



OPzV 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

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⊗ Floating design life

Floating design life is 18 years for 2V tubular gel batteries.
and 15 years for 12V battery (25°C)

⊗ Plate

Tubular type for positive plate, active substance break off is avoided. Framework is die casted with multielement alloy, it's crystal grain is micro and compact, corrosive proof performance is enhanced and in long service life.

Pasted type for negative plate, grid in radial structure, utilization ratio of active substance and large current discharge capacity are improved, and in good charge acceptance.

⊗ Gel electrolyte

Main material is made of gas phase SiO₂ imported from Germany, in initial stage, the electrolyte is in watery collosol state, fully filled in all the plate space, equalized reaction is achieved for all plates. Sufficient electrolyte design could insure battery could not be dry up in condition of high temperature and over charged, thermal capacity is large, heat dissipation is good, thermorunaway will not be happen. In finished battery, electrolyte is in gel state, no flow, so there is not acid leakage and delamination. Electrolyte is in low density, normally 1.24~1.26g/ml, it is less corrosion to plate.

⊗ Special separator

Particular micropore PVC-SiO₂ separator imported from European AMER-SIL is adopted, porosity is large and electrical resistance is low. Electrolyte storage space is large, pro-heterozygosity is good with electrolyte. Battery has long cycle life.

⊗ Long service life

Good corrosion proof Pb-Ca-Sn multielements alloy and gas recombination technology are adopted for positive and negative plate.

Optimize active substance formula, battery capacity is higher about 5-15% than DIN40742:1999 standard.

Low electrolyte density, reduce the corrosion to grid.

High temperature and humidity solidifying technology is, 4BS lead paste formula.

Particular and high efficiency formation technology insure the plate 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.

⊗ **Applicable for wide temperature range**

Batteries could be used in -25~60°C ambient temperature.

Sufficient excessive electrolyte insure battery could not be dry up under high temperature condition.

⊗ **Good quake proof performance**

Battery container and lid are thick with good impact resistance and shock proof ABS material,in transportation and operation, no leakage and bulge, reliable and safe.

Main Applications

- ⊗ Telecommunication, Mobile, Network, Railway, Airport and other telecom,signal system backup power supply.
- ⊗ Electric power system, unclear power generation station backup power supply.
- ⊗ Solar,wind,water energy power generation storage, wind and solar energy hybrid project.
- ⊗ Warship, maritime and other application backup power supply.
- ⊗ Petrochemical industry backup power supply.
- ⊗ Maritime signal and navigation mark.
- ⊗ Formation industry.
- ⊗ UPS,medical instrument, emergency lighting and other application backup power supply.
- ⊗ High requirement in environmental and energy saving occasion.
- ⊗ Data and TV signal transmission system.
- ⊗ EPS/UPS.
- ⊗ Cycle application.

Chapter Two Type and Dimensions

Product Series

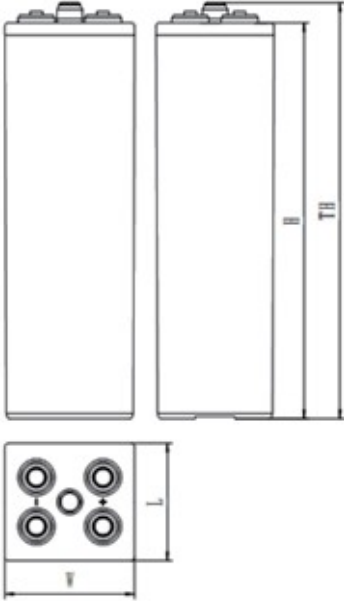
Table 2-1 battery type and dimensions

Battery Type	Rated Voltage (V)	Rated Capacity C10 (Ah)	Dimensions								Weight		Short 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					
GFMJ-150H (3 OPzV 150)	2	150	103	4.06	206	8.11	352.5	13.87	385	15.16	15	33.07	1500	0.80	GFM-28
GFMJ-200H (4 OPzV 200)	2	200	103	4.06	206	8.11	352.5	13.87	385	15.16	18	39.6	2000	0.75	GFM-28
GFMJ-250H (5 OPzV 250)	2	250	124	4.88	206	8.11	352.5	13.87	385	15.16	22	48.4	2500	0.70	GFM-28
GFMJ-300H (6 OPzV 300)	2	300	145	5.71	206	8.11	352.5	13.87	385	15.16	25.5	56.1	2999	0.60	GFM-28
GFMJ-350H (5OPzV 350)	2	350	124	4.88	206	8.11	471	18.54	503.5	19.82	28	61.6	3049	0.58	GFM-28
GFMJ-420H (6 OPzV 420)	2	420	145	5.71	206	8.11	471	18.54	503.5	19.82	33.5	73.7	3658	0.55	GFM-28
GFMJ-490H (7 OPzV 490)	2	490	166	6.54	206	8.11	471	18.54	503.5	19.82	38.0	82.5	4268	0.50	GFM-28
GFMJ-500H (7 OPzV 500)	2	500	166	6.54	206	8.11	471	18.54	503.5	19.82	38.0	82.5	4268	0.50	GFM-28
GFMJ-600H (6 OPzV 600)	2	600	145	5.71	206	8.11	646	25.43	678.5	26.71	46.5	102.3	4606	0.45	GFM-28
GFMJ-800H (8 OPzV 800)	2	800	191	7.52	210	8.27	646	25.43	678.5	26.71	62	136.4	6141	0.40	GFM-28
GFMJ-1000H (10 OPzV 1000)	2	1000	233	9.17	210	8.27	646	25.43	678.5	26.71	77.0	176	7676	0.35	GFM-28
GFMJ-1200H (12 OPzV 1200)	2	1200	275	10.83	210	8.27	646	25.43	678.5	26.71	91.5	201.3	9211	0.30	GFM-28
GFMJ-1500H (15 OPzV 1500)	2	1500	340	13.39	210	8.27	646	25.43	678.5	26.71	112.5	247.5	11514	0.24	GFM-28
GFMJ-2000H (16 OPzV 2000)	2	2000	399	15.72	212	8.35	772	30.4	804	31.67	153	336.6	12657	0.22	GFM-29
GFMJ-2500H (20 OPzV 2500)	2	2500	487	19.17	212	8.35	772	30.4	804	31.67	187	411.4	15821	0.17	GFM-29
GFMJ-3000H (24 OPzV 3000)	2	3000	576	22.69	212	8.35	772	30.4	804	31.67	222	488.4	18986	0.12	GFM-29
6GFMJ-50H (12V 1 OPzV 50)	12	50	272	10.71	205	8.07	335	13.19	365	14.37	33.5	73.7	500	13	GFM-30
6GFMJ-100H (12V 2 OpzV 100)	12	100	272	10.71	205	8.07	335	13.19	365	14.37	52.5	115.5	1000	7.2	GFM-30
6GFMJ-150H (12V 3 OpzV 150)	12	150	380	14.96	205	8.07	335	13.19	365	14.37	73.5	161.7	1500	6.2	GFM-30

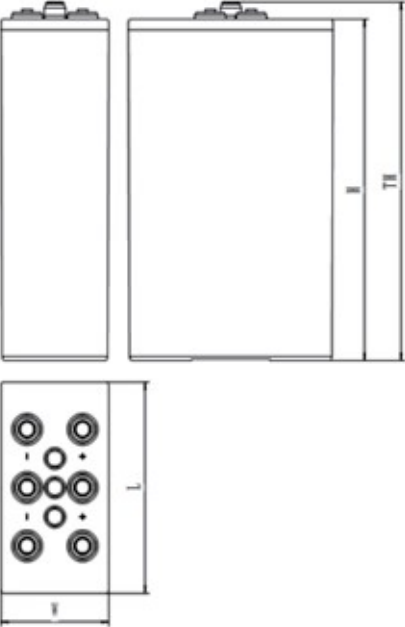
Battery and Terminal Layout



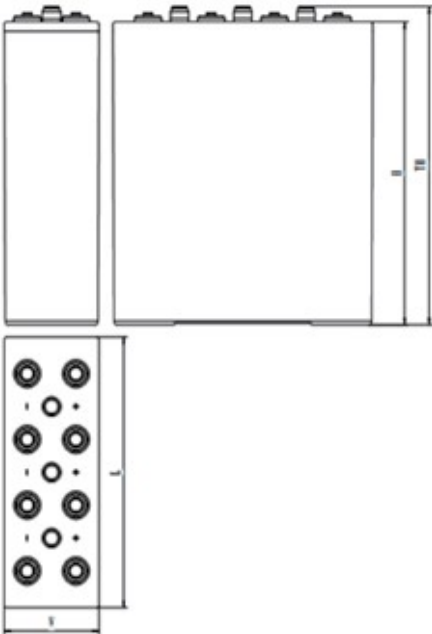
■ GFMJ-150H 200H 250H 300H 350H 420H 490H 500H 600H



■ GFMJ-800H 1000H 1200H 1500H

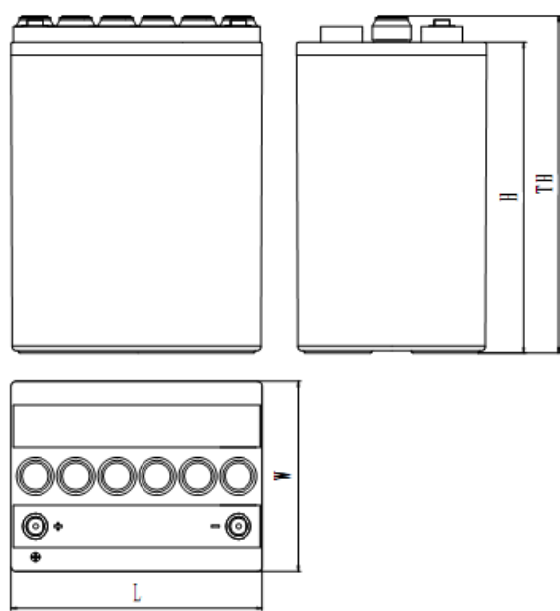


■ GFMJ-2000H



■ GFMJ-2500H 3000H





■ 6GMJ-50H 100H 150H

Chapter Three Technical Characteristics

Performance Curve

Cycle performance curve (25°C)

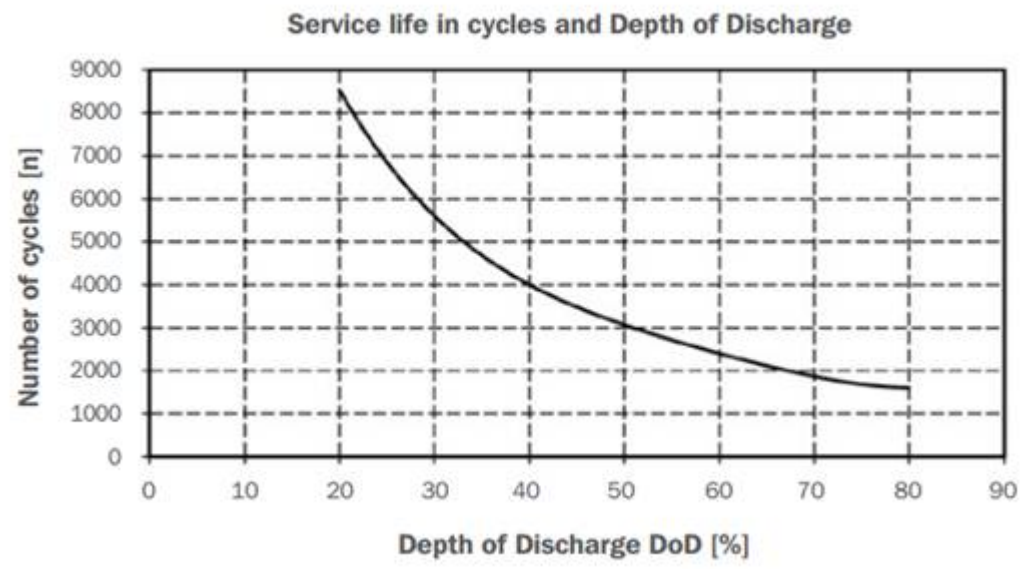


Figure 3-1 cycle times curve at different depth of discharge
Voltage curve of simulation wind energy system cycle application

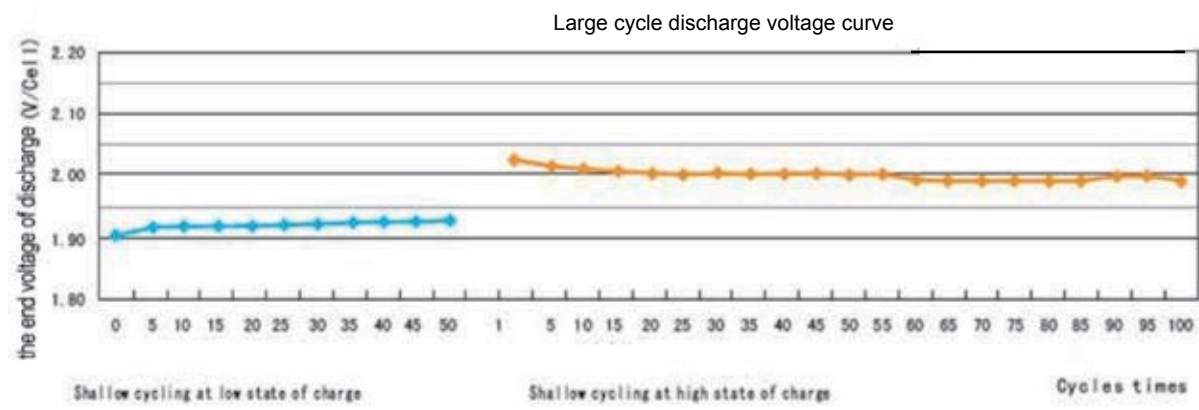


Figure 3-2 Voltage curve of simulation wind energy system cycle application



Discharge capacity and temperature curve

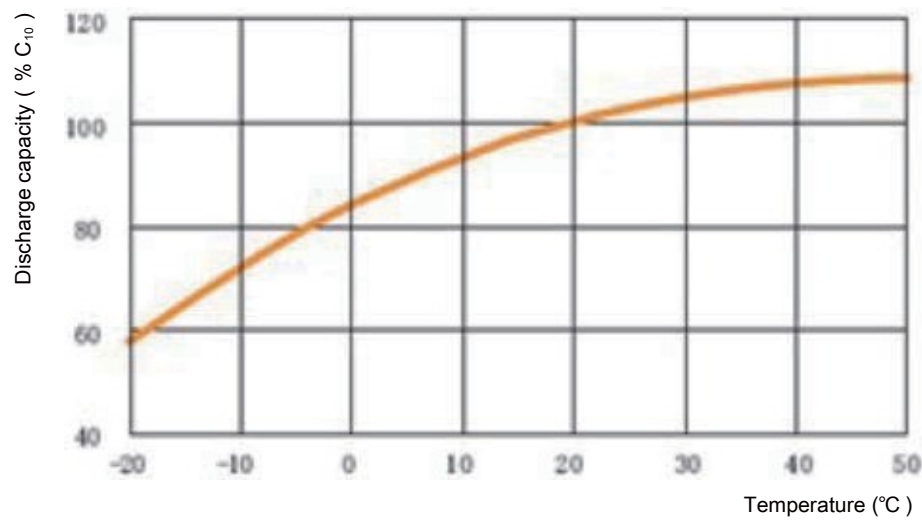


Figure 3-3 Discharge capacity curve under different temperature

2V Service life and temperature curve

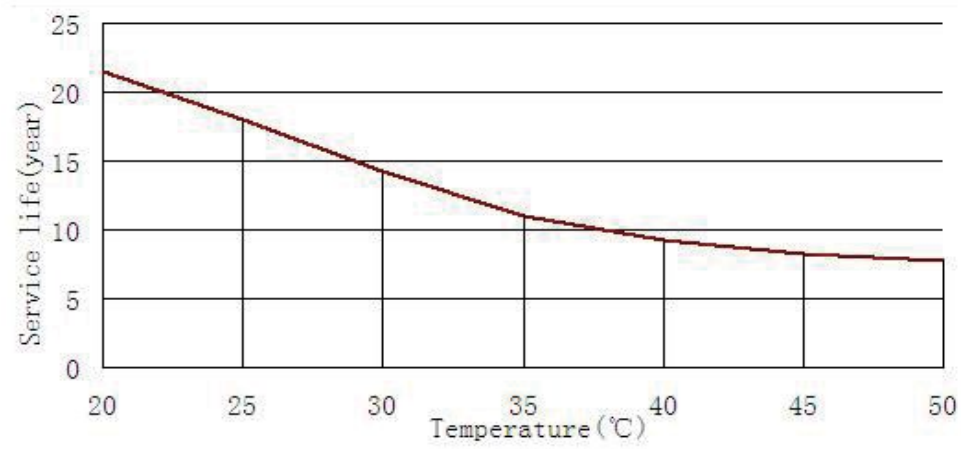
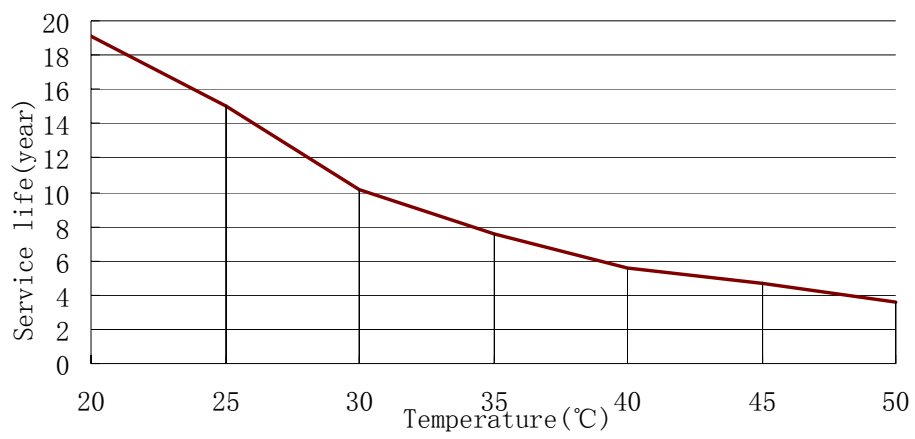


Figure 3-4 Floating service life curve under different temperature

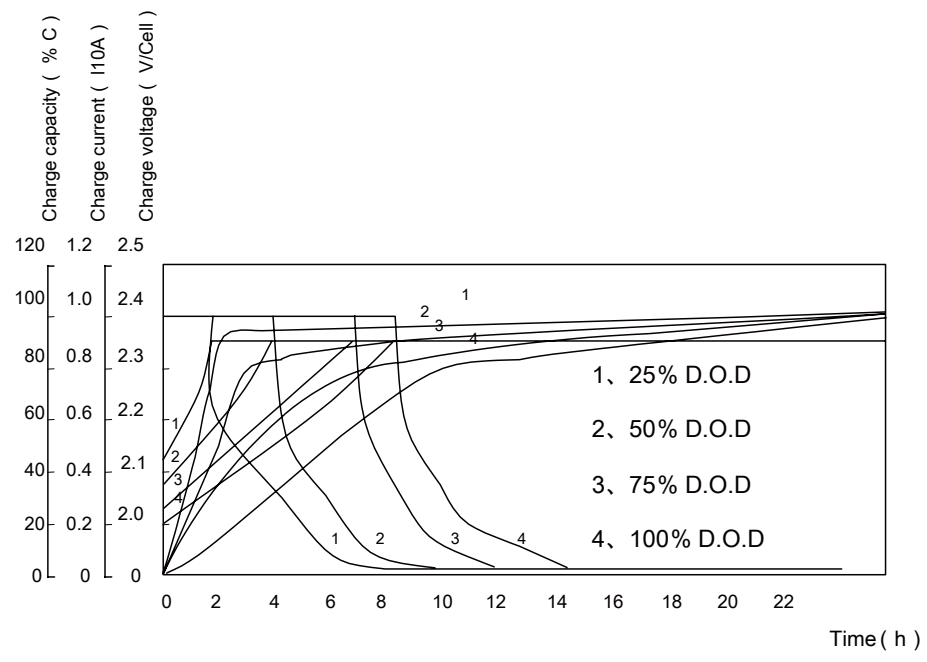
12V Service life and temperature curve



- Figure 3-5 Floating service life curve under different temperature



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



- Figure 3-6 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 $-25^{\circ}\text{C}\sim 60^{\circ}\text{C}$. 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 60°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 $2.23\text{V}/\text{cell}$, 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:

2.33V / 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 $\pm 3.5\text{mV} / \text{cell} / ^\circ\text{C}$, 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 $\pm 3.5\text{mV}/^\circ\text{C}$ / 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 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 Operation 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 2.33 Vpc for 8 to 12 hours;

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

Maintenance

⚙️ 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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