



# Stationary VRLA Batteries

## Installation and Operating Procedures

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## 1. Safety Measures

Before proceeding with unpacking, handling, installation and operation of Power Sonic Valve Regulated (commonly known as SLA) lead-acid storage batteries, the following general information and safety precautions must be followed.

### **Skilled Personnel**

Work on batteries under instruction of skilled personnel only, observing commissioning instructions and instructions for use!

### **Safety Gear**

When working on batteries wear protective safety goggles and clothing!

### **Chemical Hazard**

The electrolyte is sulphuric acid and very corrosive and may be released as a result of a damaged battery case.

### **Risk of lead contamination**

Power Sonic VRLA batteries are recyclable, dispose spent batteries properly. Call PSE for further information if required.

### **Electrical hazard**

Risk of shock by high voltage and current.

Avoid short circuits! Caution! Metal parts of the batteries are always live, do not place tools or other objects on the battery! Do not touch uninsulated terminals and connectors. Remove jewelry and wrist watches. Be aware of high voltages when cleaning the battery.

### **Explosion hazard**

Risk of hydrogen gas; ventilate well when operating the battery.

### **Chemical hazard**

Risk of chemical burns by the sulphuric acid electrolyte

Sulphuric acid can cause blindness or severe burns. Flush eyes and affected body parts with water. Get medical help ASAP

### **Ignition hazard**

Risk of explosion or fire

No smoking, open flames, sparks and electrostatic discharges near the battery. Do not use dry rags or feather dusters for cleaning.

### **Risk of battery case damage by chemicals**

Do not use chemicals, sprays or similar to clean the battery. Use water damp cloth only.

### **Battery Weight**

Block batteries and cells can be extremely heavy! Ensure secure installation and only use suitable handling equipment, tools and measuring equipment!

## 2. Delivery

Upon delivery, immediately inspect the battery consignment for signs of transit damage e.g broken pallets or damaged packing material. If any damage is observed, note the damage on the delivery receipt before signing. Any damage must be reported immediately to the carrier and the damaged items retained for inspection by the carriers representative. Take photographs of damage.

## 3. Concealed Damage

Within 10 days of receipt, examine all blocs for concealed damage. If damage is observed, immediately request an inspection from the carrier and file a concealed damage claim. Do not delay notifying the carrier as loss of right to reimbursement for damages may be lost. Before proceeding with the unpacking, handling, installation and operation of this sealed lead-acid storage battery, the following general information should be reviewed together with the recommended safety precautions.

Open the packaging and check the cells and hardware against the packing list. Power Sonic VRLA batteries/cells are shipped fully charged and must be treated with care at all times:

## 4. Handling

Always lift the individual batteries /cells from underneath or use the built in lifting handles. Never apply force and ensure nothing is dropped on the terminal posts which could results in:

- Damage to the terminals
- Internal damage
- Damage to the terminal seals
- Cause a sparks and high short circuit currents.

Inspect each battery for physical damage e.g. cracks to the case or cover, distortion of the battery/cells and/or terminals. Measure the battery open circuit terminal voltage which should be > 2.1 volts/cell battery. If any batteries are lower they will need a supplementary charge prior to installation.

## 5. Storage

The batteries should be installed ASAP or otherwise store indoors in cool, dry conditions, avoiding direct sunlight and to avoid possible damage to the batteries /cells:

- Do not stack the pallets
- Do not store objects/other materials on top of the pallets
- Do not store where the possibility of metallic objects falling on the battery may occur.

Storage temperatures should be kept at 20° C if possible, otherwise more frequent freshening charges will be necessary. Freshening charges should be given every 6 months or when the cell voltage drops below 2.1v

## 6. Freshening Charge Details

FRESHENING VOLTAGE (V)	DURATION (HRS)
2.275 at 25 Deg C	48

Storage of batteries beyond the recommended temperatures or storage time, without charging, can result in sulphation of the battery plates, hardened lead sulphate crystals, loss of capacity and loss of float life. In extreme cases, cell shorting can occur; furthermore it can also void the battery's warranty.

## 7. Preparation For Installation

### a. Terminal Preparation

To minimize contact resistance and to remove any traces of oxidation gently clean the contact surface of the terminals with a soft brass bristle brush. Immediately after this cleaning, apply a thin layer of antioxidant grease or petroleum jelly to the contact areas.

Equipment required for installation would include but not limited to the following:

- Digital Voltmeter
- Insulated Socket spanner
- Calibrated Torque Spanner
- Rubber Gloves
- Plastic Apron
- Portable eyewash
- Safety Goggles
- Acid Spillage /neutralizing kit

### b. Floor Loading

The area where the battery system is to be installed should have the capability to support the weight of the battery as well as any auxiliary equipment. The total battery weight will depend on the battery size, number of batteries, as well as the configuration involved. Prior to installation, the floor integrity to accommodate the battery system should be checked.

### c. Floor Anchoring

Where seismic conditions are anticipated, floor anchoring should be provided and is the responsibility of the user.

## 8. Battery Installation

Ensure that the racks, cabinets, or shelves are stable before installing the cells/batteries,

- Do not use grease on the racks and ensure that the batteries are installed in the approved orientation.
- Avoid open flames, sparks and short circuits, electrostatic discharges from clothing. Remove jewelry and wrist watches when installing and operating Power Sonic batteries
- Never lay tools or other metallic objects on batteries.
- Do not reach or lean across batteries on step racks. Remember, hazardous voltages are present. Be aware of what you are touching at all times.
- If the units need cleaning only use a water damp cloth, do not use chemicals, solvents or sprays.
- Maintain a gap of 10mm between individual units.
  
- DO NOT try to remove the vents and add water to the batteries, this would present a safety hazard and void the warranty.
  
- Check unit polarity and voltage before making inter unit connections and use specified cables and accessories only.
  
- Install the inter-tier cabling, again checking unit polarity. Attach the inter-tier cabling to the wall or the rack so that the weight of the cable is not on the battery terminal. If using a stiff cable, pre-bend the cable so no 'spring' force is placed on the battery terminals. Failure to support the cable weight could result in a premature battery failure and loss of battery integrity.
  
- Within a string check that all connections are properly made (positive to negative) and measure the total string voltage. Tighten the interconnections on to the terminals to the following recommended torque values:

**Recommended Torque Setting for Terminal Nut and Bolts**

TERMINAL TYPE	FASTENING TORQUE (NM)
M6	3.9-5.0
M8	11-14.7

- For parallel strings, connect batteries in parallel with cables of similar resistance and only at the end terminals of the strings.
  
- Affix no. stickers to each unit starting with no.1 at the positive end of the battery.
  
- Make sure the settings of the charger or rectifier are set to the correct float voltage. Power down the charger/rectifier. Finally connect the main positive terminal of the battery with the positive terminal of the charger/ rectifier
  
- Monitor the battery to ensure the operation is proceeding normally i.e. the charge acceptance of the battery is reducing; the batteries are not overheating and are within 3 deg of each other and the ambient

## 9. Equalisation Charge

An equalization charge is not normally required except under following conditions:

- Temperature variation the string greater than 3°C
- Low float voltages
- Low operational temperature without temperature compensation
- Frequent deep discharges
- Rapid recharge required
- Long delay in recharging the battery after a discharge
- Unevenly paralleled string balance

Equalization should be performed only when necessary .Frequent equalizing can result in water consumption leading to reduced capacity and shortened battery life.

### Equalization Charging at 25 Deg

EQUALISATION VOLTAGE (V)	DURATION (HRS)
2.35	24
2.4	12

After the equalization charge the battery will be put on normal float charge details of which are as follows :

## 10. Float Charge

<i>Recommended charge voltages for different temperatures</i>	
Temperature	Float Use (V)
-10°C (14°F)	2.32 – 2.37
0°C (32°F)	2.30 – 2.35
10°C (50°F)	2.28 – 2.33
20°C (68°F)	2.26 – 2.31
25°C (77°F)	2.25 – 2.30
30°C (86°F)	2.24 – 2.29
40°C (104°F)	2.22 – 2.27
50°C (122°F)	2.20 – 2.25

## 11. Recharge

In a standby application it is usually recommended to limit the charging current, especially when higher voltages are used e.g. during equalization charging the max current should not exceed 0.25 C20. In most cases, however, a nominal charging current is used based on 0.10 C20.

Recharge batteries immediately or as soon as possible after a discharge. Do not wait to initiate the recharge after the batteries have been discharged. Failure to follow this recommendation could result in a permanent loss of capacity due to plate sulphation.

## 12. Operating Temperatures

The batteries should be installed in a dry and adequately ventilated area, with an operational temperature of 20°C .

Battery operational temperature over 20°C will have a severely detrimental effect on battery service life, see section 18.

Ideal operating temp operating temp is 20 ° C, higher temperatures will reduce battery service life.

Air circulation within the battery room must be sufficient to prevent temperature layering effects and to avoid hot and cold spots. Up to a maximum of 3 deg temp spread across the cells is acceptable.

## 13. Gassing and Ventilation

Provision must be made for sufficient diffusion and ventilation of any gases emitted, during charging, from the battery to prevent the accumulation of an explosive atmosphere.

Power Sonic batteries contain a self-resealing valve which will release any internal pressure build up due to overcharging and will close, preventing any air from entering the battery.

Under normal float charge conditions 99 % of the gases recombine internally, the volume of gases emitted to the atmosphere is therefore, very small and mechanical ventilation is not normally required.

Never install and charge batteries in an airtight enclosure.

Please note: in most cases the normal unrestricted air movement around the individual cells/batteries required to prevent hot and cold spots is typically more than adequate to avoid the build up of an explosive gas mixture.



## 14. Battery Capacity Testing

Since discharge or load testing gives the only real measure of battery capacity, it is therefore recommended that capacity checks are carried out on an annual basis.

There are two discharge tests that can be carried out:

1. A ratings test discharge - the intention here is to determine the percent of battery capacity as compared to the rated capacity. This is typically a 10 or 20 hour discharge test.
2. A service test discharge - this test is to determine the battery standby time under the actual load conditions of intended battery usage.

### Test Procedure

The battery test procedure for either test is:

- Ensure the battery is fully charged before capacity testing and that all connections are clean and tight. .
- Prepare the load bank or test load system. Ensure all temporary cable connections are secure and connected to the proper polarity and have sufficient current carrying capacity.
- Determine the battery temperature by measuring and recording the temperature of each bloc. Average the readings to determine average battery temperature. Measure the battery temperature in the middle of the side (preferably) or the end wall of the container.
- If a ratings test is being performed, the load current or power must be temperature corrected if the battery temperature is significantly different from 25°C. Use the following formula for calculating temperature corrected load
- Temperature corrected load = load at 25°C x CF, where CF is the capacity correction factor for temperature.

The following table should be used :

Test Temperature (°C)	Correction Factor (CF)
0	0.78
5	0.84
10	0.89
15	0.94
20	0.97
25	1.00
30	1.03
35	1.05

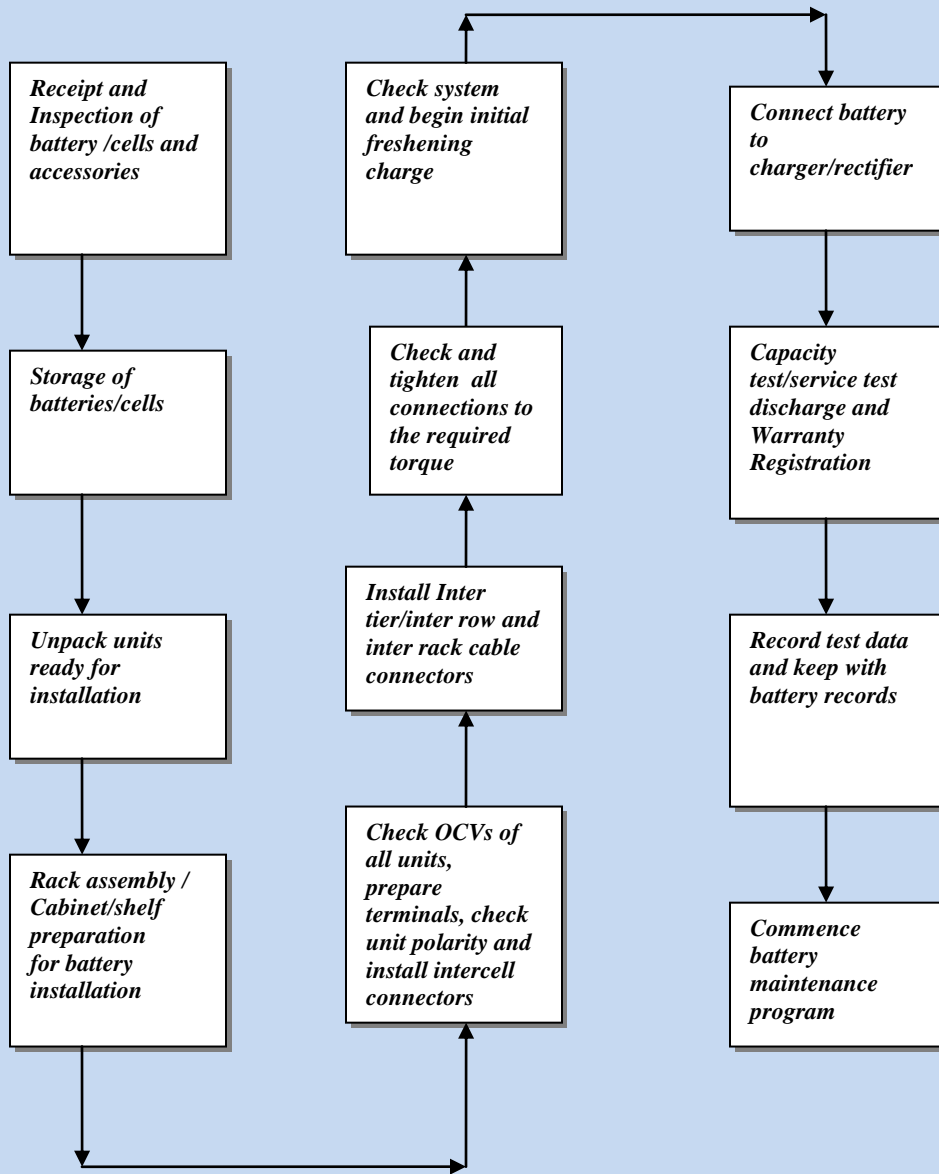
If the service test is being performed, no temperature correction is necessary.

- Just prior to starting the discharge test, measure and record the individual bloc voltages, the string voltage and float current
- Remove or disconnect the charger from the battery string.
- Connect the load to the battery and start a timer.
- Record the load current, string and individual cell voltages on a regular basis. A minimum of three sets of readings should be taken. The time interval between sets of readings will vary based on the expected test time. For example, take readings every hour for the first 4 hours of an 8 hour rating test. For the following 3 hours take readings every ½ hour. For the last hour, take readings every 15 minutes. For a 15 minute UPS discharge, readings every 3 minutes would be desirable.
- Continue the discharge until the string voltage drops below the end-point voltage per cell times the number of cells in the string.
- Stop the timer and remove the load from the battery.
- Recharge the battery using the existing charger or an external charger. An equalising voltage may be used to reduce charge time.
- Record the discharge time and calculate percentage capacity if a ratings test was performed.
- Keep a copy of all the test data with the battery records.

#### Discharge Test Notes :

- The batteries /cells full capacity will be obtained after several cycles
- String voltage should be measured at the battery terminals, not at the load connections.
- Accurate meters are essential for correct test results. Ensure all meters, shunts, etc., are properly calibrated before usage

### 15. Battery System Installation Flow Chart



## 16. Battery Maintenance

As part of the maintenance program Power Sonic batteries should be inspected visually for:

Corrosion at the terminals, connections, and rack, cabinet, shelves. Check units for signs of acid leakage, damage e.g. cracks, distortion of unit cases and covers

### Cleaning

Clean the units when necessary using a soft dry cloth or damp cloth do not use abrasives cleaners, solvents or chemical sprays.

### Voltage checks

Measure and record individual unit/cell float voltages after a minimum of 3 days after a battery discharge or equalization charge.

### Charger voltage

Charging voltage can affect battery life and reliability; this should be checked on a regular basis

### Pilot Cell

A pilot unit is selected in the series string to reflect the general condition of all units in the battery. The pilot unit should be the battery with the lowest voltage in the string following the initial charge. The pilot battery/cell serves as an indicator of battery condition between scheduled overall individual unit readings. A complete recorded history of the battery operation should be kept safe in order to review the battery performance. Good records will also help eliminate possible charging, maintenance or environmental problems.

A. Upon completion of the initial charge and with the battery on float charge at the proper voltage for one week, read and record the following:

1. Individual battery voltages
2. Individual battery conductance/impedance
3. Battery string terminal voltages
4. Ambient temperature

B. Every 6 months, a complete set of readings as specified in Paragraph A above must be done and all individual connections retorqued.

C. Whenever the battery is given an equalising charge, an additional set of cell voltage and temp readings should be taken and recorded.

The suggested frequency of record taking shown below is the absolute minimum to protect warranty. For critical applications more frequent quarterly readings are recommended.

\*Failure to adhere to these minimum maintenance schedules will void the battery's warranty.

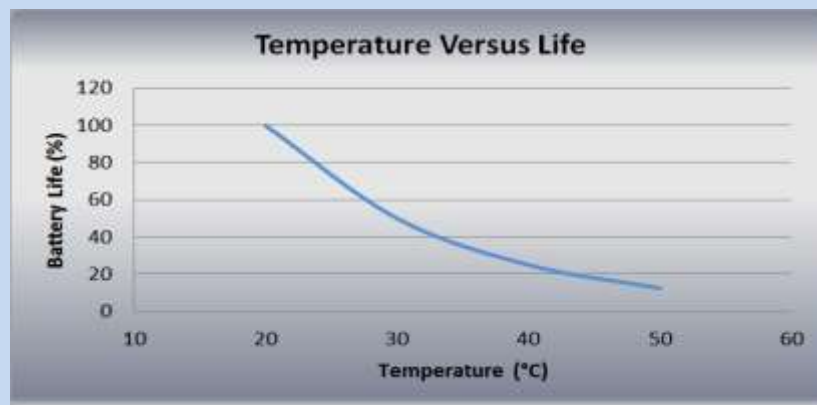
## 17. Minimum Maintenance Schedule

STRING VOLTAGE	MEASURE/RECORD	EVERY 3 MONTHS
Individual Voltages	Measure/Record	Every 6 Months
Individual bloc impedance/conductance	Measure/Record	Every 6 Months but preferably every 3 months
Pilot Unit Voltage/temp	Measure/Record	Every 1 Months
Ambient Temperature	Measure/Record	Every 3 Months
Inter-Unit Connections	Inspect/Retorque	Every 12 Months

## 18. Effect of Temperature

Temperature has a direct affect on battery life at temp above 20 ° C the battery life is reduced .See Fig 1 below:

Fig.1



It is important to keep operating temp of the battery under float conditions below 40° C. VRLA batteries can suffer thermal runaway at temp above 40 ° C. Thermal runaway is a condition that occurs in a valve regulated battery when charging energy results in heat generation within the battery greater than the heat dissipated, causing an uncontrolled rise in temp and subsequent melt down of the battery.

## 19. Battery Maintenance Report

Battery/Cell Type \_\_\_\_\_

Installation Date \_\_\_\_\_  
 Battery Location \_\_\_\_\_  
 No. Of Strings Per Battery \_\_\_\_\_  
 No Of Cells Per String \_\_\_\_\_

**Battery On Float**

Date: \_\_\_\_\_  
 Time: \_\_\_\_\_  
 Battery Overall Voltage (Volts) \_\_\_\_\_  
 Charge Current (Amps) \_\_\_\_\_  
 Ambient Temp °C \_\_\_\_\_

**Battery Discharged**

Date: \_\_\_\_\_  
 Capacity Achieved (Ah) \_\_\_\_\_

**Battery Equalised**

Date: \_\_\_\_\_  
 Duration: \_\_\_\_\_

**Individual Cell Readings**

Cell	Float Voltage (v)	Impedance / Conductance
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

**Pilot Unit Readings  
 Monthly Record**

Date	Pilot Unit Float Voltage	Over all Battery Terminal Voltage (v)	Temp (oC)

Remarks

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Readings taken by \_\_\_\_\_