

GE 6V/12V Series valve-regulated lead-acid battery

Technical Manual

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Chapter I: Product Introduction

Product Characteristics

Advantages

- Design life: 10 years (25°C) ;
- EUROBAT Classification: Long life;
- High discharge performance;
- 99%+ gas recombination efficiency;
- Maximum charge efficiency;
- Low self-discharge rate;
- Easy installation and handling;

Design features

- Positive plates: Thick flat pasted plate with lead-calcium-tin grid alloy ;
- Negative plates: Flat pasted plate with lead-calcium grid alloy ;
- Separators: Microporous AGM separator ;
- Container and lid: High-strength ABS (option: available in Flame Retardant UL94 V0 version) ;
- Terminal posts: High-conductivity terminals with threaded inserts ;
- Posts sealing: Double sealing structure ;
- Vents: two-layer and explosion-proof acid filter valve;
- Electrolyte: Absorbed sulfuric acid;
- Plates suspension: Bottom supported ;
- Inter-cell connectors : Insulated rigid copper ;
- Terminal hardware: Stainless steel + Cover .

Main Applications

- Telecommunications;
- Emergency power;
- UPS

- Electrical Power plants and substation

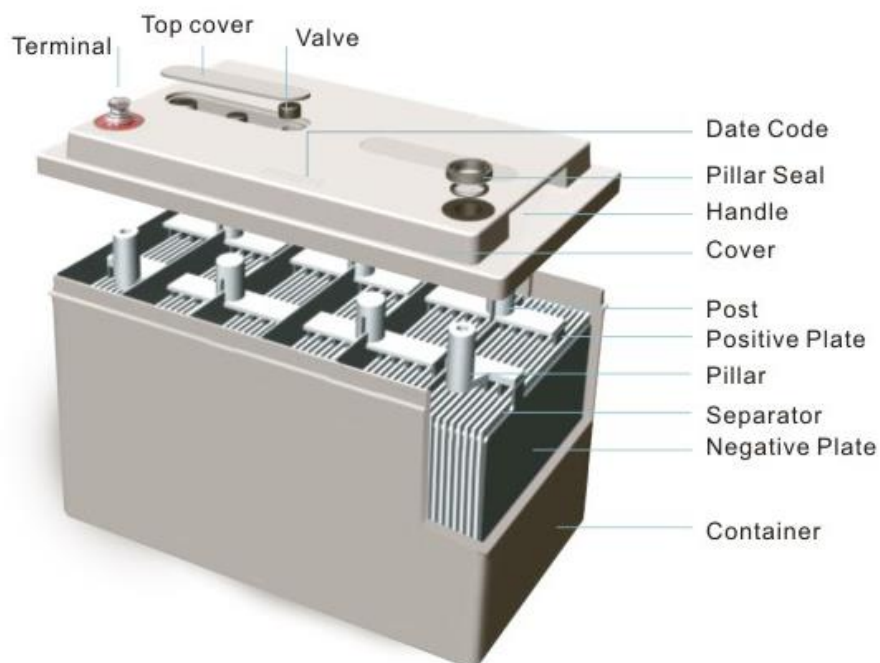
- Transportation

Standards

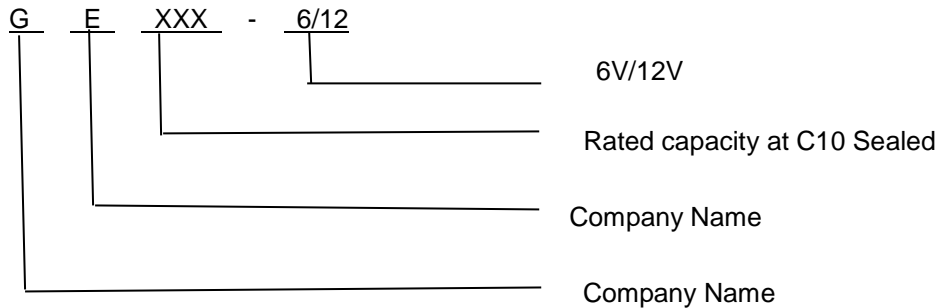
- GB/T19638.1-2014
- YD/T799-2010
- DL/T637-1997
- JIS C8704-1:2006
- JIS C8704-2:2006
- IEC60896-21/22:2004
- Eurobat guide
- Installation compliant with EN50272-2

Battery Construction

Battery Inside Structure:



General Specification



GE 6V/12V series

Table 1-1 GE 6V/12V series battery general specification:

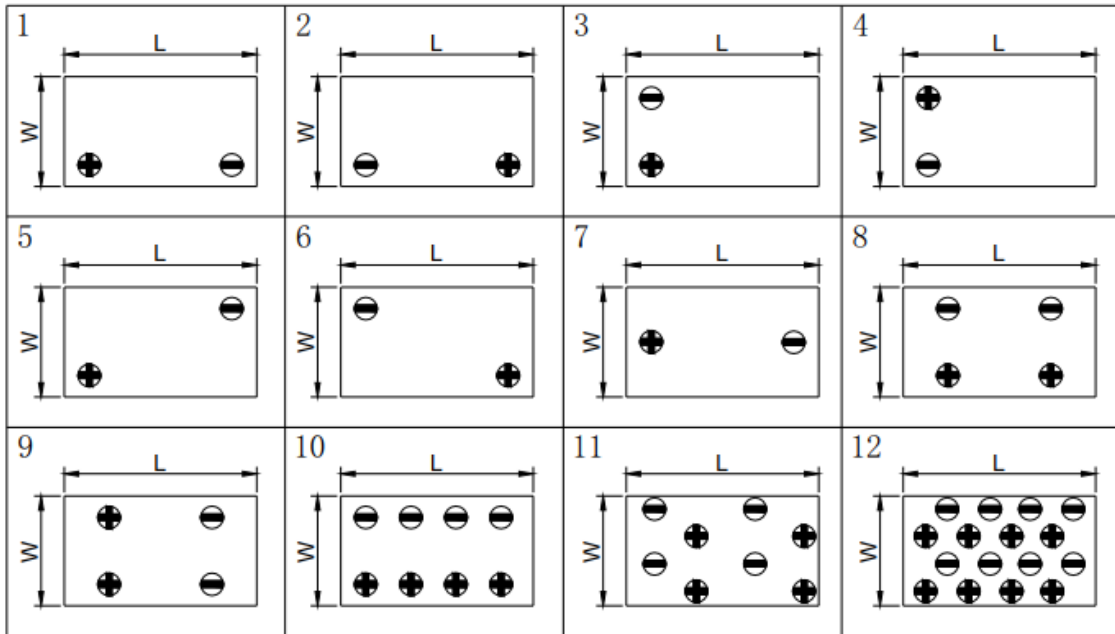
Medium Sealed Rechargeable Lead-Acid Batteries

Model	Nominal Voltage(V)	Rated Capacity@25°C (AH)		Approx Dimensions								Approx Weight		Terminals Type	Layout
		10HR 1.80V/ Cell	1HR 1.75V/ Cell	Length		Width		Height		Total Height		kg s.	lbs.		
				m m	in.	m m	in.	m m	in.	m m	in.				
GE100-6	6	100	55.0	195	7.68	170	6.69	206	8.11	209	8.23	15.9	35.05	F	5
GE120-6	6	120	66.0	195	7.68	170	6.69	206	8.11	209	8.23	17	37.48	F	5
GE130-6	6	130	71.5	260	10.24	180	7.09	247	9.72	251	9.88	20.5	45.19	H	6
GE180A-6	6	180	99.0	260	10.24	180	7.09	247	9.72	251	9.88	29	63.93	H	6
GE180-6	6	180	99.0	306	12.05	168	6.61	220	8.66	225	8.86	29	63.93	H	6
GE200A-6	6	200	110.0	260	10.24	180	7.09	247	9.72	251	9.88	30	66.14	H	6
GE200-6	6	200	110.0	323	12.72	178	7.01	224	8.82	227	8.94	30.2	66.58	H	5
GE210-6	6	210	116.0	260	10.24	180	7.09	247	9.72	251	9.88	30.5	67.24	H	6
GE225-6	6	225	124.0	244	9.61	190	7.48	275	10.83	275	10.83	31	68.34	H	6
GE230-6	6	230	126.5	260	10.24	180	7.09	247	9.72	251	9.88	31.5	69.44	H	6

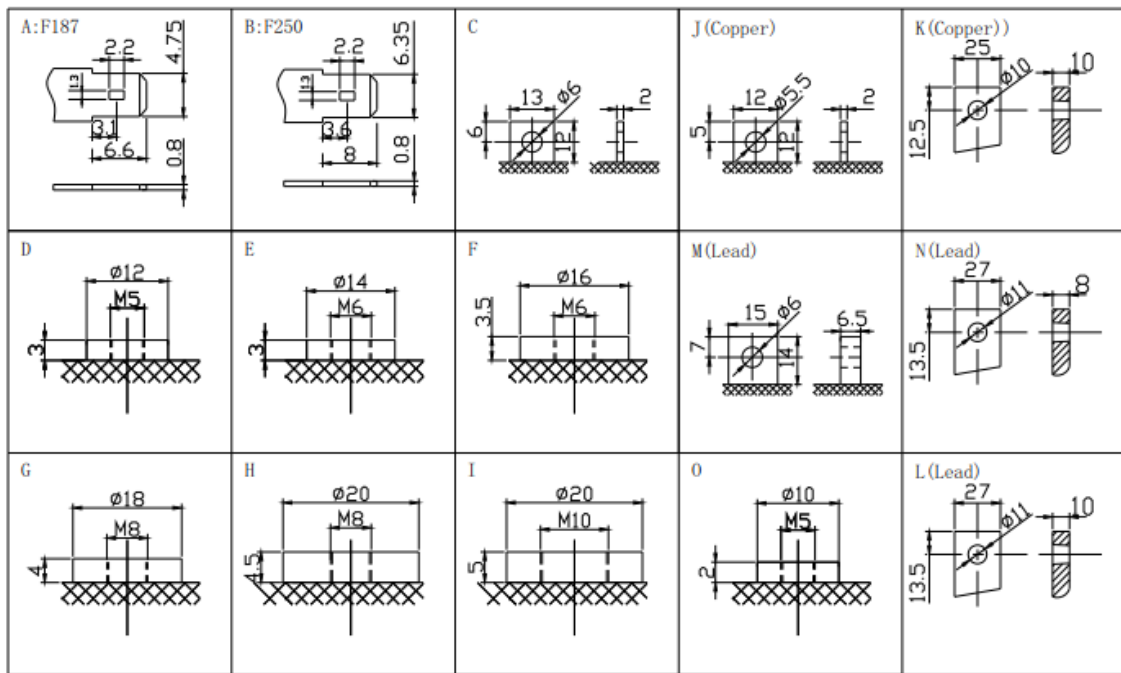
GE310-6	6	310	170.5	29 5	11. 61	17 8	7.0 1	34 5	13. 58	35 0	13. 78	47	103. 62	H	6
GE450-6	6	450	247.5	29 5	11. 61	17 9	7.0 5	40 4	15. 91	42 4	16. 69	57 .4	126. 54	H	6
GE24A-12	12	24	14.3	16 7	6.5 7	17 6	6.9 3	12 5	4.9 2	12 5	4.9 2	7. 5	16.5 3	E	2
GE24-12	12	24	15.4	16 6	6.5 4	12 5	4.9 2	17 5	6.8 9	17 5	6.8 9	7. 6	16.7 5	E	2
GE26-12	12	26	24.7	16 6	6.5 4	12 5	4.9 2	17 5	6.8 9	17 5	6.8 9	9	19.8 4	E	2
GE28-12	12	28	26.6	19 6	7.7 2	13 1	5.1 6	15 5	6.1 0	16 7	6.5 7	9. 5	20.9 4	F	2
GE33-12	12	33	17.6	19 6	7.7 2	13 1	5.1 6	15 5	6.1 0	16 7	6.5 7	10 .5	23.1 5	F	2
GE35-12	12	35	19.3	19 6	7.7 2	13 1	5.1 6	15 5	6.1 0	16 7	6.5 7	12	26.4 6	F	2
GE38-12	12	38	20.9	19 7	7.7 6	16 5	6.5 0	17 0	6.6 9	17 0	6.6 9	11 .8	26.0 1	F	2
GE40-12	12	40	22.0	19 7	7.7 6	16 5	6.5 0	17 0	6.6 9	17 0	6.6 9	12 .5	27.5 6	F	2
GE55-12	12	55	30.3	22 8	8.9 8	13 8	5.4 3	20 8	8.1 9	22 7	8.9 4	15 .4	33.9 5	F	1
GE60-12	12	60	33.0	26 0	10. 24	16 9	6.6 5	21 0	8.2 7	21 4	8.4 3	18 .3	40.3 4	F	1
GE65-12	12	65	35.8	34 8	13. 70	16 8	6.6 1	17 8	7.0 1	17 8	7.0 1	19 .5	42.9 9	F	1
GE75-12	12	75	41.2	26 0	10. 24	16 8	6.6 1	20 8	8.1 9	23 1	9.0 9	20 .6	45.4 1	F	1
GE80-12	12	80	44.0	26 0	10. 24	16 8	6.6 1	20 8	8.1 9	23 1	9.0 9	20 .8	45.8 6	F	1
GE90-12	12	90	49.5	32 9	12. 95	17 2	6.7 7	21 5	8.4 6	24 3	9.5 7	26 .5	58.4 2	G	1
GE100-12	12	100	55.0	32 9	12. 95	17 2	6.7 7	21 5	8.4 6	24 3	9.5 7	28	61.7 3	G	1
GE100A-12	12	100	55.0	33 9	13. 35	17 2	6.7 7	21 2	8.3 5	21 7	8.5 4	29	63.9 3	G	1
GE100-12	12	100	55.0	40 7	16. 02	17 5	6.8 9	20 8	8.1 9	23 8	9.3 7	30 .5	67.2 4	G	1
GE105-12	12	105	57.8	40 7	16. 02	17 5	6.8 9	20 8	8.1 9	23 8	9.3 7	31 .2	68.7 8	G	1
GE120-12	12	120	66.0	40 7	16. 02	17 5	6.8 9	20 8	8.1 9	23 8	9.3 7	33 .7	74.3 0	G	1
GE134-	12	134	73.7	34	13.	17	6.8	28	11.	28	11.	41	91.4	G	1

12				1	43	3	1	1	06	8	34	.5	9		
GE150-12	12	150	82.5	48 3	19. 02	17 0	6.6 9	24 1	9.4 9	24 1	9.4 9	43 .5	95.9 0	G	1
GE180 A-12	12	180	99.0	53 2	20. 94	20 7	8.1 5	21 4	8.4 3	24 0	9.4 5	49	108. 03	G	3
GE180-12	12	180	99.0	52 2	20. 55	24 0	9.4 5	21 8	8.5 8	24 4	9.6 1	55 .7	122. 80	G	3
GE200-12	12	200	110.0	52 2	20. 55	24 0	9.4 5	21 8	8.5 8	24 4	9.6 1	58 .5	128. 97	G	3
GE230-12	12	230	126.5	52 0	20. 47	26 9	10. 59	20 3	7.9 9	22 6	8.9 0	59	130. 07	H	3
GE240-12	12	240	132.0	52 0	20. 47	26 9	10. 59	20 3	7.9 9	22 6	8.9 0	60	132. 28	H	3
GE250-12	12	250	137.5	52 0	20. 47	26 8	10. 55	22 0	8.6 6	24 9	9.8 0	68 .2	150. 35	H	3
GE260-12	12	260	143.0	52 0	20. 47	26 9	10. 59	22 0	8.6 6	20 9	8.2 3	77	169. 75	H	3

Terminal Layout:



Terminal Type:

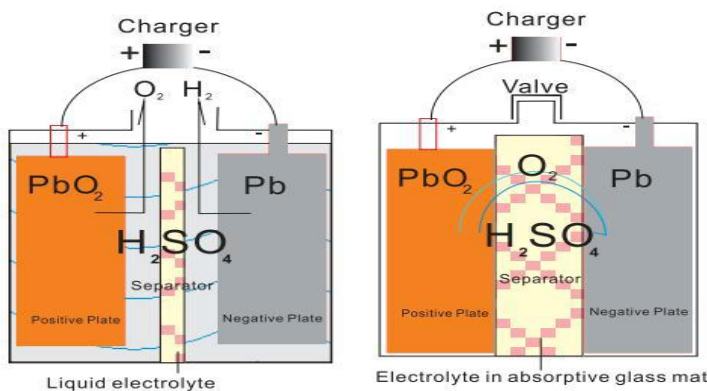


VRLA Technology

The electrochemical reaction of batteries in charge and discharge process as follows:

In the final stage of charge process, active substance in positive plate transformed to lead dioxide, negative plate has not reached fully charged stage, the process of active substance in negative plate transformed to spongy lead has not finished, oxygen gas generated in positive plate reaches the negative plate through separator pores and reacts active substance in negative plate, resulting depolarized state in negative plate, and restraining the generation of hydrogen.

Principle of the oxygen reduction cycle follows:



Chapter II: Electrical Characteristics

Discharge Characteristic Curve

The battery capacity is directly related to the discharge current, end voltage and discharge temperature. In general, the smaller discharge current, the lower end voltage, the higher temperature will cause larger discharge capacity. Figure 2-1 is the discharge curves of 6V/12V Series at different discharge rate at ambient temperature 25°C. Table 2-2 and 2-3 is constant current discharge data, customers could choose battery accordingly.

Figure 2-1 Discharge characteristic curve under different discharge rates (25°C)

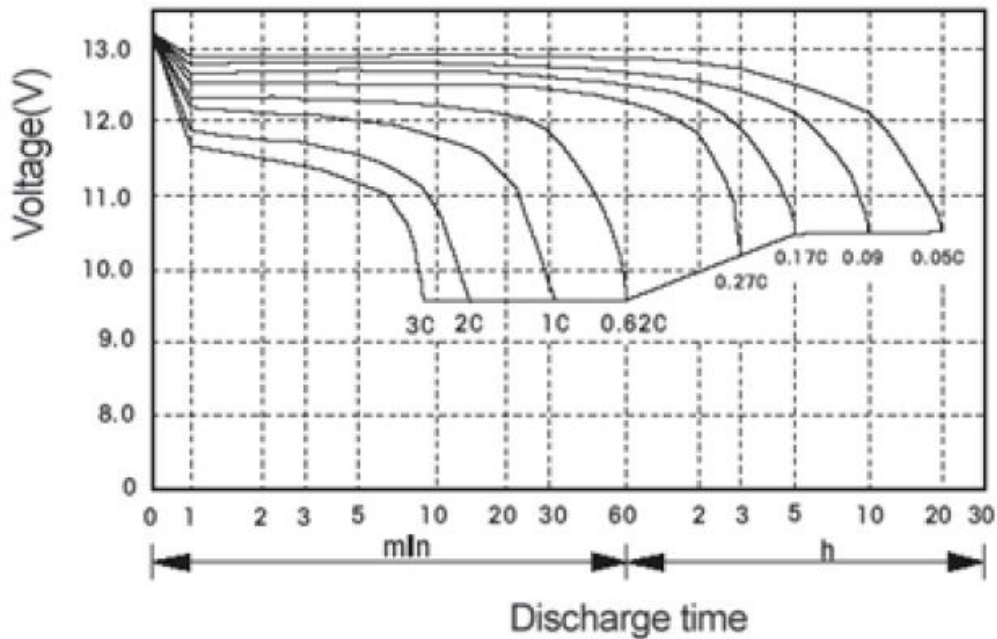


Table 2-1 6V/12V series battery end voltage at different discharge rate (25°C)

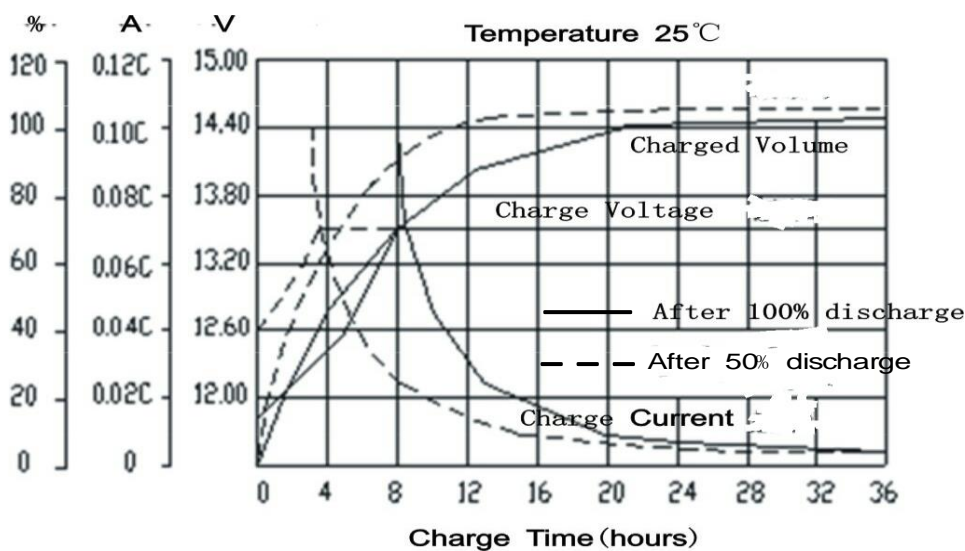
Discharge Rate(A)	End Voltage(V/cell)
$I \leq 0.01C_{10}$	1.95
$0.01C_{10} < I \leq 0.05C_{10}$	1.90
$0.05C_{10} < I \leq 0.09C_{10}$	1.85
$0.09C_{10} < I \leq 0.25C_{10}$	1.80

$0.25C_{10} < I \leq 0.55C_{10}$	1.75
$0.55C_{10} < I \leq 0.65C_{10}$	1.65

Charge Characteristic Curve

Figure 2-2 is the battery charge characteristic curves with constant voltage of 2.35V / cell, limited current of $0.1C_{10}$ A, Charge the battery for 25 hours after fully discharged battery and the charged capacity can be as high as the 104% of the discharged capacity.

Constant Charge Characteristics



Chapter III: Operation and maintenance

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 department . If there is need to replace and maintain, please contact after-sale service department;

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 flame and spark



Recycled



No short circuit



Proper disposal



Read instructions



UL certificate



CE certificate

Operation Parameters

6V/12V series batteries could be used in ambient temperature of $-15\text{ }^{\circ}\text{C} \sim +50\text{ }^{\circ}\text{C}$, and the recommended operation temperature is $25\pm 5\text{ }^{\circ}\text{C}$, higher or lower temperature will shorten battery service life.

The floating charge voltage, equalizing charge voltage showing in Table 3-1 is the setting data under ambient temperature of $25\text{ }^{\circ}\text{C}$, for parameter at other temperature please refer to Temp.Coefficient.

Table 3-1

floating charge voltage	2.25V/cell($25\text{ }^{\circ}\text{C}/77\text{ }^{\circ}\text{F}$)
equalizing charge voltage	2.35V/cell($25\text{ }^{\circ}\text{C}/77\text{ }^{\circ}\text{F}$)
Max.Charge current	$\leq 0.25C_{10A}$
Temp.Coefficient	$-3\text{mV}/\text{ }^{\circ}\text{C}/\text{cell}$

According the communication state power supply condition, line introduction and operation state, the city power supply can be divided into four types; divided conditions shall meet the following requirements:

I Type power supply : Introduction of each supply line from two independent power supply, the power supply is stable and reliable. The two lines should not appear at the same time the outage, the monthly average interruption frequency should not be more than 1 times, the average of each fault time should not be greater than 0.5h. The two supply lines should be automatically input device of standby power supply.

II Type power supply : supply line allows the planned maintenance outage, the monthly average interruption frequency should not be more than 3.5 times, the average of each fault time should not be more than 6h. The power supply shall meet the one of the following conditions requirements:

- 1) Introduction one supply line from stable ring network, the ring network formed by two or more independent power supply.

2) Introduction one supply line from one stable and reliable independent power supply or one stable and reliable transmission line.

III Type power supply : Introduction one supply line from one power supply, power supply line long, many users, the monthly average interruption frequency should not be more than 4.5 times, the average of each fault time should not be more than 8h.

IV Type power supply: The power supply shall meet the one of the following conditions requirements:

- 1) Introduction one supply line from one power supply, the supply line regular power failure, the power supply not ensure, not up to requirements of III type power supply.
- 2) A long time seasonal power failure or no power available.

Factors Influencing Capacity

Quantity of electricity battery discharge under certain condition is called battery capacity, symbol is “C” ,normal unit is Ampere Hour, in short is Ah. Usually discharge rate is indicated through the suffix of “C” ,such as C₁₀ means capacity at 10 hours discharge rate. C₃ means capacity at 3 hours discharge rate.

Battery capacity contains rated capacity and actual capacity, for GFM series battery rated capacity please refer to Table 1-1, it equal to discharge current multiply discharge time, unit is Ah.

The battery capacity is directly related to the discharge current, end voltage and discharge temperature. In general, the smaller discharge current, the lower end voltage, the higher temperature will cause larger discharge capacity.

Temperature Effect On Battery Capacity

Temperature effect on battery capacity. Figure 3-1 is capacity(C₁₀) and temperature curve, for example, temperature fall from 25°C to 0°C, capacity will be 80% of rated capacity, meanwhile, low temperature will cause long term charge shortage, negative plate will be vitriolization, finally there will be not any capacity. If discharge temperature is not 25°C, you could convert the capacity to C_{25°C} according to following formula.

$$C_{25^{\circ}\text{C}} = \frac{C_T}{1 + k (T - 25)}$$

In formula:

T---Discharge temperature

C_T---Capacity at temperature of T k---Temperature coefficient;

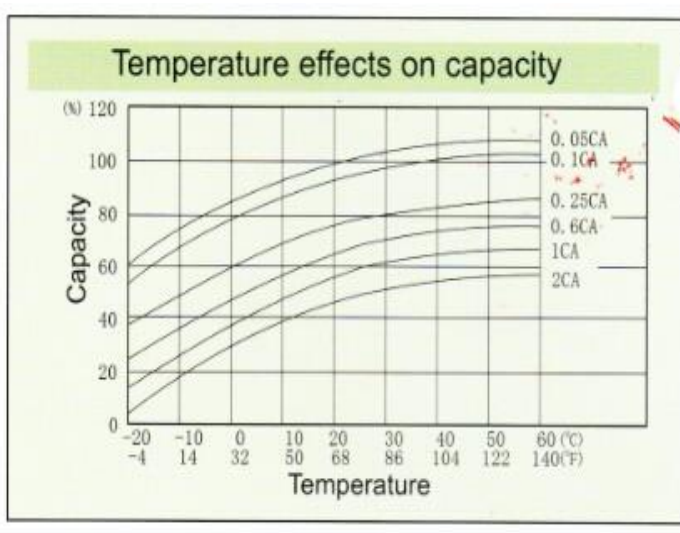
k=0.006/°C at C₁₀ discharge;

k=0.008/°C at C₃ discharge;

k=0.01/°C at C₁ discharge.

Along with temperature rise, battery capacity will be larger among certain range, for example, temperature rise from 25°C to 35°C, capacity will be about 105% of rated capacity, but temperature continue rise, capacity rise will be slow, finally, capacity will maintain no change.

Figure 3-1 6V/12V series temperature effect on battery capacity curve



Temperature and Floating/Equalizing Charge Voltage

Choose suitable floating charge voltage is for reaching perfect service life and rated capacity, if floating charge voltage is over high, floating current will be large accordingly, that will enhance plate corrosion speed and battery water loss, then shorten battery service life; if floating charge voltage is over low, battery can not maintain fully charged state, irreversible vitriolization will be caused easy, capacity reduced accordingly, then shorten battery service life as well.

Floating charge application, charge voltage could be adjusted according to ambient temperature, temperature compensation coefficient is -3mV/°C/cell. The same way to adjust

equalizing charge voltage. Please refer to Table 3-3. The floating voltage, equalizing voltage at different temperature are calculated as following formula:

$$V_T = V_{25^\circ\text{C}} + \frac{K \times (T - 25)}{1000}$$

In formula:

V_T ---Floating/Equalizing voltage at temperature of T, V/cell ; $V_{25^\circ\text{C}}$

---Floating/Equalizing voltage at 25°C, V/cell ;

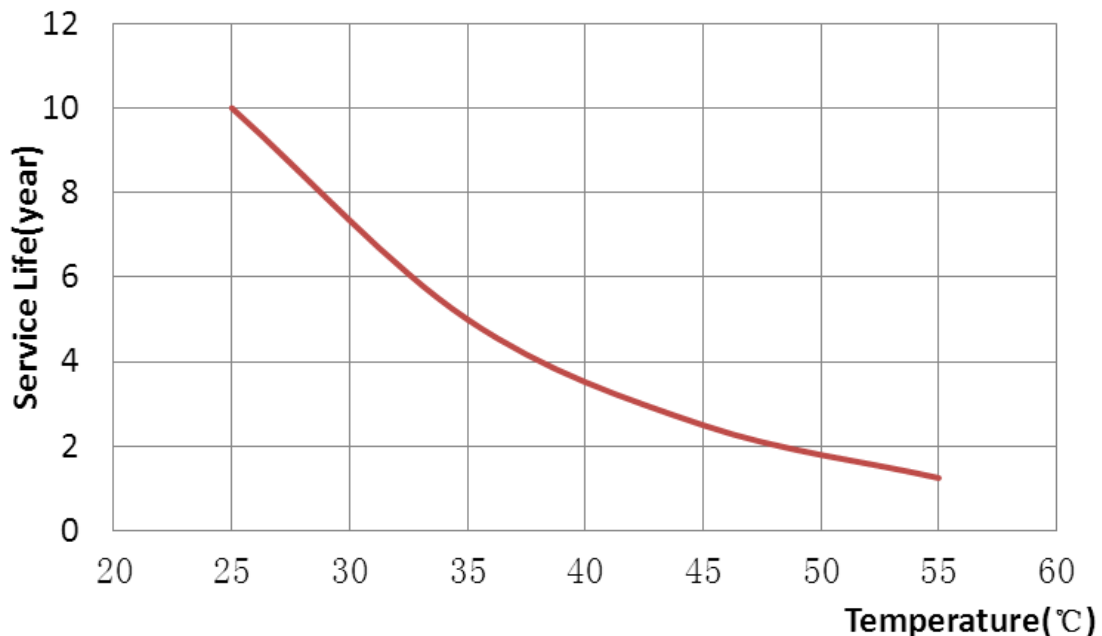
K---Temperature coefficient, mV/°C/cell ;

T---Environment temperature, °C.

Temperature Effect on Battery Service Life

Higher temperature will speed up the battery grid corrosion and water loss, thus greatly shorten the battery life, when the temperature is over 25°C, the service life of the battery will be shortened by half as the temperature increasing by 10°C, shown in Figure 3-2.

Figure 3-2.



Charge Requirement

Equalizing Charge and Supplementary 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.
- Running in full-floating operation for three months, or when there are more than two batteries with voltage of lower than 2.18V. ● The battery is out of work beyond 3 months. ecommended charge method as follows:

- Using the constant current $0.1C_{10}A \sim 0.15C_{10}A$ charging the battery group to the battery average voltage reach to equalizing voltage, then switch to using the constant equalizing voltage charging the battery, the equalizing charging time is generally 10-20h.
- After equalizing charging, for still lower than 2.18V/cell battery, should be using $0.1C_{10} A$ discharge 3-4h, and then equalizing charge.

Recharge

Recharge the battery immediately after complete or partial discharge according to the below method:

Using the constant current $0.1C_{10}A \sim 0.15C_{10}A$ charging the battery group to the battery average voltage reach to equalizing voltage, then switch to using the constant equalizing voltage charging the battery until the end of battery fully charged. Using the above method charging, the fully charged marks can use any of the following two conditions as the basis of adjustment:

- Different depth of discharge, the battery fully charged time refer to table 3-4.
- At the constant voltage condition, the charging current value is invariable in continuous three hours at the end of charging.

Under special conditions, the battery should be fully charged asap, may be appropriate to increase the charging current: limited current $\leq 0.25C_{10} A$,

table 3-4.

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	$0.10C_{10}$	1.6	2.35	12

	0.15C ₁₀	1.2	2.35	10
50	0.10C ₁₀	4.3	2.35	18
	0.15C ₁₀	3.3	2.35	16
80	0.10C ₁₀	6.8	2.35	20
	0.15C ₁₀	5.5	2.35	18
100	0.10C ₁₀	8.7	2.35	24
	0.15C ₁₀	6.8	2.35	22

The above charging time, voltage is under ambient temperature of 25°C, charging voltage should be adjusted according temperature compensation coefficient.

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. For floating operation, the charge voltage should be suitable adjusted according to ambient temperature as shown in Figure 3-3.

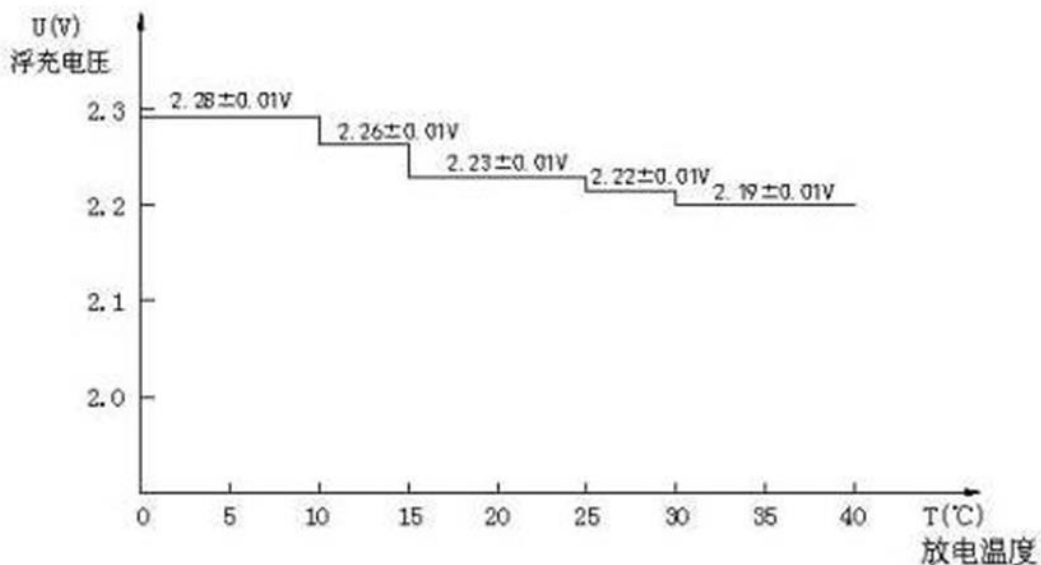


Figure 3-3. Environmental Temperature-Float Charge Voltage Relationship Curve

Storage

■ The battery can be stored at -10~45°C before installation; the storage time shall not exceed 6 months and 3 months at -10~30°C and 31~45°C respectively. Battery that has been stored for a long time shall be charged and the longest storage time should not exceed 18 months.

■ The battery should be stored in clean, ventilate, and dry environment with dustproof, moisture proof, anti-collision and other protective measures. To place the battery in closed containers is strictly prohibited.

■ The used battery shall be charged fully before storage, then store the battery following the storage requirements.

Maintenance

To ensure the performance of battery, the battery should be correctly inspected and maintained. The maintenance methods are recommended as follows.

Monthly Maintenance

- Keep the battery space clean.
- Measure and record the ambient temperature of the battery-room and battery container temperature.
- Check battery cleanliness, terminal damage and heating track, container and lid damage and over heating track.
- Check battery and battery rack connection, spring mat and bolts connected tight or not, input terminal heating or not, connected terminal between layer heating or not.
- Check the container sealing, leakage/potential leakage or not in terminal, valve and container position.
- Check charge temperature compensation function in normal or not, parameters setting correct or not, equalizing charge voltage, floating charge voltage period and other parameters reasonable setting or not.
- Measure and record the total voltage and floating current of the battery system.

Quarterly Maintenance

- Repeat every item of monthly inspection.
- Measure and record the floating voltage of each on-line battery. After temperature emendation, if more two batteries with a voltage of lower than 2.18V, the battery system needs equalizing charge. If the problem is not solved, go on annually maintenance even three yearly maintenance items. All the above methods fail, please contact our after-sale service center.

Annually Maintenance

- Repeat every item of quarterly maintenance and inspection.
- Check whether the battery beyond service expiry or not.
- Perform a discharge test to check the exact load every year, discharge 30%-40% of the rated capacity.

Maintenance notes

- 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;

Check whether safety valve twisted tightly or not, but please do not take down it;

- 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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