星光电源实业有限公司

Starlight Power Industrial Company Limited

[详细阅读后再进行操作]

Please read this manual carefully before operation

Reliable Power Solution

FM GFM 阀控式密封铅酸蓄电池

FM GFM Sealed Valve-Regulated Lead-Acid Storage Battery

技术手册

Technical manual

目　录 Content

1 引言 Introduction

FM GFM 系列阀控密封铅酸蓄电池是在研究传统的“铅——硫酸——二氧化铅”电化学的基础上，应用气体再化合原理，采用新型材料、新技术设计制造而成。

The FM GFM series valve-controlled confinement lead-acid battery was made with new material and new technology by using gas recombination principle. It’s based on the study of the traditional “lead-sulfuric acid-lead dioxide” electrochemistry.

星光电源科技有限公司融汇国内外数十年的科研成果，形成了自己独特的阀控密封铅酸蓄电池设计技术，产品采用国际 IEC、日本 JIS 和我国电力、邮电等行业标准制造，按国际最先进的 ISO9001 管理模式建立质量保证体系，并被有效的运行，对产品容量、开路电压、浮充电压均衡性、密封性、安全阀开启压力以及极性等性能 100%在线检测，因而具有很高的可靠性和稳定性。该产品多次通过电力部、邮电部和解放军总参部检测，并被列为定点配套入网产品。是国际上九十年代的最新型蓄电池产品。

Starlight Power Technology Co Ltd. designs its own peculiar sealed valve-control lead-Acid storage battery by combining the scientific achievements of domestic and international scientific research field for some tens of years complied with international IEC, JIS of Japan and our country’s electric power & post and telecommunications and other industries’ standard. We set up the quality guarantee system using the most advanced internationally recognized ISO9001 management pattern with good performance. On-line detect shall be finished for product capacity, open-circuit voltage, equalization performance, float charge voltage, confinement feature, protection valve’s response pressure, polarity and other performances. The product with a high percentage of reliability and stability has passed for many times test by Ministry of Electric Power, Ministry of Post and Telecommunications and Ministry of PLA General Staff. The battery has been listed as regular locality and complete net-joining product. It is the newest type storage battery in international market of the 90’s.

2 主要用途 Main usage

2.1 浮充使用（备用电源）

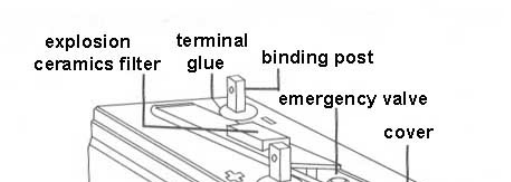
Float charge usage (standby power supply).

- 电信、通信设备、程控交换机。
- Telecommunications, communication apparatus, SPC exchange.
- 应急照明系统。
- Emergency lighting system.
- 安全防盗、防火报警系统。
- Safety and prevention of burglary, fire protection alarm system.
- 计算机 UPS。
- Computer UPS.
- 电力开关系统。
- Electric power switch system.
- 发电厂、变电所直流操作电源及备用电源。
- Electric power plant, substation directly current operation electric source and standby electric source.
- 发动机起动、船舶设备。
- Engine startup, ship craft equipment.
- 太阳能系统。
- Solar system.

2.2 循环使用 Cycled usage

- 便携式电视机、摄录像机、收录音机。
- Portable TV, pickup camera, radio and tape recorder.
- 电动工具、割草机、吸尘器。
- Electric tool, field mower. Vacuum cleaner.
- 照相机、新闻摄影设备。
- Camera, news photography equipment.
- 便携式个人计算机、语言处理器、终端。
- Portable personal computer, language processor, terminal.
- 野外测试设备、医疗仪器设备。
- Outdoor testing equipment, medical instrument equipment.
- 移动电话机、对讲机。
- Mobile phone, walkie-talkie.
- 矿灯、割胶灯、应急灯、铁路信号灯。
- Lamp, tapping lamp, emergency light, railway signal light.
- 电动玩具、电动轮椅。
- Electric toy, electric wheel chair.

3 电池结构 Structure of the battery



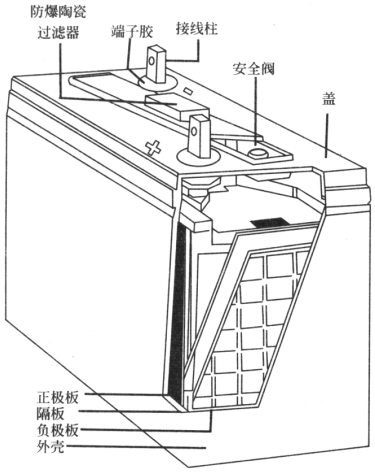


图 1.蓄电池结构(12V 系列)　　Fig.1 structrue of the storage battery (12V series)

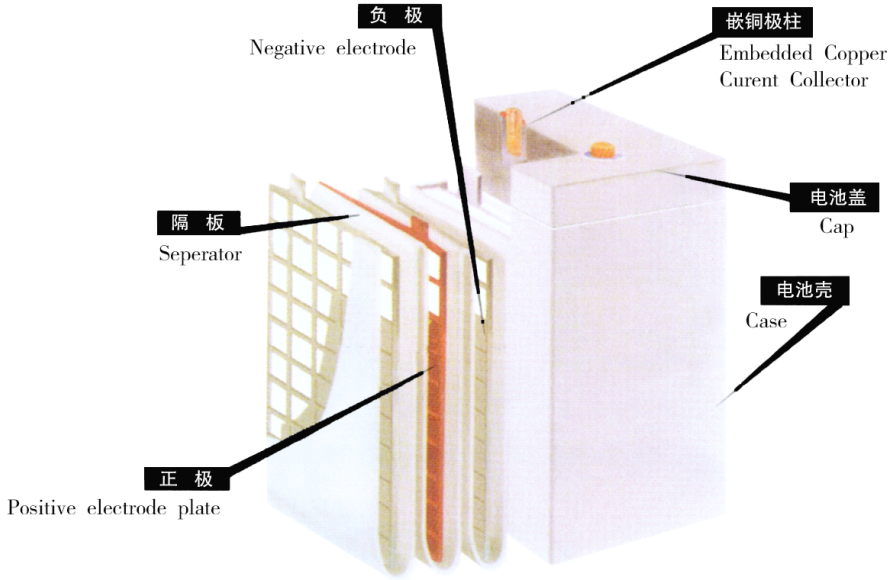


图 2.蓄电池结构(2V 系列)　　Fig.2 structrue of the storage battery (2V series)

表 1　FM GFM 系列蓄电池构件与功能

Table.1 SUPER FM GFM series storage battery component and its function

部　　件 **Component**	结构材料 **Structural material**	功能 **Function**
正极板 Positive plate 负极板 Negative plate	涂浆式极板,把活性物质涂在特制铅钙合金骨架上。 Paste-smeared plate spread active material on specially made lead-calcium alloy frame.	保持足够的容量 Keep sufficient capacity 维持容量长期使用性用（长寿） Keep capacity that can be used for long. (Longevity) 减低自身放电量。

		Reduce self-discharge volume 提高释放气体电极电位。 Increase releasing gas electric pole and electric potential
隔板 Dummy plate	高强度耐热氧化性极佳的优质超细玻璃纤维毡。 High density, heat resisting, excellent oxidizability, high quality superfine glass fiber mat.	防止正、负极板之间短路。 Preventing short circuit between positive and negative plate. 吸附储备电解液，无流动电解液。 Absorption of the reserve electrolyte, no flowing electrolyte. 紧压极板表面，防止活性物质脱落。 Coarctation the surface of the polar plate, preventing the active material from coming off.
电解液 Electrolyte	分析纯硫酸配以高纯水和特定的添加剂。 Analytical pure sulfuric acid mixed with high pure water and special additives.	正负极活性物质间产生电化学反应。 The active material between positive and negative poles produces chemical reactions. 导电作用。 Conduction of electricity
外壳和盖 Shell and cover	丙烯腈（A）—丁二（B）—苯乙烯（S）共聚物合成树脂。 Propenyl cyanide (A) – bivinyl; butadiene (B)-styrene (S)-interpolymer synthetic resin.	容纳由正负极板和隔板组成的极群。保持足够的机械强度，可抵受蓄电池内的压力。 Holding pole clusters consisting of positive plate, negative plate and dummy plate, keep in enough mechanical strength to withstand pressure from inside the storage battery.
安全阀 Emergency valve	用无双键、耐酸性极好、品质稳定而耐用的合成橡胶制成。 采用帽形或柱形。 内装陶瓷过滤器。 Made with artificial rubber with no double bond, excellent acid proof, the quality is stable and endurable in use. Adopting cap-like or column. Installed interior ceramics filter.	如果蓄电池内气压高于正常值时，便放出气体，使内压正常化。 防止氧进入和酸雾放出。 If the atmospheric pressure within the storage battery is above the normal value, gas will be sent out, and the pressure from inside will become normal. Preventing oxygen from coming inside and acid mist going outside.
端子 Terminal	用铅合金制成，与接线柱一起整体模制。 Made with aluminum alloy, it is molded completely with the binding post.	非焊接及截面积大的接线端子提高放电倍率和可靠性。容易连接。 Binding post of the weldless connection and large sectional area can increase the discharge magnification and improve reliability. It can be easily connected with the battery’s contact pin.

极柱密封 Pole confinement	封口剂的颜色：正极为红色，负极为蓝色。特种密封胶，专用密封圈。 The color of the sealing off agent; red for the positive pole, blue for the negative pole. Special sealing glue, special sealing ring.	内外多层密封，防止爬酸渗液。 Multiple layers of sealing from both inside and outside. Acid liquid cannot be leaked out.

4 密封原理 Sealing Method

铅酸蓄电池的充放电的电化学反应过程如图 3，反应方程式如下：

The electrochemical reaction process of the lead-acid storage battery, see Fig.3, the reaction equation as follows:

$$PbO_2 + 2H_2SO_4 + Pb \underset{\text{充电 charge}}{\overset{\text{放电 discharge}}{\rightleftharpoons}} PbSO_4 + 2H_2O + PbSO_4 \cdots\cdots\cdots (1)$$

正极	电解液	负极	正极	水	负极
Positive pole	electrolyte	negative pole	positive pole	water	negative pole

充电后期在正极板产生氧气，在负极板产生氢气

In the later stage of the charging, the positive plate produces oxygen, the negative plate produces hydrogen.

正极 Positive pole：$H_2O \rightarrow 1/2O_2 + 2H^+ + 2e$……（2）

负极 Negative pole：$2H^+ + 2e \rightarrow H_2$……（3）

铅酸蓄电池实现密封免维护的难点就是充电后期水的电解，SUPER FM GFM 系列电池采取了以下几项重要措施，从而实现了密封性能。

For sealing & maintenance free of the lead-acid storage battery, the difficulty lies in the effect of the electrolysis of the water during the later period of charging. SPUER FM GFM SERIES Storage Battery adopted the following important measures and the sealing nature can be realized afterwards.

- 采用铅钙合金板栅，提高了释放氢气电位，抑制了氢气的产生，从而减少了气体释放量，同时使自放电率降低。
- Using lead-calcium alloy slab grid to increase electric potential and preventing the production of the hydrogen so that releasing volume of the gas was reduced, meantime the self-discharge ratio was also reduced.

- FM GFM 系列蓄电池利用了负极活性物质海绵状铅的特性，这种物质在潮湿条件下活性很高，能与氧快速反应，阴极吸收氧气，抑制了水的减少而无需要补充水。
- FM GFM Series Storage Battery uses the features of sponge-like lead in the negative pole active material. This material has high activity under damp condition and can be quickly reacted with oxygen. The negative pole absorbs the oxygen, the reduction of water can be prevented and there is no need for adding water.
- 在充电最终阶段或在过量充电情况下，充电能量消耗在分解电解液的水份，因而正极板产生氧气，此氧气与负极板的海绵状铅以及硫酸起反应，使氧气再化合为水。同时一部分负极板变成放电状态，因此也抑制了负极板氢气产生。与氧气反应变成放电状态的负极物质经过充电又恢复到原来的海绵状铅。
- In the final period of the charging or under the condition of over charging, the charging capacity was consumed by the water in the decomposition of the electrolyte, and the positive plate produces oxygen, the oxygen reacts with the sponge-like lead and the sulfuric acid in the negative plate and make the oxygen recombined into water. Meantime a part of the negative plate turns into discharging status; this prevents the production of hydrogen in the negative plate. The negative pole material that reacted with oxygen and became the discharging status restores into the original sponge-like lead after charging.
- 为了让正极释放的氧气尽快流通到负极，采用了新型超细玻璃纤维隔板，其孔率可达 90%以上，贫液紧装配设计使氧气易于流通到负极再化合为水。
- In order to let the oxygen that released from the positive pole flows quickly to the negative pole, new type superfine fiberglass dummy plate was applied; the aperture ratio can reach to 90% and up. The design of lean solution can make the oxygen flow easily to negative pole and recombine into water.

充电的最终阶段或过量充电情况下所进行的化学反应如图 4，反应方程式如下：

The chemical reaction in the final period of the charging or under the condition of over charging, see Fig.4, the reaction equation as follows:

正极的反应 Reaction of the positive pole：$2H_2O \rightarrow O_2+4H^+ +4e$……（4）

负极的反应 Reaction of the negative pole：$2Pb+O2 \rightarrow 2PbO$（吸收氧气）……（5）

$2PbO+2H_2SO_4 \rightarrow 2PbSO_4+2H_2O$……（6）

$2PbSO_4+4H^+ +4e \rightarrow 2Pb+2H2SO_4$($PbSO_4$还原)……（7）

负极总反应 Overall reaction of the negative pole：$O_2+4H^+ +4e \rightarrow 2H_2O$……（8）

综上所述：从正极板产生的氧气硫电时很快与负极板的活性物质起反应并恢复成水，由于损失极少，故此使蓄电池成为密封式电池。

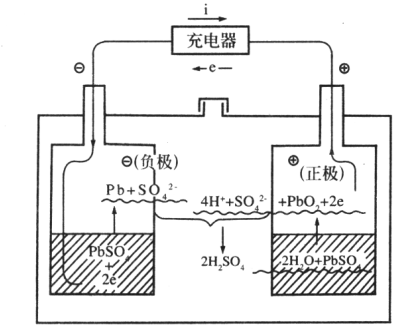
In a word, the oxygen produced from the positive plate will react quickly with the active material in the negative plate and restored into water, because the loss is very little, the storage battery becomes sealing type battery.

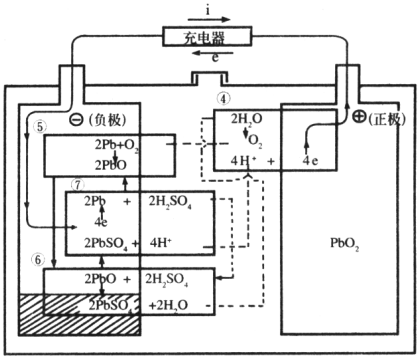
当充电电流超过一定值或充电温度低于特定的温度，正极产生的气体可能不会被负极全部吸收，这种情况下，内部压力就要升高，在特定的压力下（10-49KPa）安全阀就要开启。

When charging current exceeds a certain value or charging temperature is below a special setting value, the gas produced from the positive pole cannot be completely absorbed by negative pole, under this circumstance, the pressure from inside is sure to rise, under special pressure (10-49KPA), the emergency valve will crack.

一定要注意：当安全阀开启时，电解液就要消耗，就会引起电池性能的降低，为了防止这一情况，充电时一定要遵照本技术手册规定的充电要求进行操作。

Attention: When the emergency valve cracks, it is certain the electrolyte will be consumed, and the performance of the battery shall be reduced accordingly; In order to prevent this please follow the instructions stipulated in this technical manual when charging.





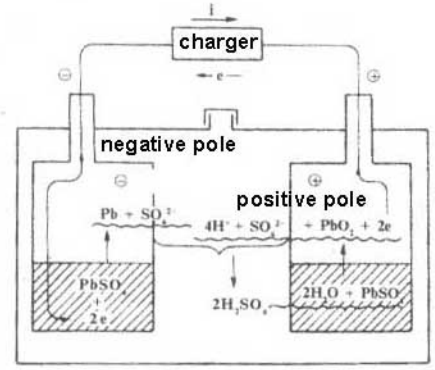


Fig. 3 reaction before finishing charging and after charging

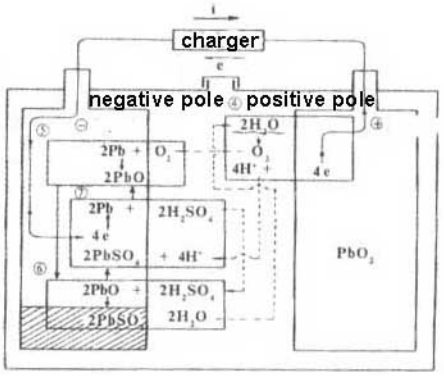


Fig. 4 reaction after the final stage of the charging

图 3：充电开始到最后阶段前的反应

图 4：充电最后阶段之后的反应

5 技术特点 Technical Characteristics

● 免维护操作 Free of Maintenance

在整个寿命期间无需加酸加水和检查电解液密度，对内部无需维护。

During the whole life expectancy, there is no need to add any acid and water and check the density of the electrolyte. There is no need for interior maintenance.

● 密封无泄漏 Sealing without leakage

采用特殊 AB 密封胶粘接壳体，端子极柱采用多层密封防渗漏技术，无爬酸漏液现象。

Using special AB seal gum cemented hard surface, terminal pole used the technology of multiple layers

sealing leakage proof. There is no phenomenon of weeping acid and leaking liquid.

● 极低的自放电 Extremely low self-discharging

采用电化学方法制作的特殊铅钙合金制造板栅和高纯材料制造电池，自放电很低，在 20℃环境温度下，自放电每天低于额定容量 0.1%（每月小于 3%）

The self-discharging is extremely low by using electrochemical method in making special lead calcium alloy slab grid and using high, pure material in making battery. Under environmental temperature of 20℃ the self-discharging is below the nominal capacity 0.1% every day (Every month it is less than 3%).

● 安全防爆 Safety and explosion protection

设有防火安全阀，当内部产生气体过多时自动放气，然后关闭。同时防止腐蚀性气体放出和外部火花向内部引爆。

Fire protection emergency valve is equipped. It will automatically release the gas when too much gas produced inside and then shut off. Meantime it can prevent corrosive gas from coming out and prevent outside electric spark from coming inside and making explosion.

● 长寿命设计 Long life cycle design

● 使用耐蚀性优良的特殊铅钙合金制成的重型板栅、高强度隔板和紧装配防脱粉工艺，具有 10 年以上的浮充寿命。

● Using heavy type slab grid with good quality and corrosion resistant made of special lead calcium alloy; high-strength dummy plate and tight assemblage powder disengage free technology; it has more than 10 years' floating charging life expectancy.

● 高倍率放电性能好 High magnification discharging performance

采用独特低内阻设计制造工艺，具有良好的大电流放电性能。

Using special low intrinsic resistance design and manufacturing technology. It has excellent high-current discharging nature.

● 便于安装 Easy installation

采用高效能气体再化合设计，无腐蚀性气体放出，无流动电解液，可以任意角度（倒立除外）柜式或架式安装，实现机（器）—电池同室安装使用。

Using high performance gas recombination design, no release of corrosive gas, no flowing electrolyte, can be installed at any angles (with exception of turning upside down) including cabinet type or frame type, the machine and the battery can be installed and used together in the same room.

6 技术规格 Technical Parameters

表 2　SUPER FM GFM 系列密封铅酸蓄电池规格型号

Tab.2 Specifications for SUPER FM GFM series sealed Lead-acid Battery

型号 **Model**	额定电压 **Rated voltage** (v)	10H 率容量 **10H Rate capacitance** (AH)	外 型 尺 寸 **Dimensions**			
			长 **Length** (L)	宽 **Width** (W)	高 **Height** (H)	总高 **Total height** (TH)
6-FM-3.5	12	3.5	114	65	65	74
6-FM-6.5	12	7.2	151	65	94	101

6-FM-10	12	10	151	97	95	101
6-FM-12	12	12	150	98	96	101
6-FM-15	12	15	181	76	167	176
6-FM-24	12	24	165	175	128	134
6-FM-38	12	38	197	165	145	145
6-FM-50	12	50	325-352	168	179	179
6-FM-65	12	65	325-352	168	179	179
6-FM-80	12	80	380-410	170	222	240
6-FM-100	12	100	380-410	170	222	240
GFM-100	2	100	64	170	325	350
GFM-150	2	150	110	175	330	350
GFM-200	2	200	110	175	330	340
GFM-250	2	250	157	175	330	340
GFM-300	2	300	157	175	330	340
GFM-400	2	400	212	178	330	340
GFM-500	2	500	244	175	330	341
GFM-600	2	600	300	175	325	346
GFM-800	2	800	411	175	332	342
GFM-1000	2	1000	479	175	332	342
GFM-1200	2	1200	400	350	344	355
GFM-1500	2	1500	400	350	344	355
GFM-2000	2	2000	490	350	340	350
GFM-3000	2	3000	710	353	340	350

7 电气性能 Electrical Performance

7.1 充电特性 Charging Characteristic

无论用户使用状态如何，FM GFM 系列蓄电池要求采用限流—恒电压方式充电，即充电初期控制电流（小于 0.2C）一般采用恒流（0.1C）中、后期控制电压的充电方法。充电参数见表 3：

Current limit-voltage constant mode charging must be used for SUPER FM GFM series battery, that is: current constant (0.1C) is carried out in the initial charging stage for control current (less than 0.2C) and in the middle and final stage, voltage constant charging manner shall be used. Charging parameters shown as Table 3

表 3　充电基本参数（25℃）Tab. 3 charging parameters (25℃)

充电方法 Charging mode / 参数 Parameters / 使用方法 ApplicationMode	恒流充电电流 **Constant charging current** (A)		恒压充电电压 **Constant charging voltage** （V）	
	标准电流范围 **Standard current range**	最大允许范围 **Allowable maximum range**	允许范围 Allowable range	设置点 **Setting point**
浮充使用 Float charge	0.08-0.10C	<0.2C	2.23-2.25	2.24
循环使用 Cycle	0.08-0.10C	<0.2C	2.35-2.45	2.40

注：如 100AH 电池，则恒流充电电流 I=(0.08-0.1)*100=8-10A

***注意：蓄电池一般应在 5-35℃范围内进行充 电，低于 5℃高于 35℃都会降低寿命。充电的设定电压应在指定范围内，如超出指定范围将造成蓄电池损坏，容量降低及寿命缩短。**

Note: Storage battery should be charged in the temperature range from 5 to 35℃. Once the temperature is lower than 5℃ or higher than 35℃, the life cycle of the battery will be reduced. The preset voltage value for charging use should be in prescribed range. Beyond the range the storage battery will be damaged.

7.1.1 浮充电特性 Floating Charge Characteristics

25℃时 2V 蓄电池浮充电压采用 2.24V，12V 蓄电池浮充电压为 13.5V。浮充饱和时浮充电流一般每 AH 为 1-2mA，其充电特性见图 5。

Float charge voltage shall be 2.24V for 2V battery at 25℃ and for 12V battery to be 13.5V. While float charge saturation state reaches, float charge current shall be generally 2-4mA for each AH, whose charging feature shown as Fig.5.

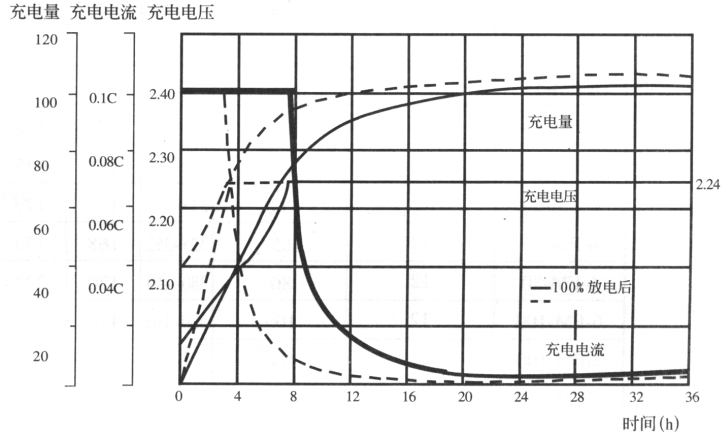
浮充电压应根据温度变化进行调整，其校正系数 K 为-3mV/℃即

Float charge voltage must be regulated in accordance with variation of temperature, herein ,calibrating coefficient K is -3mv/℃

$Vt=V_{25}+K(t-25)$

具体选择可按图 6 进行。

Specific selection shall be made as Fig.6.



充电量 charging volume
充电电流 charging current
充电电压 charging voltage

图 5 充电特性曲线 Fig.5 Charging Characteristic Curve

7.1.2 循环充电特性 Cycled charging characteristics

25℃时循环使用 2V 蓄电池充电电压为 2.40V ，12V 蓄电池充电电压为 14.4V。其充电特性同图 5。

Charging voltage shall be 2.40V at 25℃ for cycled use 2V battery and for 12V battery should be 14.4V. Its charging characteristic is the same as Fig.5.

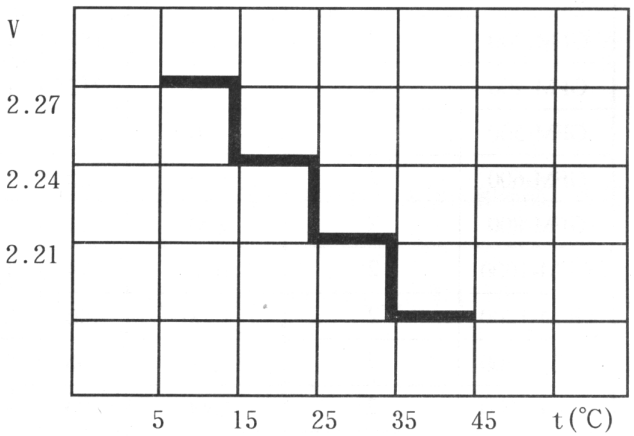


图 6　浮充电压选择指南　　Fig.6 Float Charge Voltage Selection Guide

7.1.3 均衡充电特性 Equalizing charge characteristic

SUPER FM GFM 系列蓄电池正常浮充使用时不需要进行均衡充电，当出现整组电池浮充电压偏差大于 0.1V 或个别单体电压过低（<2.18）以及严重过放等情况，需提高浮充的恒压电压给电池均衡充电。其充电特性同图 5，只是其充电电压为 2.30V-2.40V，一般采用 2.35V(12V 电池为 14.1V)。There is no need of equalizing charge when SUPER FM GFM series battery is in a normal application of float charge. While following cases happened such as float charge voltage bias greater than 0.1V for the whole set of battery and/or individual single battery voltage lower than 2.18V and /or serious over discharge, equalizing charge to the battery in order to raise float charge constant voltage herein, charging voltage shall be within the range of 2.30-2.40V and generally 2.35V is selected (14.1V for 12V battery) which charging feature is same as the Fig.5.

7.2 放电特性 Discharge Characteristic

7.2.1 恒流放电特性 Constant Current Discharge Characteristics

蓄电池放出容量与放电电流有关，放电电流越大，放出容量越小，其不同倍率放电特性曲线如图 7，基本放电参数见表 4。

Battery discharge capacitance is related to its discharge current. The greater the discharge current is, the smaller the discharge volume will be. The discharge characteristics for different magnification are shown as Fig.7 and the basic discharge parameter as Table 4

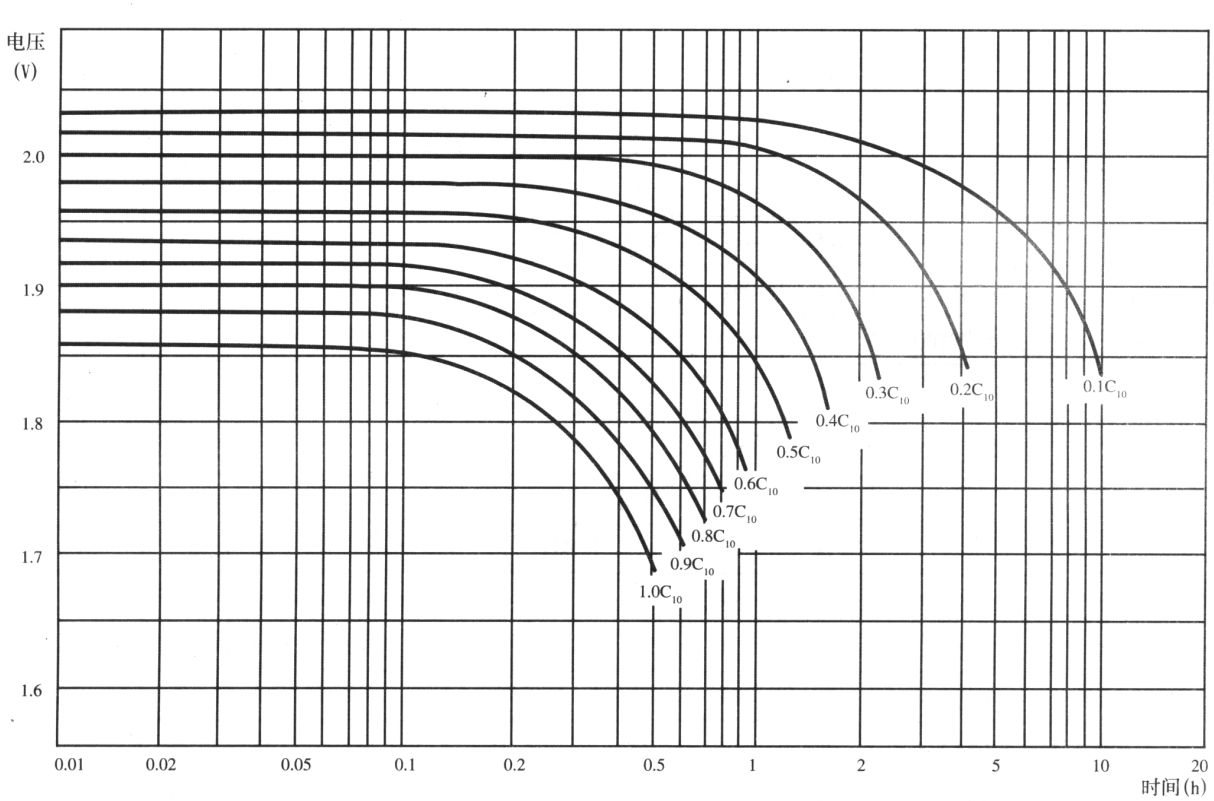


图 7　不同放电率放电特性曲线

Fig.7 Discharge characteristic curve at different discharge velocity

电压 voltage　时间 time

FM GFM 小型密封电池最大放电电流为 15 倍率，固定密封电池最大放电电流为 6 倍率，最为有效的放电电流范围是 0.05CA-1.0CA。

蓄电池过放会缩短使用寿命，应尽量避免。放电时端电压不能低于终止电压，否则会发生过放电现象。

Maximum discharge current magnification for miniature sealed battery shall be 15 and for fixed type sealed battery should be 6; the most effective discharge current range is from 0.05CA to 2.0CA. Overdischarging battery will reduce its life cycle. While the battery being discharged, terminal voltage should be not lower than end point voltage to prevent overdischarge.

表 4　FM GFM 12V、2V 密封蓄电池的放电基本参数与电气性能

Tab.4 Discharge Parameters and Electrical Performance for 2V &12V Sealed Battery.

蓄电池型号 **Battery type**	各种倍率放电　**Various magnification discharge**							
	10 小时率 **10-hour rate**（1.80V）		0.5 倍率 **0.5- magnification**（1.60V）		1 倍率 **1-magnification**（1.60V）		6 倍率 **6-magnification**（1.30V）	
	A	AH	A	Min	A	Min	A	Min
6-FM-3.5	0.35	3.5	1.75	78	3.5	30	10.5	6
6-FM-6.5	0.65	6.5	3.25	78	6.5	30	19.5	6
6-FM-10	1.0	10	5.0	78	10	30	30	6
6-FM-12	1.2	12	6.0	78	12	30	36	6
6-FM-15	1.5	15	7.5	78	15	30	45	6
6-FM-24	2.4	24	12	78	24	30	72	6
6-FM-38	3.8	38	19	78	38	30	114	6
6-FM-50	5.0	50	25	78	50	30	150	6
6-FM-65	6.5	65	32.5	78	65	30	195	6
6-FM-80	8.0	80	40.0	78	80	30	240	6
6-FM-100	10	100	50.0	78	100	30	300	6

蓄电池型号 Battery Type	各小时率放电 **Various hour-rate discharge**			
	10 小时率 **10h rate**	5 小时率 **5h rate**	3 小时率 **3h rate**	1 小时率 **1h rate**

	终压 **End point voltage 1.8V**		终压 **End point voltage 1.8V**		终压 **End point voltage 1.8V**		终压 **End point voltage 1.75V**	
	A	**AH**	**A**	**AH**	**A**	**AH**	**A**	**AH**
GFM-100	10	100	18	90	25	81	55	60
GFM-150	15	150	27	135	37.5	120	82.5	90
GFM-200	20	200	36	180	50	162	110	120
GFM-300	30	300	54	270	75	243	165	180
GFM-400	40	400	72	360	100	324	220	240
GFM-500	50	500	90	450	125	360	275	300
GFM-600	60	600	108	540	150	486	330	360
GFM-800	80	800	144	720	200	648	440	480
GFM-1000	100	1000	180	900	250	810	550	600
GFM-1200	120	1200	216	1080	300	972	660	720
GFM-1500	150	1500	270	1350	375	1215	825	900
GFM-2000	200	2000	360	1800	500	1620	1100	1200
GFM-3000	300	3000	540	2700	750	2430	1650	1800

7.2.2 放电容量的温度特性 Temperature characteristics of discharge capacity

蓄电池放电容量与环境温度有关如图 8。温度低，容量低；温度过高，虽然容量增大，但严重损害寿命，最佳工作温度为 15-25℃。一定温度下放出容量与 25℃所放出的容量关系为：

$Ct=C_{25}(1+K(t-25))$

式中：K-温度系数，10 小时率放电时 K=0.008，1/℃；1 小时率放电时 K=0.01,1/℃。

Battery discharge capacitance is related to environment temperature shown as Fig.8. If the temperature is lower then the capacity will be smaller ; when the temperature is higher, although the capacity increases, service life cycle shall be damaged seriously .Optimum working temperature shall be within the range of 15-25 ℃ . Equation of discharge capacitance at between 25 ℃ and at specific temperature shall be $C_t=C_{25}(1+K(t-25))$, herein , K is a temperature coefficient .

K=0.006 , 1/℃ for 10h rate discharge.

K=0.008 ,1/℃ for 3h rate discharge.

K=0.01 , 1/℃ for 1h rate discharge.

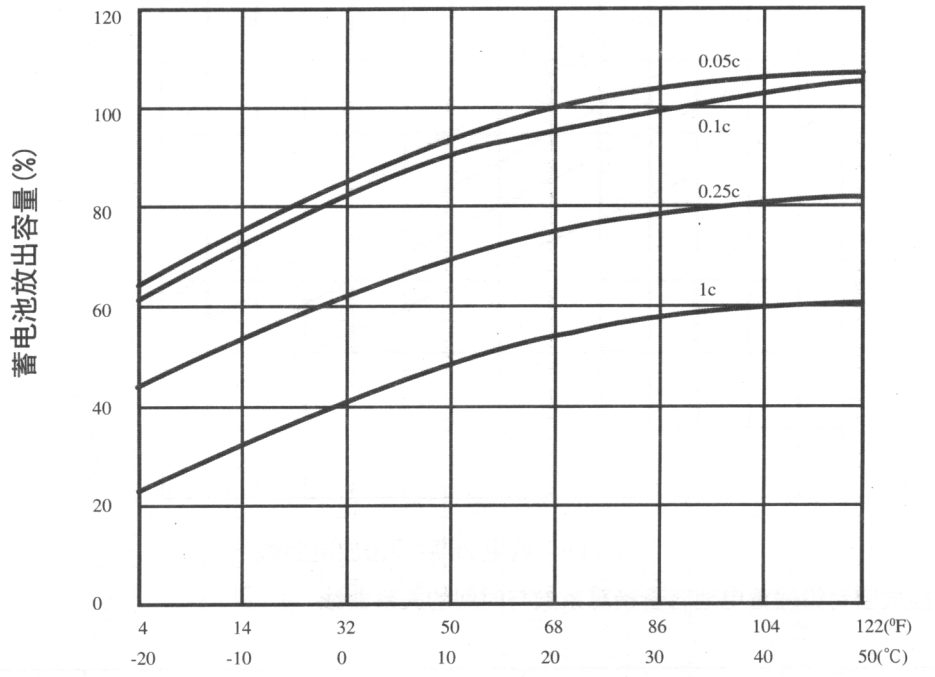


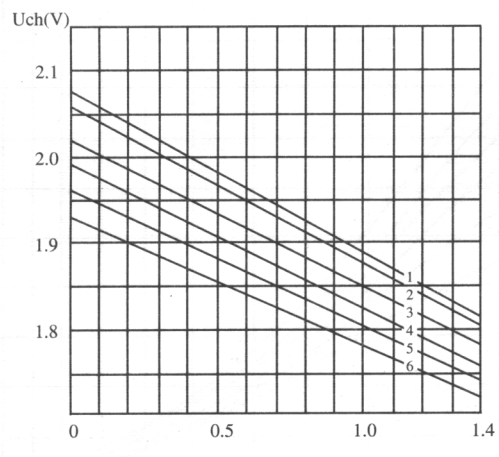
图 8 温度对电池容量的影响 Fig.8 The influence of temperature on battery capacity

蓄电池放出容量 capacity released by storage battery

7.2.3 冲击放电特性 Impact Discharge Performance

蓄电池以恒定电流放电 0.5 小时、1 小时和 2 小时后叠加冲击电流 I 放电 5S 电池电压（Uch）与冲击系数 Kch(Kch=I/C10)关系如图 9、图 10、图 11。

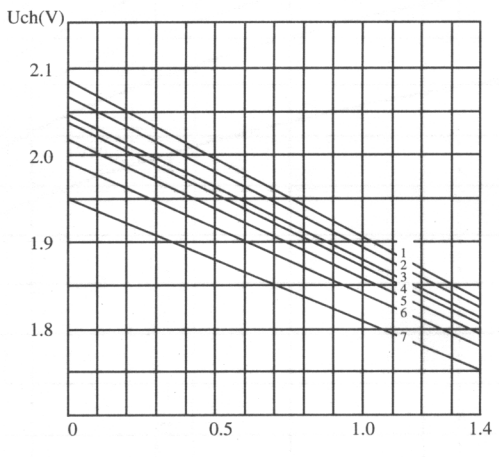
The relationship of battery voltage (Uch) and impact coefficient (Kch) is shown as Fig.9, 10,11 after constant current discharging for 0.5h & 1h an d superposed impact current I while discharging for 5S.



1-持续放电 1-0.1C_{10} 4-持续放电 1-0.35C_{10}

2-持续放电 1-0.2C_{10} 5-持续放电 1-0.40C_{10}

3-持续放电 1-0.3C_{10} 6-持续放电 1-0.45C_{10}



1-持续放电 1-0.1C_{10} 5-持续放电 1-0.40C_{10}

2-持续放电 1-0.2C_{10} 6-持续放电 1-0.45C_{10}

3-持续放电 1-0.3C_{10} 7-持续放电 1-0.55C_{10}

4-持续放电 1-0.35C_{10}

图 9　放电 1h 后冲击放电曲线 Fig.9 Impact discharge curve after 1h discharging

1.Continuous discharge 1-0.1 C10

2.Continuous discharge 1-0.2 C10

3.Continuous discharge 1-0.3 C10

4.Continuous discharge 1-0.35 C10

5.Continuous discharge 1-0.4 C10

6.Continuous discharge 1-0.45 C10

图 10　放电 0.5h 后冲击放电曲线 Fig.10 Impact discharge curve after 0.5h discharging

1.Continuous discharge 1-0.1 C10

2.Continuous discharge 1-0.2 C10

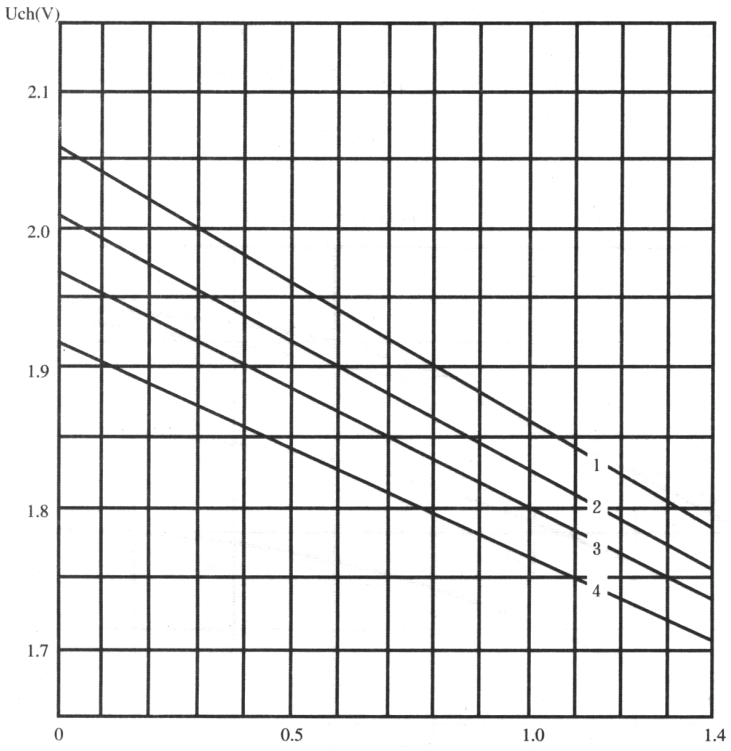
3.Continuous discharge 1-0.3 C10

4.Continuous discharge 1-0.35 C10

5.Continuous discharge 1-0.4 C10

6.Continuous discharge 1-0.45 C10

7.Continuous discharge 1-0.45 C10



1-持续放电 1-0.1C_{10}

2-持续放电 1-0.2C_{10}

3-持续放电 1-0.25C_{10}

4-持续放电 1-0.30C_{10}

1.Continuous discharge 1-0.1 C10

2.Continuous discharge 1-0.2 C10

3.Continuous discharge 1-0.25 C10

4.Continuous discharge 1-0.30 C10

图 11　放电 2h 后冲击放电曲线 Fig.11 Impact discharge curve after 2h discharging

7.2.4GFM 型阀控式密封铅酸蓄电池容量换算系数与时间的关系曲线 Relationship between capacity coefficient and time (GFM valve-control sealed lead acid storage)

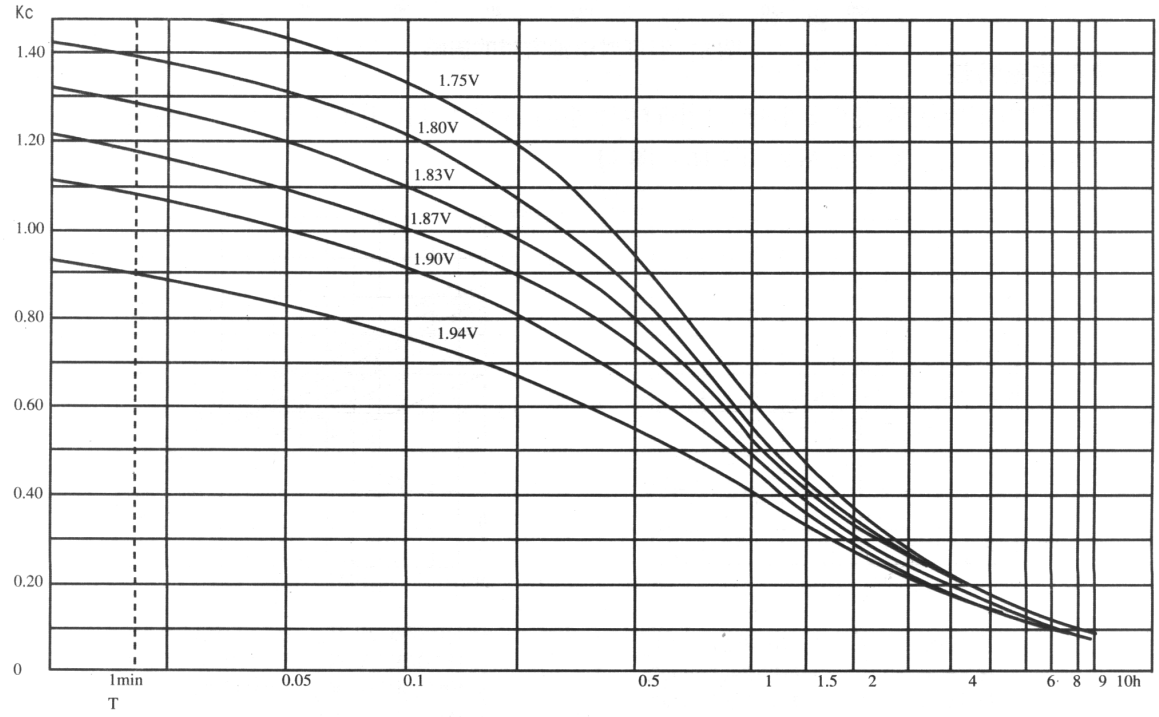


图 12　FM 型阀控式密封铅酸蓄电池容量换算系数与时间关系的曲线

Fig.12 Relationship between capacity coefficient and time (GFM valve-control sealed lead acid storage)

7.2.5 容量换算系数比较 Comparison of capacity conversion coefficient

容量换算系数是反映蓄电池放电性能的主要参数之一，是蓄电池容量的计算依据。

Capacity conversion coefficient is one of the main parameters which reflect the discharge performance of storage battery, and the base for counting battery's capacity.

表 5　GFM 型蓄电池在各放电率及不同终止电压下的容量换算系数表

Table 5 Capacity conversion coefficients of GFM storage battery at different discharge rates and with different end voltages

T / Uz Kch	5S (min)	1 (min)	29 (min)	30 (min)	5 (min)	60 (min)	90 (min)	120 (min)	340 (min)	360 (min)	480 (min)	600 (min)
1.75	1.52	1.50	0.970	0.950	0.616	0.610	0.466	0.385	0.230	0.167	0.129	0.107
1.80	1.42	1.40	0.900	0.880	0.588	0.580	0.446	0.365	0.222	0.163	0.128	0.106
1.83	1.34	1.30	0.826	0.804	0.566	0.560	0.427	0.355	0.215	0.158	0.126	0.103
1.87	1.20	1.18	0.760	0.740	0.530	0.525	0.402	0.337	0.207	0.153	0.121	0.0995

1.90	1.11	1.08	0.680	0.668	0.491	0.485	0.380	0.315	0.200	0.146	0.116	0.096
1.94	0.94	0.904	0.594	0.580	0.441	0.435	0.350	0.295	0.185	0.138	0.109	0.089

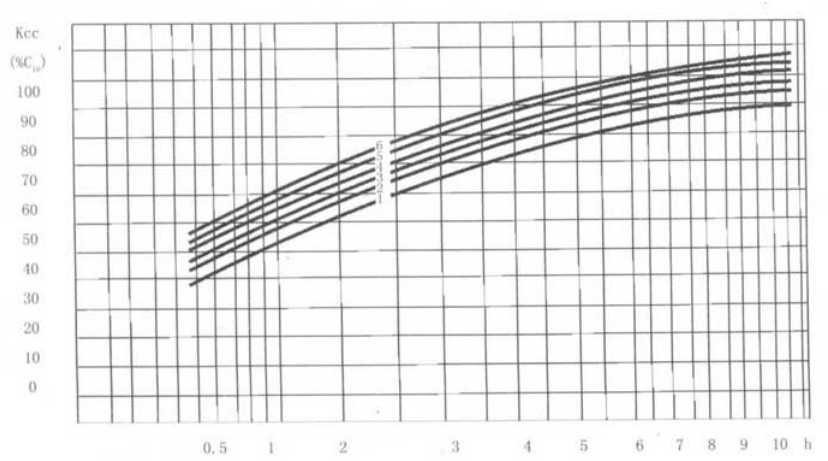
注：T-放电时间　U_z-放电终止电压　K_{ch}-容量换算系数（$K_{ch}=I/C_{10}$）

Note: T-time of discharge　U_z-end voltage of discharge　K_{ch}-capacity conversion coefficient（$K_{ch}=I/C_{10}$）

7.2.6 恒定终止电压放电特性 Constant end point voltage discharge characteristics

蓄电池在确定的终止电压后以不同小时率电流放电，其容量系数 Kcc（Kcc 为不同放电率容量与 10 小时率容量的百分比）与放电时间关系如图 13。

The storage battery discharge with current of different hour rate after the end voltage is set, and the relationship between the capacity coefficient Kcc (Kcc means the percent of the capacity at different discharge rate to that at 10-hour rate) and discharge time is shown in Fig.13.



6-终止电压 1.75V　End voltage=1.75V

5-终止电压 1.80V　End voltage=1.80V

4-终止电压 1.83V　End voltage=1.83V

3-终止电压 1.87V　End voltage=1.87V

2-终止电压 1.90V　End voltage=1.90V

1-终止电压 1.94V　End voltage=1.94V

图 13 容量系数与放电时间关系曲线（25℃）

7.2.7 大电流放电特性-1 分钟放电特性 Great Current Discharge Feature—1min Discharge Feature

蓄电池以不同电流放电 1 分钟时电池电压与冲击系数 Kch 关系如图 14。

Battery voltage has relation with impact coefficient kch shown as Fig.14 when the battery has discharged for 1min. with different current.

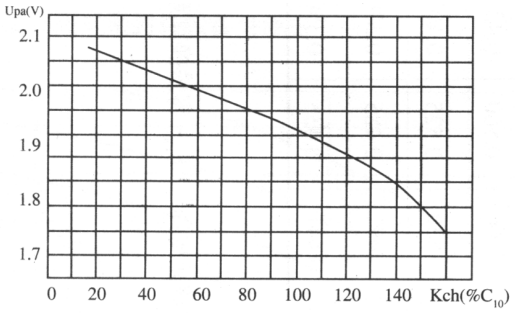


图 14Imin 冲击放电特性曲线（25℃）Fig.14min impact discharge characteristics(25℃)

7.3 容量保持特性-自放电 Capacitance self-contained Feature-self-discharge

蓄电池在长期存贮中容量逐渐损失，容量的损失速度与温度有关如图 15。

Battery capacitance shall gradually decrease during long-period storage, decreasing rate of capacitance is related to the temperature shown as Fig.15

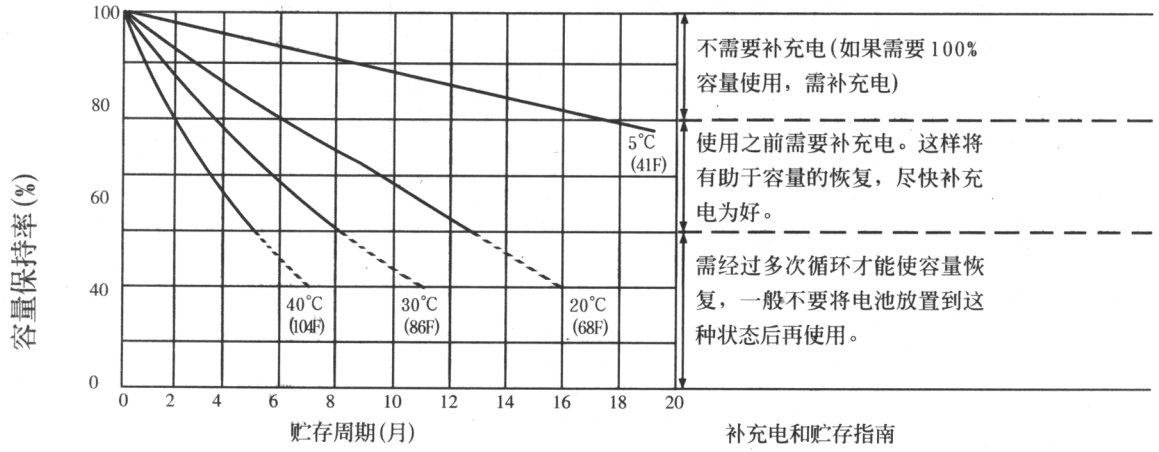


图 15 容量保持性和贮存性指南

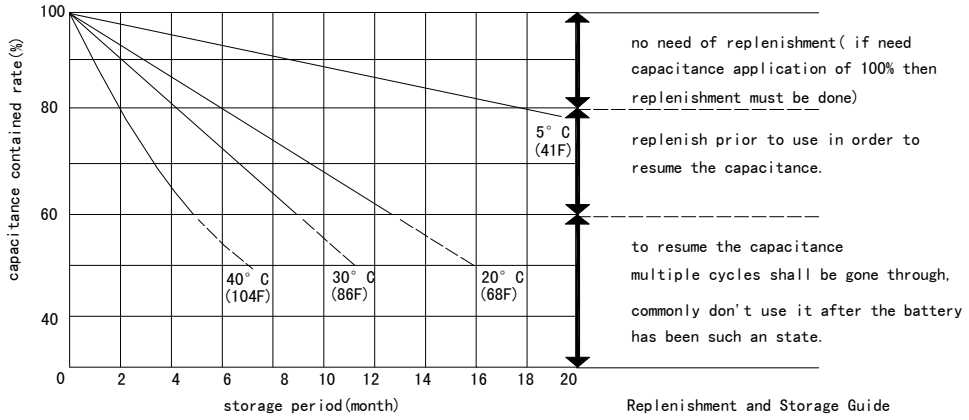
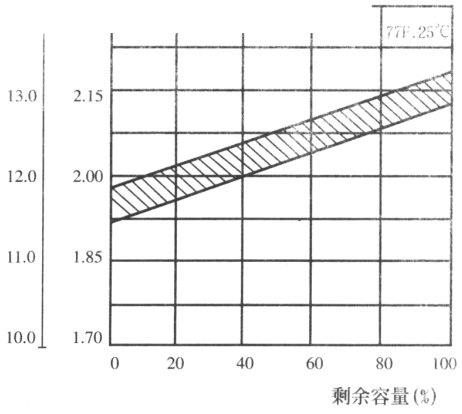


Fig.13 capacitance-contained & storage characteristics guide

容量保持率可以通过电池开路端电压简单地来判断，一般充足电的新电池开路端电压在 2.15-2.18V，



电池开路端电压与剩余的容量关系如图 16。

Capacitance contained rate can be judged by open-circuit terminal voltage in general, the open circuit terminal voltage of a new battery with sufficient charge shall be within the range of 2.15-2.18v. The terminal voltage is related to remained capacitance shown as Fig.16

图 16　开路电压与剩余容量关系

Fig. 16　Relationship between open circuit and remained capacitance

7.4 内阻特性 Intrinsic Resistance Performance

蓄电池内阻与容量规格、荷电状态有关，充足电时内阻最小。表 6 给出了 SUPER FM GFM 蓄电池内阻供用户参考。因为电池内阻很小，测量时应很好地消除接触电阻，否则测量结果偏大。

Battery intrinsic resistance is related with capacitance specification and charging state. The intrinsic resistance is the smallest in the state of charging to saturation and the largest for the state of finishing discharge refer to table 5.

表 6　GFM 蓄电池内阻 **Tab.6 Intrinsic resistance of GFM battery**

容量规格 **Capacity** (AH)	200	300	400	500	600	800	1000	1200	1500	2000	3000
内阻 **Intrinsic resistance** (mΩ)	0.5	0.4	0.35	0.30	0.25	0.2	0.15	0.12	0.09	0.08	0.07

7.5 寿命特性 Life Cycle feature

蓄电池的寿命与放电次数、工作温度、放电深度、浮充电压以及充放电电流等有着直接的关系。

Battery's lifetime has direct relations to discharging times, working temperature, discharging degree, float voltage and charging & discharging current and so on.

●放电深度 Discharging degree

反复地大量放出蓄电池电量（深放电）将缩短电池寿命，寿命与放电深度和循环次数关系如图 17。

Discharging repeatedly and largely discharging deeply shall shorten the battery's service lifetime which has relation to discharging degree and cycle times shown as Fig.17.

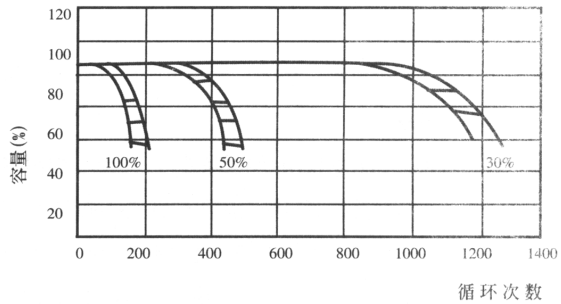


图 17　循环寿命与放电深度的关系

Fig.17 Relationship between cycle lifetime and discharge degree

●温度的影响 Temperature

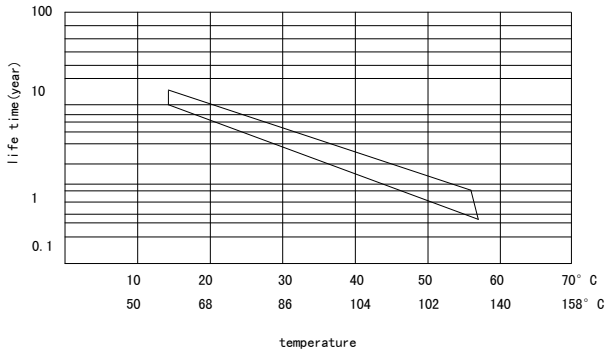
温度升高将加速电池组份的分解。在恒压充电时，高的室温环境，充电电流将增大，导致充电过量，这样就缩短电池寿命。

在低温充电时，将产生氢气，使内压增高，电解液减少，电池寿命缩短。最佳使用温度为 15-25

℃。浮充寿命与温度关系如图 18。

Increasing temperature shall accelerate decomposition of battery component. High indoor environment temperature shall cause charging current increasing up to overcharge that shall bring a result of shortening lifetime during constant voltage charging.

Hydrogen shall be produced, which shall raise inner pressure and reduce electrolyte to lower the battery's service lifetime while charging at lower temperature. Optimum working temperature shall be from 15℃to 25℃.Float charge lifetime has relation with temperature as Fig.18.



18　浮充寿命的温度特性

Fig.16 float chare life time & temperature relations curve

●浮充电压、电流 Float Charge Voltage & Current

浮充使用时必须保持浮充电压的稳定，这就要求必须选择性能优良的充电设备。若充电机不能保持电压、电流的稳定，就会造成电池过充、欠充等现象，大大缩短电池的使用寿命。为了使蓄电池达到最佳的使用寿命，配套充电机必须达到以下要求：

To keep a stable float charge voltage, charging equipment with good performance shall be selected. Unstable voltage/current shall lead to overcharge or undercharge that can shorten the battery's life. Mating

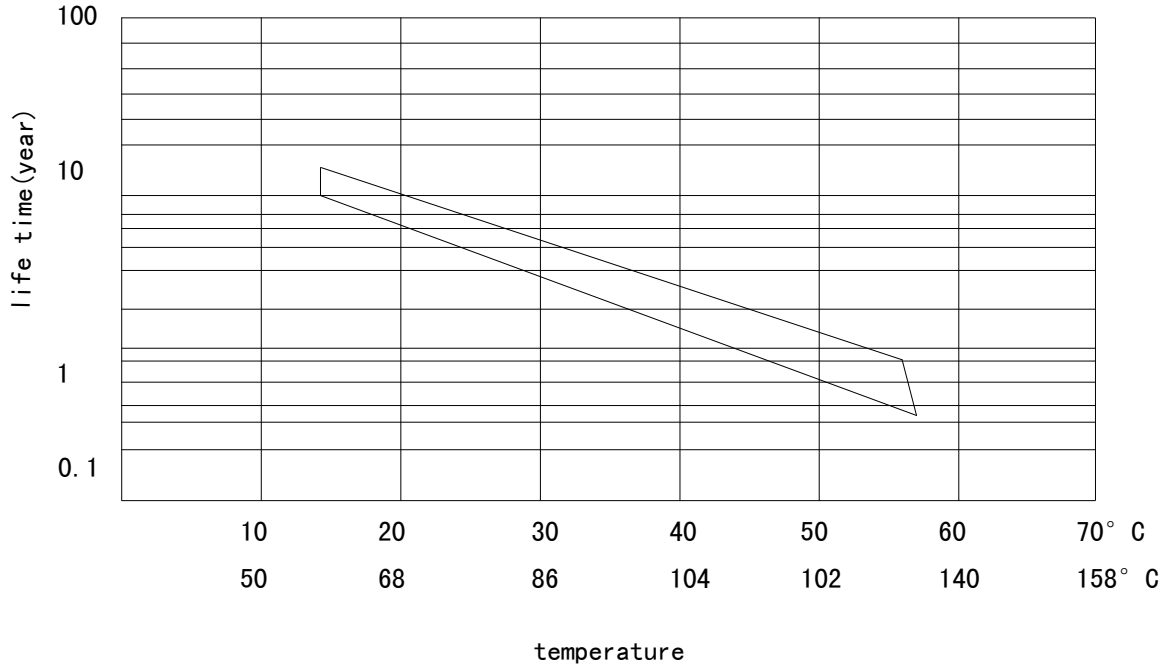


Fig.16 float chare life time & temperature relations curve

8 安装指南 Installation Guide

8.1 安装注意事项 Point for attention during installation

- 使用前应仔细阅读本技术手册，以保证正确施工。安装前应逐只检查电池有无损坏，电压是否正常。
- Reading is technical handbook prior to operation to ensure constructing correctly. Batteries shall be checked one by one to prevent from abnormal voltage prior to installation.
- 由于电池串联后电压较高，存在着电击的危险，因此装卸导电连接片时应使用绝缘工具。
- Insulation tools should be used when installing & removing conductive connection slices due to higher serial voltage to protect from electric hit.
- 本电池带电出厂，电池在运输、安装过程中必须特别小心，防止短路。
- During transportation & installation, battery's short-circuit must be paid attention to because the battery delivered is electric.
- 本电池为密封免维护结构，在正常情况下，不存在硫酸对皮肤和眼睛腐蚀的危险。万一硫酸溅进眼里，应立即用大量水冲洗并去医院治疗。
- The battery with sealed free maintenance construction hasn't changer of etching skin and eyes in normal case. Once sulphuric acid splashed in one's eye's rinsing with a plenty of water must be done and go to hospital.
- 清洗外表面可用肥皂水、湿布、不应用干布、掸子进行清洁。否则因产生的静电可导致爆炸，也不能使用有机溶剂。
- Exterior surface shall be washed with soap water and wet cloth .Dry cloth and duster shouldn't be used, which can produce static to cause explosion, organic solvent shouldn't be used either.

8.2 蓄电池的安装 Installation of storage battery

- 蓄电池可任何方向安装使用（倒置除外），安装时严格按串并联线路进行连接，决不能连错或反极。
- Battery may be installed in any direction (with the exception of turning upside down) connection must be according to serial/parallel circuit. It is not allowable for incorrect and reverse pole connection.
- 蓄电池端子连接排等所有接触面应用砂纸或铁刷清除氧化膜和污物，减少接触电阻，避免发热。安装前应把端子涂一层凡士林油，在安完端子连接件和导通电池系统前，检查电池系统的总电压和正负极，以保证安装正确。
- Oxides and dirty on battery's terminals contact surface should be removed with sandpaper or iron brush to reduce contacting resistance and prevent from producing heat. A layer of vaselinum oil must be coated prior to installation. Check the system's general voltage and positive & negative pole before power is on to ensure right installation.
- 连接电缆应尽可能缩短，不能只考虑容量输出来选择电缆的大小规格，电缆的选择应考虑不能产生过多电压降。
- Shorten connecting cables if it is possible. Voltage drop produced should be taken consideration into selection of cables and for the cable' specification, output capacitance shall not be as a unique factor.
- 为了达到要求的电池容量，电池组可以进行并联，并联连接的导线应尽可能短，力求电压降小。

- Battery may be shunted to reach its capacitance required. To reduce voltage drop, shunted connecting wire shall be most probably short.
- 不能把不同容量、不同性能或新旧不同的蓄电池连接在一起使用。
- Batteries with different capacitance and /or performances and /or new & old degree shouldn't be taken into service together.
- 蓄电池应避免安装在密闭的设备内，蓄电池应有良好的通风环境。不要安装在变压器等发热物体附近。
- Battery should avoid installing inside on enclosed device. Good air ventilation is required. Don't mount it nearby heat generating objectives e.g. transformer etc.
- 蓄电池连接的扭矩值为 11.3 牛顿/米。
- Torque value for connecting battery shall be 11.3 N/M.
- 蓄电池与充电器在或负载连接前，电路开关应置于“断开”位置。同时蓄电池的正极与充电器或负载的正级相连接，蓄电池的负极与充电器或负载的负极相连接。
- Circuit switch shall be in position of "off" and the battery's positive/negative pole shall be in that of corresponding connection of charger's (load's) positive/negative pole.

8.3 电池柜的安装 Installation of Battery Cabinet

为满足广大用户的要求，解决蓄电池占地面积大，不美观的问题，我们设计了高层次结构的电池组柜，节省占地面积，方便检修，可直接放置在机房中使用，如图 19 和表 7。

我公司还可以根据用户应用场地的具体要求，特殊设计制造电池柜。请写清：电池的总电压、电池规格、电池柜要求颜色（国际号）、长×宽×高尺寸、基础承载情况等。

High arrangement construction shall be adopted for battery panel in order to save area and facilitate to maintain, we can specially design and manufacture the battery panel in accordance with user's requirements. Please write distinctly about battery's general voltage & specification & color (international code) & dimensions (L × W × H) & foundation support cases.(Installation of Battery cabinet style see Table 6 and Fig.17,Fig.18, Fig.19, Fig.20, Fig. 21, Fig. 22, Fig. 22).

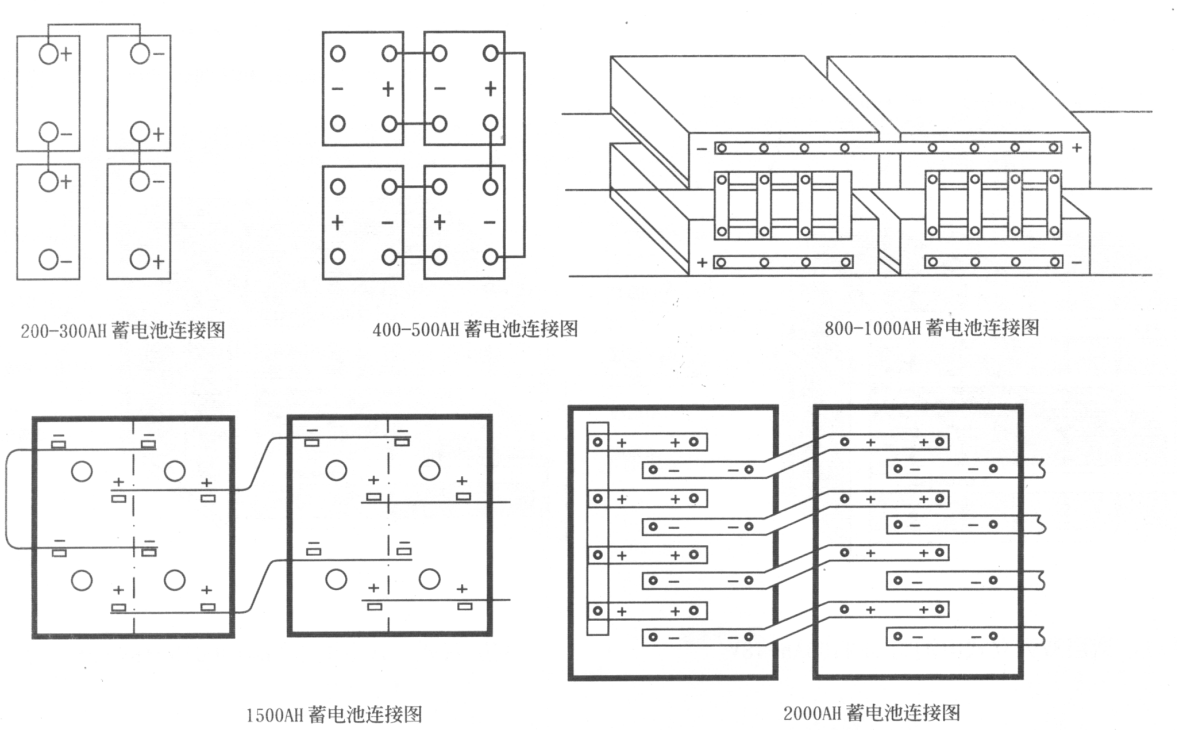


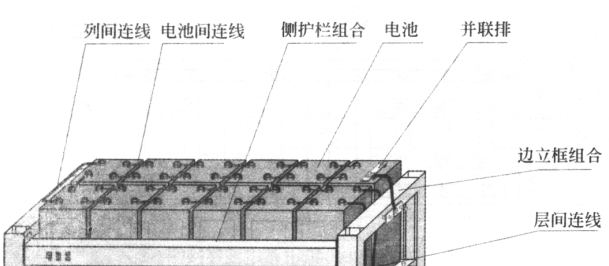
图 19 蓄电池连接示意图　Fig.19 Connection Diagram for various batteries

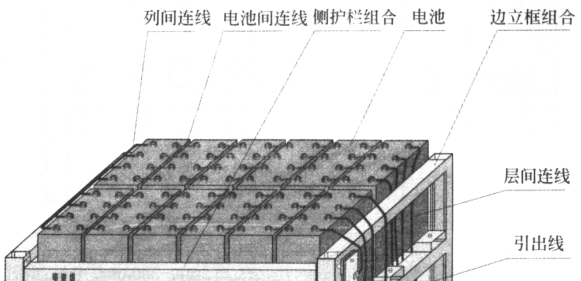
表 7 各种规格蓄电池组柜尺寸、数量和重量

Tab.7 Dimensions, Quantity and Weight of Various Battery Panel

蓄电池组系统电压 **System voltage**	额定容量型号 **Rated capacitance and type**	蓄电池数量 **Number of batteries**	联接铜排数 **Number of connection copper plates**	电池柜数 **Number of battery panels**	单柜外型尺寸 **Dimensions**			系统重量 **System weight**
					长 **Length**	宽 Width	高 **Height**	
V	AH	只	根	个	mm	mm	mm	Kg
48	6-FM-100	4	3	1	600	550	1700	150
	GFM-200	24	23	1	650	550	1700	390
	GFM-300	24	23	1	650	550	1700	660
	GFM-400	24	43	1	800	550	1700	800
	GFM-500	24	43	1	800	550	1700	960
	GFM-600	24	43	2	800	550	1700	1200
	GFM-800	24	83	2	800	600	1700	1400

	GFM-1000	24	83	2	800	600	1700	1800
220	GMF-100	108	107	1	800	600	2200	700
	GMF-200	108	107	2	800	600	2200	1700
	GMF-300	108	107	3	800	600	2200	2800
	GMF-400	108	200	4	800	600	2200	3500
	GMF-500	108	200	4	800	600	2200	4000
	GMF-600	108	200	6	800	600	2200	4300
	GMF-800	108	600	6	1150	600	2200	6500
	GMF-1000	108	600	N	1150	600	2200	7800





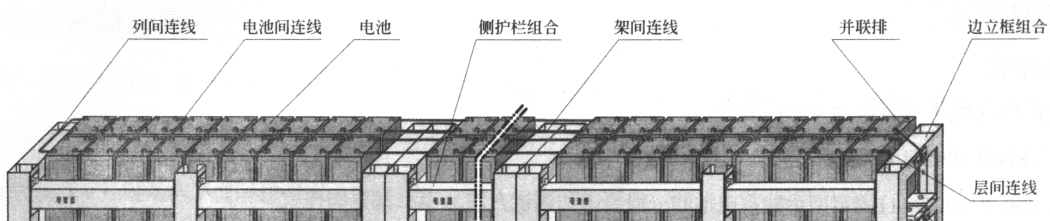
双层双列立式电池组 GFM400Ah-48V　　双层双列立式电池组 GFM1000Ah-48V

Double-desk double-row vertical battery group GFM400Ah-48V

Double-desk double-row vertical battery group GFM1000Ah-48V

单层双列立式电池组 GFM100Ah-48V

Single-desk double-row vertical battery group GFM100Ah-48V



双层双列立式电池组 GFM400Ah-220V

Double-desk double-row vertical battery group GFM400Ah-220V

通讯电池柜 200Ah-48V　Communication Battery Cabinet 200Ah-48V;

通讯电池柜 300Ah-48V　Communication Battery Cabinet 300Ah-48V

9 验收 Acceptance

9.1 验收标准 Acceptance Standard

SUPER FM GFM 系列蓄电池采用标准为：

JIS C8707-1992 阴极吸收式密封固定型铅酸蓄电池

IEC 896-2（1995-11）固定型铅酸蓄电池的一般要求和测试方法 第二部分阀控式

JB/T8451-96 固定型阀控密封式铅酸蓄电池

YD/T799-1996 通信用阀控式密封铅酸蓄电池技术要求和检验方法

DL/T637-1997 阀控式密封铅酸蓄电池订货技术条件

Q/HJZ002-1998 阀控式密封铅酸蓄电池企业标准

Standard complied with for SUPER FM GFM series battery as follows:

JISC8707-1992 Cathode-absorbing Sealed Fixed Lead-acid Battery.

IEC896-2 (1995-11) General Requirements and Test Procedures of Fixed Lead-acid Battery, Part Ⅱ Valve-controlled.

JB/T8451-96 Fixed Confinement Valve-controlled Lead-acid Battery.

YD/T799-1996 Confinement Valve-controlled Lead-acid Battery's Technical Requirements and Test Procedures for Communication

DL/T637-1997 Valve-controlled Lead-acid Battery's Technical Specification for Ordering.

Q/HJ 2002-1998 Valve-controlled Lead-acid Battery's Enterprise Standard.

9.2 验收规则 Acceptance Rule

对 SUPER FM GFM 系列蓄电池验收可以按以下标准的出厂检验规则验收：

Factory test rule as follows:

1. 外观整洁，无物理损坏现象，极性正确。

   Neat looking, no physical damage, correct polarity.

2. 开路电压差小于 30mV。

   Open-circuit voltage differential<30mV.

3. 浮充电压差小于±50mV。

   Float charge voltage differential<±50mV

4. 无漏液、发热现象。

   No liquid-leakage and heat-generating phenomenon.

5. 安全阀开启压力应在 10-49KPa.

   Cracking pressure for safety valve:10-49Kpa

6. 初次 10 小时率放电容量应大于额定容量 95%。

   10h rate discharging capacitance for the first time shall be rated capacitance of 95%.

9.3 容量校核 Capacity verification

SUPER FM GFM 蓄电池出厂产品已进行了 10 小时率容量放电校核是完全合格的产品，用户可不必再进行容量校核。如果用户有特殊要求进行容量校核应按以下要求操作：

SUPER FM GFM factory products having been verified 10h rate capacitance are qualified. Subsequent operations may be done in accordance with user's specific requirement for capacitance verification.

容量校核分三步进行：The verification shall be divided into three steps.

第一步：逐只测量蓄电池开路端电压，如果开路端电压>2.13V 则可按 7.1.2 循环充方式进行充

电，当电流降至 0.005-0.01C10A 保持 3-5 小时基本不变时再充 3-5 小时，电池充电基本饱和。如果开路端电压≤2.13V，应先放出 20%容量然后再进行循环充电至饱和。

第二步：以 0.1C10 电流放电至 1.80V，每隔 1 小时记录一次放电电流、温度和电压，并计算出放电容量，容量大于 95%额定容量为合格即放电超过 9.5 小时。（如室温不是 25℃应按 7.2.2 进行换算然后再进行比较）。

第三步：将放完电的电池组进行元首锲充电至饱和后转浮充运行。测量浮充电压，观察其均衡性。

First step: Measure battery's open-circuit terminal voltage one by one. If the terminal voltage is greater than 2.13V, charge in a cycle mode shall be performed. Replenish for 3-5 hour. If the terminal voltage is equal to or less than 2.13V, 20 percent of capacitance shall be discharged then charge in a cycle up to full.

Second step: Discharge to 1.8V as $0.1C_{10}$ current. Log discharge current & temperature & voltage every second hour and calculate the discharge capacitance. The capacitance greater than the rated capacitance of 95% shall be qualified i.e. discharging time is over 9.5h.

(If working temperature is not at 25℃, conversion and comparison must be made in accordance with § 7.2.2)

Third step: Equalizing charge the battery to saturation then switch to float charge. Measure float charge voltage and view its equalization.

10 使用与维护 Operations and Maintenance

- FM GFM 系列蓄电池为连续浮充电应用设计的，也可用于循环放电使用，充电设备应满足 7.5 要求。充电方法必须采用限流一恒压方法按 7.1 充电。蓄电池在恒压充电时电流逐渐减少，并最终趋于稳定，如果降至 0.01C 以下，并保持 3-5 小时基本不变时这表明电池已基本充饱。可以转浮充运行。
- The battery is designed for continuous float charge application (also used to charging & Discharging circularly). Charging equipment should meet requirement of § 7.5. Charging method shall be carried out according to current limit-voltage constant of § 7.1. Battery current shall gradually reduce while constant voltage charging tending to stableness. If the current is be low 0.01C and hold for 3-5h,it indicates that the battery has been charged to 90%-98% and for the current keeping up to 6-10h,it indicates that the battery has been in a state of fully.
- 蓄电池可以在-20℃~50℃内使用。有效的工作温度为 5~35℃，如果要获得最佳的使用寿命应在 15-25℃环境下使用。
- The battery can working at -20℃-+50℃,Effective working temperature shall be 5-35℃,working at 15-25℃ is the best choice to ensure long service life time.
- 蓄电池在运输、贮存和安装过程中若时间很长会失去一定容量。如果不需校核容量，当电池开路端电压≥2.13V 时可以直接投入浮充运行，当开路端电压＜2.13V 时应先进行均衡充电，然后投入浮充运行。如果需要进行容量校核应按 9.3 条要求操作。
- During long period of transportation/storage and installation, the capacitance shall lose a little. The battery can be put into float charge operation when open-circuit terminal voltage is equal to or greater than 2.13V with no need of verifying the capacitance otherwise, equalizing charge should be done at

first, then put into of float charge operation. Capacitance verification required should be performed in accordance with §9.3.

- 蓄电池每年应以实际负荷做一次放电，放电应保持电流稳定，放出额定容量的 30%左右（以 0.1C 放电 3 小时），放电每小时应测一次电压（单体及电池组）、放电电流、温度，放电后应进行均衡充电然后转浮充进行。
- The battery discharge shall be carried out for practical load for one time each year and keep the stable discharge current stable during discharging. About 30 percent of rated capacitance shall be discharged (discharging for 3h as 0.1C current). Measure voltage (including single battery and set of battery) & discharge current & temperature every 1 hour for one time. After finishing discharge, equalizing charge and float charge shall be sequentially made.
- 每月应测一次电池单体电压及终端电压，检查一下外观有无异常变形和发热，并保持完整的运行记录。浮充总电压应达到 7.1.1 要求，并保持在 1%之内。
- Measure single battery voltage and terminal voltage each month for one time. cheek whether abnormal deformation and heat-generating exists and logs complete operation. General float charge voltage shall be within 1% in accordance with §7.1.1 required.
- 每年应检查一次连接导线是否牢固、是否有腐蚀；松动应拧紧至规定扭矩，腐蚀应及时更换。
- Check whether connecting wire is secure and corrosion exists. Tighten up to specified torque while loosing and replac the corrosive part.
- 不要单独增加或减少电池组中几个单体电池负荷，这将造成单体电池容量的不平衡和充电的不均一性，降低电池寿命。如在整组电池抽出一部分做其它电源，或充电不在一起，放电时叠加一起。
- Don't individually add /exclude a few single battery loads from set of battery to prevent from unequally single battery capacitance and uniform charging. IF take some as other power supply from the whole set of battery or put them not in a whole when charging, superpose them on the whole set of battery while discharging.
- 正常浮充运行不需要均衡充电，如发现出现以下情况应进行均衡充电：
- Equalizing charge shall be made when following cases happened

① 正常浮充时，电压偏差超过 0.1V.

Voltage bias is greater than 0.1V while float charging normally.

② 个别单体电池电压低于 2.18V。

Unique single battery voltage is lower than 2.18V.

③ 停电搁置超过 3 个月。

Lay-aside time is over 3 months.

④ 长期达不到浮充要求，每半年进行一次。

Float charge requirement can’t reach for a long period, do it for one time each half year.

⑤ 放电后 24 小时之内未及时充电。

Charging in time wasn't carried out within 24h after discharging.

⑥ 长期小电流深度放电。

Little current discharging deeply for a long period.

⑦ 过流放电（电流大于规定 20%）、过压放电（单格低 1.5V）和过电量放电（超过额定容量 10%）应立即进行均衡充电。

Discharging with overcurrent (greater than 20% specified), discharging with overvoltage (each grid reduced 1.5V) and discharging with overcapacitance (greater than the rated capacitance of 10%,equalizing charge must be done at once).

- 电池最佳存贮温度为 5-20℃，存放地点应清洁，通风而不潮湿，超过三个月的电池应进行均衡充电。
- Optimum storage temperature is 5~20℃,clean storage locality, good air ventilation ,no moist.
- 经常性大电流充电、放电将缩短使用寿命。
- Great current charging/discharging sequentially shall shorten the battery's service life time
- 12V 系列容量为 50-100 安时的浮充使用，设计寿命为 3 年，2V 系列为浮充使用设计寿命为 10 年。
- Float charge application life designed shall be 3 years for/12V series with capacitance of 50~100AH and for 2Vseries to be 10 years.

11 蓄电池常见故障及消除方法 Common failures ＆ Trouble-shootings

序号 **No**	故　障 **Failure**	故障结果 **Phenomenon**	消除方法 **Trouble-shooting**
1	浮充运行电压太高(大于 2.30V) Float charge voltage is too high(＞2.30V)	耗水量大,温度升高,电池漏液,寿命缩短。 Great water consumption, temperature increases, battery deformation, life time shortens	调整电压控制值，或更换有毛病电压控制元件。 Regulate the voltage or replace the damaged voltage controlled component
2	均衡充电或补充电时电压控制太高（大于 2.40V） Voltage is too high (＞ 2.40V) while equalizing charge or replenishing	结果同上相似，但更厉害一些。 Same as the last and the result is more serious	调整电压控制值。 Regulate the voltage controlled value
3	浮充运行电压太低（小于 2.20V） Voltage is too low (＜ 2.20V ＝ in float charge operation	硫酸盐化，容量降低。 Sulphation and capacitance decreases	调整电压控制值，均衡充电。 Regulate the voltage controlled value
4	充电电流过大（大于 0.2CA） Charging current is too great (＞0.2CA)	耗水量大，温度升高，电池变形，甚至爆裂，寿命减少。 Great water consumption temperature increases battery deformation even	降低充电电流。 停电修理设备。 Lower the charging current, repair the equipment without

		crack life time shortens	power-on
5	平均环境温度过高 Mean environment temperature is too high	由于蒸发，水损增大，浮充电流增大，腐蚀加速，减少寿命。 Water consumption increases due to evaporation and float current rises to accelerate corrosion, lifetime decreases.	加强环境通风或采用空调。 Reinforce air ventilation or use air-conditioner
6	充电不能按时断开 Can't break charging	耗水量增大，温度升高，长期可能导致电池组损坏。 Water consumption increases and temperature rises, the set of battery shall be damaged	停电修理设备。 Repair the equipment with power cut
7	充电长期（不足）中断 Charging is long-term insufficient	硫酸盐化，电池组放电加快，有深放电和硫酸盐化，电压不均。 Sulphation, discharge speeds up, charger of discharging deeply and sulphation shall emerge	立即进行必要的充电，人工进行均衡充电。 Necessary charging muse be performed immediately and equalizing charge then float charge shall be carried out sequentially.
8	出厂后电池长期未能使用 No using of battery for long term after delivery	自放电，硫酸盐化，电压不均。 Self-discharge, sulphation	充电，包括均衡充电然后浮充。 Charging the battery including equalizing charge then float charge
9	深放电 Discharging deeply	硫酸盐化，容量下降。 Sulphation, capacitance reduces	均衡充电，或采用比正常充电量大的电量进行充电。 Equalizing charging/charging with greater capacitance than normal
10	深放电频繁（如每月一次） Discharging deeply happens often (e.g.once each month)	使用寿命缩短。 Service life time decreases	绝对避免，安装容量更大的电池。 Absolutely avoid the case, install larger capacitance battery
11	电池放电后开路放置 24 小时以上不进行充电。 No charging after battery discharging with in 24h open-circuit lay-aside	硫酸盐化。 Sulphation	应立即充电，小心地进行均衡充电。 Charge at once and equalized charge carefully
12	高交流脉动电流，导致温	浮充电压下降特别是对放过电的电	检查电器，减少交流成份。

	度升高 5℃左右。 High AC ripple current causes temperature rising 5 ℃ or so	池，若经常如此电池全部损坏。 Float charge voltage drops especially for discharged battery frequently, emerging the case shall lead to the whole batteries-damaged.	Check charger and diminish AC component
13	整个电池组或单个电池外部短路 The whole set of battery or a single battery's exterior short circuit happens	熔断端子，以至损坏电池组或电池。 Terminals burnt up even to wear the whole set of battery or the single battery	应绝对避免，使用绝缘工具检查连接导线。 Absolutely avoid the case, check connection wire with insulation tools
14	部分电池或电池组接反极 Positive /Negative polarity is connected reversely	反极性充电会损坏电池，可能损坏整流器及电器。后果与短路相同。 The battery is damaged. Rectifier and electric unit shall be probably damaged. The result is same as that of short circuit	应绝对避免，一旦发现应立即将电池极性换过来。 Absolutely avoid the case, reverse the polarity
15	新、旧电池在同一电路上运行。 New & old batteries operates in a circuit simultaneously	充电电压不均，减少电池寿命。 Charge voltage isn't uniform, the batteries' life time shortens	新、旧电池不易串联在同一列电池组中运行。 New & old batteries shouldn't be connected in a circuit
16	螺栓不紧固 Screw isn't tightened	火花烧损。导线或电池发热，甚至火灾。 Sparkwear occurs, wire and/or battery generate heat even to cause a fire	将所有部件清洁处理并吹干后紧固螺栓。 Clean and dry out all the parts then tighten the screw.
17	安全阀处漏液 Liquid leakage arises in the place of safety valve	减少电解液 Decrease electrolyte	及时清除电解液，拧紧安全阀，非常严重应更换安全阀。 Clear away remove electrolyte in time, tighten the safety valve, replace the valve if serious
18	端子处爬酸 Acid leakage emerges in the place of terminals	腐蚀连接件 Etch blocks	更换电池连接件。 Remove acid and have anti-corrosive treatment, Replace the battery if serious.

12 技术服务及质量信息反馈

Technical service and quality information feedback

- 向用户传授电池安装、使用与维护技术，解决使用中的疑难问题。
- Techniques including installation & operation & maintenance shall be passed on users in order to solve practical problem during application.
- 按用户要求，供应电池组柜及修理所需备品配件。
- Battery panels and spare parts for repair shall be furnished according to user's need.
- 承揽电池安装、调试或进行技术指导业务，价格优惠、收费合格。
- Services relating to erection, commissioning and technical guide shall be fulfilled with favorable price and reasonable cost.
- 按用户要求协助代购所需专用仪表、工具等。
- Assists to buy on user's behalf instruments and tools that required for a special purpose.
- 收集用户对产品的评价意见。
- Collects user's views on our products.
- 及时处理用户意见及质量问题。
- Solves the user's views and quality problems timely.
- 按信息反馈程序，及时将处理结果反给用户。
- Returns solvents to the user according to information feedback schedule.
- 属于我公司产品质量问题，及时给予包修、包换、服务上门；属于使用不当出现的问题，及时修理服务，只收修理费及材料成本费；由于运输过程中造成电池的破损，只收材料成本费，及时服务修理。
- We shall be responsible to repair, replace and /or supplement at our expense due to quality problem of products. We shall serve for the user timely for problems due to incorrect operation and repair cost & material cost shall be born by the user. In case of any damage to the battery due to transportation, the user shall be responsible for material cost and for repair service supplied by us.
- 各种技术文件，包括蓄电池的标准、产品图纸、工艺规范、供需双方签订的技术协议及本技术手册、产品样本等做为技术服务的依据和验收的标准。
- Various technical documentation relating to battery's standard, product drawings, technology standard, technical agreement signed by the two parties, current technical handbook and product samples shall be considered as standard of technical service and acceptance.

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