VALVE REGULATED SEALED
LEAD ACID BATTERY

OPERATIONAL
MANUAL

GEL Silicon Tech Series
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IMPORTANT & WARNING

This manual must be read carefully before you start installation/use/maintenance operation, a proper operation could take the best use of battery, maintenance well and extend the service life.

1) For your safety, please do NOT dismantle or open the battery, the maintenance work can only be done by person who is with specially training and knowledge about battery.

2) The battery should be only changed or repaired in our authorized agent or service center or other place which has specially training and knowledge of battery. If you need to change the battery or do maintenance, please contact service center nearby or find official contacts in our website.

3) Battery could be reclaimed, especially for Silicon Tech battery, lead materials inside would still retain up to 99% by the end of service life, but you have to handle it carefully concerning the serious harm to environment and health and you have to check your local laws and regulations, and check if you or other person or any other community/organization or business company is certified to reclaim battery, or the battery must be handled by or sent to authorized person or service center.

4) Battery replacement must be done by authorized person or service center, or person/organization has specially training and knowledge about battery and relative circumstances.
⚠️ **Warning**

Do not put battery near fire or in high temperature.

Do not clean battery with organic solvent.

Do not open battery.

Do not touch/ install/ maintenance battery WITHOUT isolated protection.

⚠️ **Warning**

**Please take serious attention to following marks**
CHAPTER 1 PRODUCT INTRODUCTION

1. PRODUCT FEATURES:

1) High performance
   a. High corrosion resistant performance: Pb-Camulti-alloy grid
   b. Patented Silicate Compound Electrolyte: Zero acid vapor, low self-discharge
   c. High Power density
   d. Excellent Charge acceptance ability
   e. Strong high and low temperature performance
   f. Optimized capability of instant high current discharge
   g. Excellent deep discharge cycle life
   h. 12 years design life

2) Optimized production
   i. Low density electrolyte decrease plate corrosion rate

3) Guaranteed raw materials
   j. High purity raw materials make sure low self-discharging

4) High strength components
   k. High strength ABS materials/ flame retardant for special needs

5) Oxygen recombination
   l. Oxygen recombination tech makes the battery real maintenance free

6) Good structure design
   m. Specialized structure design and production, prevent defective possibility

7) Safety design valve
   n. Special design relief valve guarantees battery safety and good condition under extreme condition
2. MAIN APPLICATIONS

1) Power battery series
   a. Electrical bicycle
   b. Electrical vehicle

2) Industrial purpose series
   c. Telecommunication standby power
   d. UPS and computer standby power
   e. State grid standby power
   f. Medical equipment standby power
   g. Airplane, ship, vehicle starter power
   h. Deep sea lighting and system power
   i. Fire-fighting and security system power
   j. Emergency lighting system power
   k. Railway system standby, system power
   l. Alarm system power
   m. Peak load compensation energy storage system

3) Power storage series
   n. Solar system, solar power storage system
   o. Street lamp, signal lamp, garden lamp
   p. Off-grid solar plant
   q. Emergency standby power

3. BATTERY CONSTRUCTION

![Diagram of battery construction](image)
4. BATTERY TYPES

**GEL Battery with Silicon Tech**

<table>
<thead>
<tr>
<th>Item</th>
<th>Volt</th>
<th>Capacity 2V20h/12V10h</th>
<th>Capacity 2V10h/12V3h</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>SJH21000</td>
<td>2V</td>
<td>108Ah</td>
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<td>171mm</td>
<td>72mm</td>
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<td>SJH22000</td>
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<td>200Ah</td>
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<td>108mm</td>
<td>330mm</td>
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<td>SJH23000</td>
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<td>800Ah</td>
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<td>171mm</td>
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<td>SJH215000</td>
<td>2V</td>
<td>1620Ah</td>
<td>1500Ah</td>
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<td>330mm</td>
<td>87.0kg</td>
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<td>SJH220000</td>
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<td>2160Ah</td>
<td>2000Ah</td>
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<td>337mm</td>
<td>330mm</td>
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<td>SJH225000</td>
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<td>2700Ah</td>
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<td>476mm</td>
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<td>SJH230000</td>
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<td>3240Ah</td>
<td>3000Ah</td>
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<td>330mm</td>
<td>172.0kg</td>
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<td>SJH12240</td>
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<td>24Ah</td>
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<tr>
<td>SJH12330</td>
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<td>33Ah</td>
<td>27Ah</td>
<td>195mm</td>
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<td>155mm</td>
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<td>SJH12380</td>
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<td>38Ah</td>
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<td>196mm</td>
<td>165mm</td>
<td>174mm</td>
<td>12.5kg</td>
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<td>40Ah</td>
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<td>196mm</td>
<td>165mm</td>
<td>174mm</td>
<td>12.5kg</td>
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<tr>
<td>SJH12500</td>
<td>12V</td>
<td>50Ah</td>
<td>39Ah</td>
<td>229mm</td>
<td>138mm</td>
<td>211mm</td>
<td>16.5kg</td>
</tr>
<tr>
<td>SJH12650</td>
<td>12V</td>
<td>65Ah</td>
<td>51Ah</td>
<td>350mm</td>
<td>170mm</td>
<td>180mm</td>
<td>21.0kg</td>
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<td>SJH12700</td>
<td>12V</td>
<td>70Ah</td>
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<td>168mm</td>
<td>211mm</td>
<td>22.5kg</td>
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<tr>
<td>SJH12900</td>
<td>12V</td>
<td>90Ah</td>
<td>72Ah</td>
<td>306mm</td>
<td>168mm</td>
<td>211mm</td>
<td>26.5kg</td>
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<td>SJH121000</td>
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<td>100Ah</td>
<td>81Ah</td>
<td>330mm</td>
<td>174mm</td>
<td>216mm</td>
<td>30.0kg</td>
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<tr>
<td>SJH121200</td>
<td>12V</td>
<td>120Ah</td>
<td>96Ah</td>
<td>407mm</td>
<td>173mm</td>
<td>209mm</td>
<td>34.5kg</td>
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<tr>
<td>SJH121500</td>
<td>12V</td>
<td>150Ah</td>
<td>120Ah</td>
<td>483mm</td>
<td>170mm</td>
<td>240mm</td>
<td>43.0kg</td>
</tr>
<tr>
<td>SJH122000</td>
<td>12V</td>
<td>200Ah</td>
<td>156Ah</td>
<td>522mm</td>
<td>239mm</td>
<td>219mm</td>
<td>56.5kg</td>
</tr>
</tbody>
</table>
5. OPERATIONAL PRINCIPLE

\[ \text{PbO}_2 + 2\text{H}_2\text{SO}_4 + \text{Pb} \xrightarrow{\text{Discharge}} \text{PbSO}_4 + 2\text{H}_2\text{O} + \text{PbSO}_4 \]

CHAPTER 2 PERFORMANCE

1. DISCHARGE CURVE

![Discharge Curve Graph]

- Discharge voltage (V) ranging from 8.0 to 13.0
- Time in minutes and hours
- Discharge rates: 3C, 2C, 1C, 0.6C, 0.4C, 0.2C, 0.1C, 0.05C

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2. CHARGE CURVE

![Charge Curve Graph]

3. DISCHARGE DATA

Please check specific datasheet of different type.

4. INTERNAL RESISTANCE & SHORT CIRCUIT CURRENT

Please check specific datasheet of different type.
CHAPTER 3 INSTALLATION/ USE/ MAINTENANCE

1. CAPACITY

1) Battery capacity is normally rated as unit Ampere-hour, (hereafter named “Ah”), it’s the capacity of relative battery could be discharged under nominal conditions.

2) Capacity is related to rated time like 20 hours rate, 10 hour rate, 3 hours rate, etc.

3) Actual capacity will change accordingly to different system condition like discharge condition, end voltage and temperature.

4) For discharge condition, if battery is not recharged in time after discharge, or the battery is discharged again during recharge, this insufficient charge method will cause battery lose part of capacity in short time if it happen frequently.

5) If such a discharge situation seriously happens frequently, it will make battery lose capacity and sharply shorten battery service life.

2. OPERATIONAL TEMPERATURE

6) For temperature, the recommended ambient temperature for battery is from 15- 25°C, higher or lower temperature will make battery performance changed, normally capacity is lower when temperature becomes lower, is higher when temperature becomes higher,

Below please check the temperature range which battery could work

<table>
<thead>
<tr>
<th>Battery condition</th>
<th>Temperature range</th>
<th>Recommended range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge</td>
<td>-40- 60°C</td>
<td>15- 25°C</td>
</tr>
<tr>
<td>Charge</td>
<td>-40- 60°C</td>
<td>15- 25°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20- 50°C</td>
<td>15- 25°C</td>
</tr>
</tbody>
</table>
Please check below the table about available capacity and ambient temperature.

![Graph showing capacity vs temperature](image)

**Warning**

1) High temperature get higher battery capacity, but higher temperature (higher than 25°C) will cause battery damaged and shorten service life.

   If the temperature becomes higher than 25°C, the battery service life will decrease accordingly, normally each 8-10°C higher temperature is got, half of service life will be damaged.

2) If the temperature is lower than 15°C, you should be also very careful to design your system for capacity, because the actual capacity will be less than rated capacity.
3. CHARGE METHODS

1) Regular cycle charge.

Battery need regular cycle charge after floating operation for at least 3 months, or if the voltage is lower more than half of rated voltage frequently.

Cycle charge requires constant current and limited voltage till the voltage get cycle charge voltage (25°C.), then keep the voltage to reduce current till charge finished, charge time need at least 24 hours.

2) Recharge after discharge

Battery need to be charged in time after discharge, charge method need cycle charge with constant current and limited voltage till voltage get a certain voltage (cycle or float voltage), then keep this voltage to reduce current till charge finished.

The certain voltage would be cycle voltage or float voltage, if discharge depth is higher than 15%, we recommend to use cycle voltage as certain voltage to fully charge the battery.

Please check the “Charge Curve” table on page 8 for details.

Besides, the relationship between charge voltage and temperature please check as follow,

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Charge Voltage (V)</th>
<th>Max Charge Current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temp (°C)</td>
<td>Set Point</td>
</tr>
<tr>
<td>Cycle Use</td>
<td>25</td>
<td>14.4</td>
</tr>
<tr>
<td>Float Use</td>
<td>25</td>
<td>13.8</td>
</tr>
</tbody>
</table>

3) Fast charge

⚠️ Warning

If an urgent charge is necessary, raise charge current but never higher than 0.30C, battery will get unrecoverable damage or serious accident.
4. STORAGE REQUIREMENTS

Please keep important attention to battery storage and operation regularly to check battery condition for making decision what/ how/ when to have a proper reaction to keep battery at good condition.

1) Battery must be stored in area which is clean, well ventilated, dry and without direct sunshine coverage.

2) All lead acid battery lose capacity when standby with open circuit result from self-discharge character.

3) Self-discharge rate is related to temperature, higher temperature, higher rate.

4) Regularly check and charge battery if battery is stored more than 6 months, or open circuit voltage of each cell is lower than 2.10V/Cell, by CYCLE charge method.

5) Battery must be fully charged before battery is going to be stored.

⚠️ Warning

A regular check for battery is the best way to keep it good condition if battery is going to be stored.

Keep records of storage time and recharge time (if applicable), then pay close attention to this interval to check battery condition.

Below please check self-discharge curve table
5. MAINTENANCE

A proper maintenance is key to take the best use of battery during whole service life, maintenance should be regular, systematical and trackable.

1. Monthly maintenance

   a. Clean battery and battery room.
   b. Check ambient temperature.
   c. Check each battery if battery looks normal without damage, melting part, and check terminal condition, valve condition.
   d. Check the system voltage and floating current.
   e. Make maintenance record.

2. Quarterly maintenance

   f. Do monthly maintenance.
g. Check voltage of batteries in series, calculate if voltage of at least 2 cells is lower than 2.1V after temperature compensation, make a CYCLE charge.

h. Make maintenance record.

3. Yearly maintenance

i. Do quarterly maintenance.

j. Check the installation condition including battery brackets, cables, terminal connections, etc.

k. Make discharge test by 30% DOD, make discharge test by 70% DOD after 3 years operation.

CHAPTER 4  POPULAR F&Q

1. Why the capacity of battery decreases abnormal when I put it in good condition including clean room with proper ambient temperature?

A: If the floating voltage is not set properly according to relation between voltage and temperature, setting voltage is too low to charge battery well.

Battery will decrease capacity or would be defective sharply ahead of designed service life if this insufficient charge happens for a long time.

2. Can I charge battery with only one mode always without regular check?

Battery should be charged according to its working condition and maintenance condition, if the charge method cannot be adjusted, or if the battery is always charged by cycle charge, battery will have serious problem of over charge, high temperature, over inside reaction to speed up materials degradation, especially for normal AGM series battery, beside problems above, water will lose much to make battery defective.

3. What is the problem of temperature?

Battery could work well under proper temperature, as we know the capacity has close relation to temperature, lower temperature will decrease available capacity
while higher temperature will increase available capacity but, high temperature is the worst condition to battery, the same problem as we explain for over charge.

4. I bought a brand new battery but put it away in my warehouse as a spare part, it becomes very weak when I start to use it now, why?

All battery has a certain self-discharge rate, and battery will have problem if it is put away after discharged for long time, that’s why all batteries must be fully charged before they are launched into market, a long calmly stayed discharged battery will got damage inside.

5. How can I check the status of my batteries?

Battery as an industrial purpose product, it needs well maintenance during its normal service life, regular maintenance can help you to check status of battery, as to our manual, you can do discharge test during maintenance to get the correct battery status.

6. Does lead acid battery have a memory?

No.

7. How can design the installation direction of batteries?

For some high height design battery, it’s better to put battery horizontal because if it is put vertically, density of electrolyte on the top will become lower but bottom will become higher, this will speed up self-discharge and shorten service life.

8. Why I can not put new battery mixed with old battery in one system?

New battery and old battery has different internal resistance, this will cause big difference during charge and discharge. Battery will have insufficient charge or over charge problem when connection is in series, charge and discharge current will have difference when connection is in parallel.
9. Why floating voltage has difference during initial operation for new installation batteries?

Batteries have difference during production especially for VRLA type batteries which is barren liquor design, this difference will directly cause different inside chemical reaction to result in different overpotential, but this difference will be smaller after a period operation, then floating voltage will become stable. Besides, if the connection cable has strong internal resistance or connection with terminal is loose, this will also happen time by time.

10. How could I determine a weak or failure battery during floating charge operation?

You should check the discharge voltage because weak battery has lower discharge voltage, if results tell the voltage is lower than others after at least 3 times consecutive check, there should be at least one weak battery in the array or line, you should start a cycle charge for this array or line.

11. Is a battery become defective when the container has inflation?

Normally tiny inflation is safe because battery has internal pressure, and the pressure could be relieved through valve.

So you have to pay serious attention to the battery working condition and maintenance details, if the battery is over charged always and thermal runaway, the high internal pressure will make container inflated, an inflated battery may not be a defective battery but it’s on the way running to be it.