filter valve design, sensitive open and close, acid filter in valve preventing acid fog escape and preventing out flame in when depression.

⊗ Long service life

The grid is made of lead-calcium-tin alloy with corrosion proof character, and take gas recombination technology.

Low density of gel electrolyte reduce corrosion of plate grids.

Plates cured by high-temperature and high-moisture process forming long life 4BS crystal structure;

Efficient formation process, guarantee for the plates quality;

⊗ Deep discharge performance

With excellent deep discharge proof performance, the battery can be connected in load after 100% discharge and recover the original capacity after 4 weeks. Strong recharge recovering ability after battery deep discharge, excellent long cycle endurance performance.

⊗ Low self-discharge rate

The grid is made of heavy load lead-calcium-tin multi-element alloy, low self-discharge rate, it is ≤2% per month;

High purity Gel electrolyte; storage at ambient temperature 25°C for two years, the rest capacity remains more than 50%.

⊗ **Reliable sealing performance**

Electrode poles sealing adopt multi-layer, no terminal electrolyte leakage.

Excellent gas recombination performance, no acid fog escape in operation, no corrosion to equipment and battery could be installed together with equipment.

⊗ **Applicable for wide temperature range**

Extra electrolyte design ensures it can work in high temperature or over discharge condition, preventing dry up of the battery.

Thick ABS container and cover with high impact proof, vibration proof, prevents leakage and container bulging.

Main Applications

- ⊗ Telecommunications, mobile, network, railway, airport and other communication, signal system standby power
- ⊗ Electricity power, nuclear power plants standby power
- ⊗ Data and TV signal transmission system
- ⊗ EPS/UPS;
- ⊗ Wind, solar energy and wind solar hybrid power generation
- ⊗ Ship, maritime, petrochemical and standby power systems, etc.

Chapter Two Type and Dimensions

Product Series

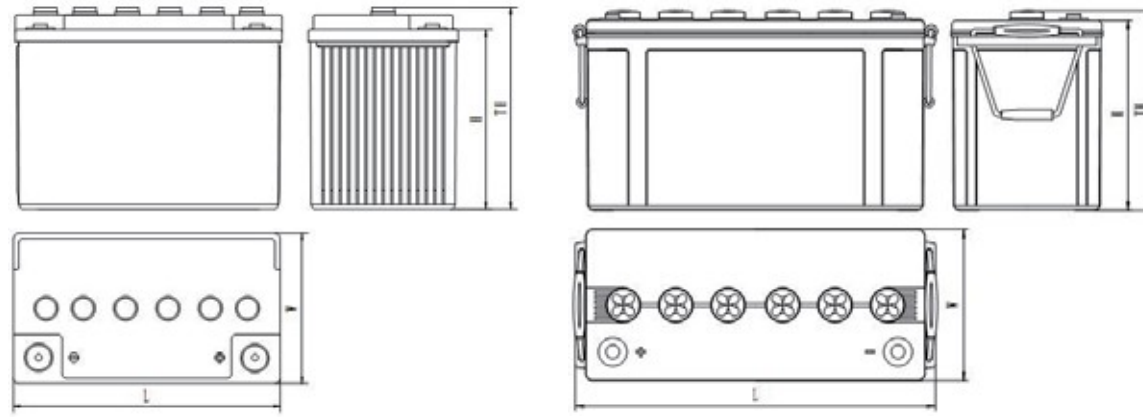
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Table 2-1 battery type and dimensions

| Model | Rated Voltage (V) | Rated Capacity C ₁₀ 1.8V/cell (Ah) | Dimensions | | | | | | | | Weight | | Short Circuit Current (A) | Reference Internal Resistance (mΩ, 25 °C) | Terminal type |
|----------|-------------------|---|------------|-------|-------|-------|--------|------|--------------|------|--------|-------|---------------------------|---|---------------|
| | | | Length | | Width | | Height | | Total Height | | kg | lbs | | | |
| | | | mm | inch | mm | inch | mm | inch | mm | inch | | | | | |
| 6FMJ-65 | 12 | 65 | 310 | 12.20 | 174 | 6.85 | 209 | 8.23 | 236 | 9.29 | 27 | 59.4 | 1540 | 7.25 | GFM-24 |
| 6FMJ-85 | 12 | 85 | 414 | 16.30 | 174 | 6.85 | 218 | 8.58 | 228 | 8.98 | 34 | 74.8 | 2060 | 5.19 | GFM-24 |
| 6FMJ-100 | 12 | 100 | 513 | 20.20 | 163 | 6.42 | 218 | 8.58 | 228 | 8.98 | 40 | 88.2 | 2950 | 3.91 | GFM-24 |
| 6FMJ-120 | 12 | 120 | 513 | 20.20 | 232 | 9.13 | 218 | 8.58 | 228 | 8.98 | 47 | 103.4 | 2980 | 3.66 | GFM-24 |
| 6FMJ-150 | 12 | 150 | 513 | 20.20 | 232 | 9.13 | 218 | 8.58 | 228 | 8.98 | 59 | 129.8 | 3020 | 3.55 | GFM-24 |
| 6FMJ-200 | 12 | 200 | 513 | 20.20 | 296.5 | 11.67 | 218 | 8.58 | 228 | 8.98 | 75.5 | 166.1 | 3050 | 3.11 | GFM-24 |

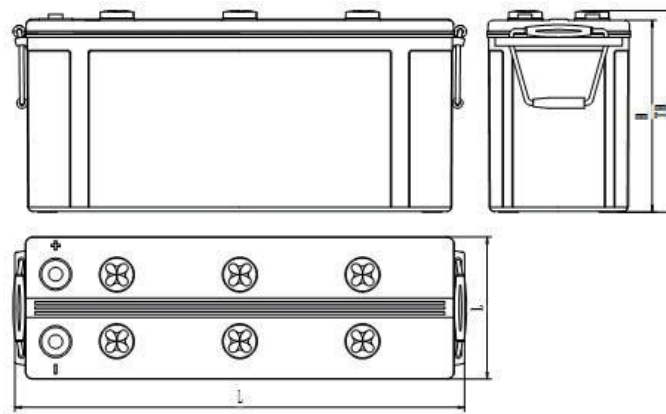
Battery and Terminal Layout

Battery Layout



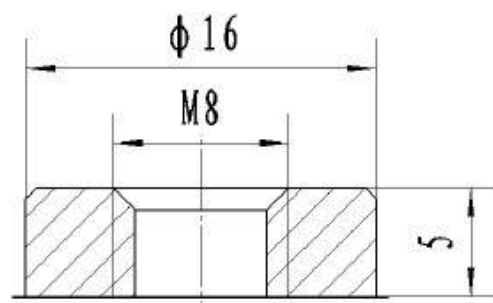
■ 6FMJ-65

■ 6FMJ-85



■ 6FMJ-100 120 150 200

Terminal Layout

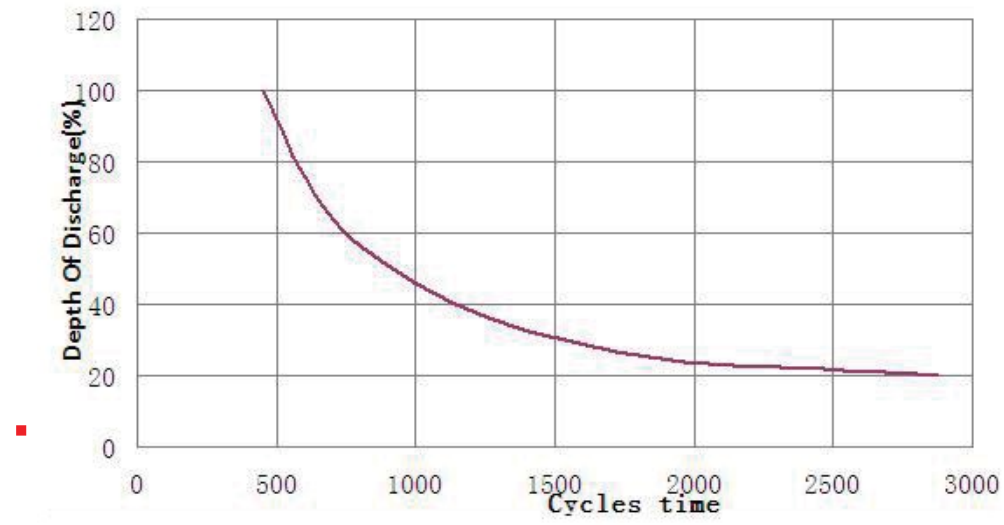


■ Terminal GFM-24

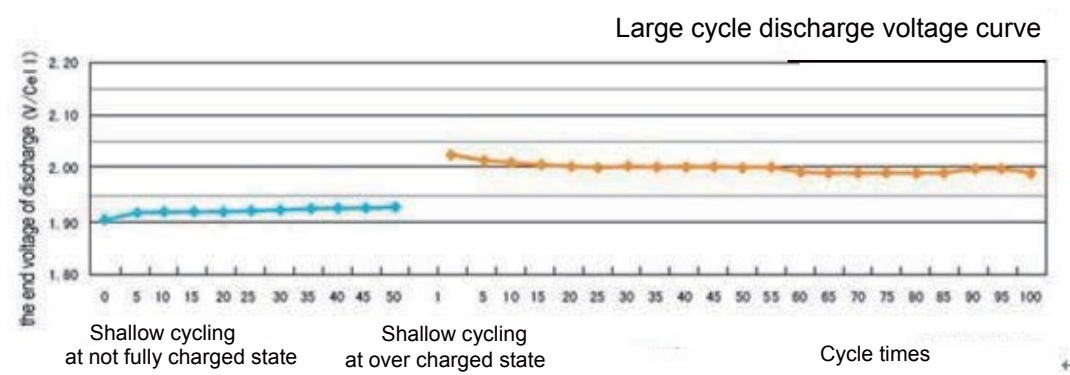
Chapter Three Technical Characteristics

Performance Curve

⊗ Cycle performance curve (25°C)



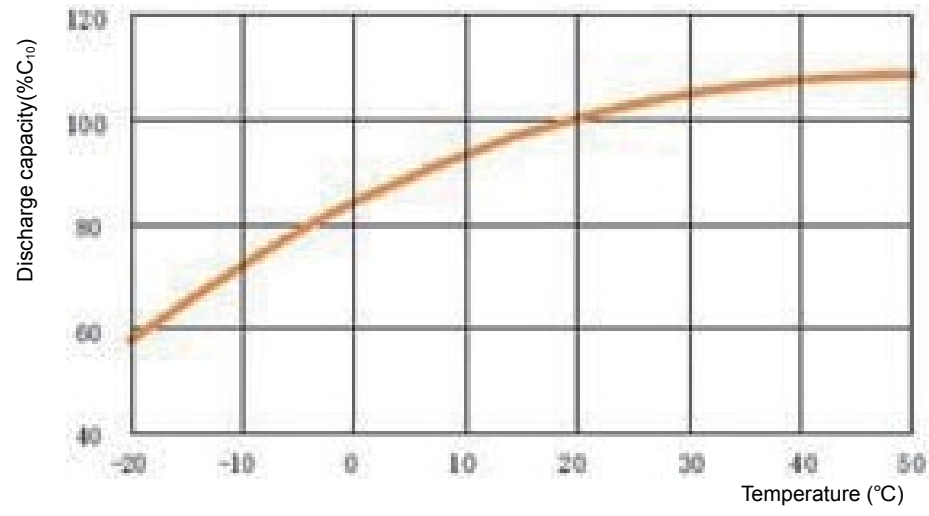
⊗ Voltage curve of simulation wind energy system cycle application



■ Figure 3-2 Voltage curve of simulation wind energy system cycle application

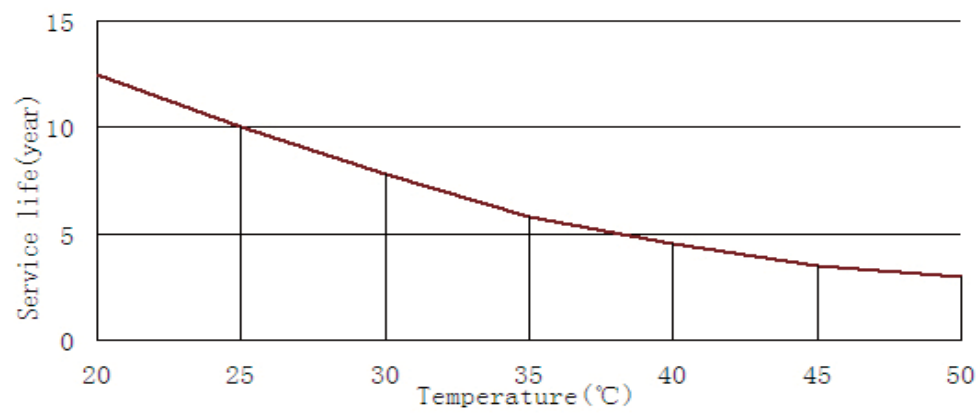


⚙️ Discharge capacity and temperature curve



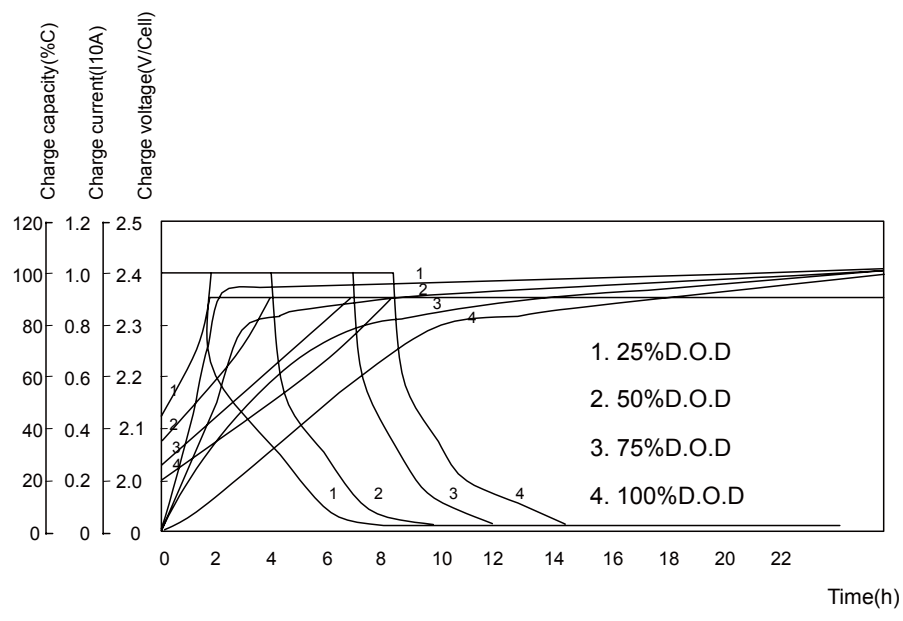
■ Figure 3-3 Discharge capacity curve under different temperature

⚙️ Service life and temperature curve



■ Figure 3-4 Floating service life curve under different temperature

⚙️ Charge characteristic curve under different depth of discharge (25°C)



■ Figure 3-5 Charge characteristic curve under different depth of discharge

Chapter Four Operation

Discharge

End voltage with different discharge rate must be less than the specified value. Charge the battery as soon as possible after discharge.

In order to extend the service life, the depth of discharge should be less than 60% of the rated capacity. The discharge over 60% DOD is deep discharge and would shorten the service life.

Under the temperature of -25°C , discharge over 60% DOD is prohibited, except protective measure is adopted such as raising temperature.

Temperature

The operation temperature range is -20°C -- 55°C . All the performance data is measured at ambient temperature of 25°C . The optimal temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$, over high temperature would shorten the service life and over low temperature would lower the capacity available. The highest acceptable temperature is 55°C .

Floating Charge and Equalizing charge

Floating charge

Floating operation is the best operation condition for battery. In floating operation, the battery keep fully charged state, under this condition, battery could reach the longest service life. Under the temperature of 25°C , recommended floating charge voltage setting value is 2.23V/cell, In such method, it take about 24~36h for battery fully charged. For achieving better performance, the floating charge voltage should be suitable adjusted according to ambient temperature, temperature compensation coefficient is $-3.5\text{mV}/^{\circ}\text{C}/\text{cell}$, for details please refer to Table 4-1.

■ Table 4-1 Floating charge voltage under different temperature

| Ambient Temperature (°C) | Floating Charge Voltage (V/cell) |
|----------------------------|------------------------------------|
| 0 | 2.33 |
| 10 | 2.29 |
| 15 | 2.27 |
| 20 | 2.25 |
| 25 | 2.23 |
| 30 | 2.21 |
| 35 | 2.19 |

⚙️ Equalizing charge

Equalizing charge or supplementary charge is needed in the following cases:

- After finish installation, before the battery system is put into operation, the battery bank should be supplementary charged.
- The battery is out of work beyond 6 months.
- Running in full-floating operation for a long term, but not discharge under more than 40% C10 capacity, the batteries need an equalizing charge regularly and the equalizing charge cycle are 6 months to one year.

Recommended charge method as follows:

2.35V / cell with limited current of 0.15 C10 (A), charge for 8–12 hours (non continuous charge is allowed)

Charge voltage shall be adjusted according to the ambient temperature, temperature compensation coefficient is -3.5mV / cell / °C, for details please refer to table 4-2.

■ Table 4-2 Equalizing charge voltage under different temperature

| Ambient Temperature (°C) | Equalizing Charge Voltage (V/cell) |
|----------------------------|--------------------------------------|
| 0 | 2.43 |
| 10 | 2.39 |
| 15 | 2.37 |
| 20 | 2.35 |
| 25 | 2.33 |
| 30 | 2.31 |
| 35 | 2.29 |

After equalizing charge, for batteries with voltage lower than 2.18V / cell, we should make the battery discharged in 0.1C₁₀ A for 4~6 hours, and then charge the battery with constant voltage of 2.33V / cell and limited current of 0.15C₁₀ A.

Recharge

Recharge the battery immediately after discharge according to the below method:

Charge the battery with constant current of no more than 0.2C₁₀(A), until the battery voltage rises to 2.33~2.37V / cell, then change to constant voltage charge of 2.33~2.37V / cell until the charge completed. Any of the following two items can be regarded as the fully charged symbol.

- Refer to the required time as table 4-3.
- In constant voltage case, the charge current keep unchanged for 3 hours in the final stage of charge.

Charge voltage shall be adjusted according to the ambient temperature, temperature compensation coefficient is -3.5mV/°C/ cell.

■ Table 4-3 Required charge time in different depth of discharge

| Depth of discharge(%) | Charge current of constant current charge(A) | Time for changing constant current charge to constant voltage charge(h) | Charge voltage of constant voltage charge(V) | Charge time(h) |
|-----------------------|--|---|--|----------------|
| 20 | 0.1C ₁₀ | 1.6 | 2.33 | 8 |
| | 0.15C ₁₀ | 1.2 | 2.33 | 6 |
| 50 | 0.1C ₁₀ | 4.3 | 2.33 | 14 |
| | 0.15C ₁₀ | 3.3 | 2.33 | 12 |
| 80 | 0.1C ₁₀ | 6.8 | 2.33 | 16 |
| | 0.15C ₁₀ | 5.5 | 2.33 | 14 |
| 100 | 0.1C ₁₀ | 8.7 | 2.33 | 18 |
| | 0.15C ₁₀ | 6.8 | 2.33 | 16 |

Storage

The battery should be stored in clean and dry environment .

Storage time: battery is ex-work in fully charged,storage time should be limited,for ensuring battery performance,storage time please do not exceed following time:

- Under 25°C, six months
- Under 30°C, three months
- Under 40°C, six weeks

The state of charge can be confirmed by the testing result of open circuit voltage after storage for 24 hours at 25°C.

■ Table 4-4 open circuit voltage at different charge state

| Charge State | Voltage(V)/cell |
|--------------|-----------------|
| 100% | ≥ 2.16 |
| 80% | ≥ 2.14 |
| 60% | ≥ 2.10 |
| 40% | ≥ 2.08 |
| 20% | ≥ 2.04 |

The battery supplemental charge method during the storage is: charge battery with 2.35V/cell for 8 to 12 hours.

It is necessary to limit the current, and the optimum limiting value is within 0.2C10 (A) .

Testing of the open circuit with the storage battery can decide whether it shall be supplemental charged. If the voltage drops to 2.10V/cell, the battery shall be supplemental charged in time. Improper maintenance will shorten the battery service life or decrease the service performance.

Chapter Five Installation,Commissioning and Maintenance

Installation

Batteries integrated in equipment should be compliance with the installation instructions, Battery which is separately installed on rack and cabinets should be connected by bolts to the foundation. Battery racks or cabinets should be properly installed according to instructions.

Connection

Before connecting, make a overall check of all the batteries and connectors to see whether there is hardware damage or manufacturing defects,and make sure the right polarity.

The charge equipments are in cut-off state and without loads, then connect the positive and negative terminals to chargers.

During the installation and transit of the battery, use insulated tools, gloves, aprons and safety glasses,avoiding battery is impacted, do not twist connecting terminals and safety valve in transit.

Placing tools and conductive articles on the battery is strictly prohibited.

Dusty connecting terminal or loose connection will cause battery sparkle,so please keep the connecting terminals clean and tighten the connectors as per required torque value,but please do not cause torsional stress to terminals.

Commissioning

Assure battery operation in the clean environment.

Before operation, battery charge voltage must be adjusted as constant value as per ambient temperature.Such as,at 25°C, charge the battery with 2.23V/cell for 16 to 24 hours, or with 2.33V/cell for 8 to 12 hours;

If the storage condition is serious, adjust charge voltage is necessary.

⚙️ Monthly maintenance:

- Measure and record the ambient temperature of the battery-room, battery container and terminals temperature.
- Check battery cleanliness, terminal damage and heating track, container and lid damage and temperature.
- Measure and record the total voltage and floating current of the battery system.
- Correct immediately once finding problem.

⚙️ Quarterly Maintenance:

- Repeat every item of monthly inspection.
- Measure and record the floating voltage of each on-line battery.

⚙️ Annually Maintenance:

- Repeat every item of quarterly maintenance and inspection.
- Check whether the connector loose or not, please tight immediately once finding loose parts.
- Perform a discharge test to check the exact load every year, discharge 30%-40% of the rated capacity.

⚙️ Three-year Maintenance:

- Carry out a capacity test(C10) every three years and every year after six years of operation. If the capacity of the battery is lower than 60% of the rated capacity, the battery should be replaced.

Maintenance notes

- Please do not operate and store battery in inversion position or in horizontal position
- Check whether the battery installation is comply with design requirement or installation documents or not.
- Please use insulated tools when operation and maintenance,any metal objects to be put on top of the battery shall be strictly prohibited;
- Please do not use any organic solvent to clean batteries;
- Please do not take down safety valve or add any substance into battery
- Please do not smoke or set out fire near batteries.
- Please keep battery fully charged within 24 hours after discharge,avoid capacity affected
- Stored battery performance could be in degeneration,please put the battery in operation early.
- Only professionals shall be allowed to maintain the battery



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