

Handling Manual

1 Scope of Application

The following describes precautions should to be observed when operating a VRLA battery with a capacity of 4.5 to 100 Ah.

2 Precautions for Design of Power Supply Unit

2.1 Charging

(1) For Standby Use (Trickle Charge or Float Charge)

- ✓ Charge the battery at a constant voltage of 2.275 V/cell (25°C or 77°F). When charging at an ambient temperature of less than 5°C (41°F) or more than 35°C (95°F), and average temperature above 25°C (77°F), it is necessary to adjust the charge voltage in ratio to the temperature. The temperature coefficient should be -3.3mV/°C cell.
- ✓ Initial charging current should be 0.3CA (where C is the nominal capacity value and A is amperes) or less.
- ✓ We recommend charging the battery at an ambient temperature between 5°C (41°F) and 35°C (95°F) to prevent any adverse effects on its effective life.

(2) For cycle service

- ✓ Maintain a modified constant voltage or a constant voltage charge at a voltage of 2.45 V/cell (25°C or 77°F). When charging at an ambient temperature of less than 5°C (41°F) or more than 35°C (95°F), it is necessary to adjust the charge voltage in ratio of the temperature. The temperature coefficient should be -5mV/°C cell.
- ✓ Initial charging current should be 0.3CA (where C is the nominal capacity value and A is amperes) or less.
- ✓ To avoid overcharging, when charging is finished, we recommend charging to be stopped by using a timer or the constant voltage to be dropped to 2.275 V/cell (25°C or 77°F).
- ✓ We also recommend charging the battery at an ambient temperature between 5°C to 35°C to prevent any adverse effects on its effective life.
- ✓ If rapid charging is required, please contact us.

2.2 Discharge

- ✓ The continuous discharge and maximum discharge current (for 5 Seconds) should never exceed the values shown in the Specification List.
- ✓ Final discharge voltage and discharge current should be the same as shown in Table 1. Never discharge the battery until the voltage and current are less than the values shown in this table. Repeated over discharge will shorten the battery's life.

- ✓ After discharging, immediately recharge the battery. Never leave it discharged. The capacity to hold a charge may not be recovered if the battery is left discharged for a long period.

Table 1 Discharging current and final discharge voltage

Final discharge voltage (V/Cell)	Series			
	UPS,RUM	HR,HRL,XHRL	GP,GPL,EVH,EVX,XTV,TPL	MU,MSV,MSJ
1.90	0.05C > (A)			
1.80	0.025P > (W)	0.05 P > (W)	0.1 C > (A)	0.05 C ≤ (A) < 0.25 C
1.75	0.025P ≤ (W) < 0.075P	0.05P ≤ (W) < 0.15P	0.1 C ≤ (A) < 0.30 C	0.25 C ≤ (A) < 0.40 C
1.70	0.075P ≤ (W) < 0.5P	0.15P ≤ (W) < 1.0 P	0.30 C ≤ (A) < 2.0 C	(A) ≥ 0.4C
1.60	(W) ≥ 0.5P	(W) ≥ 1.0 P	(A) ≥ 2.0 C	

2.3 Installation and Connection

- (1) Secure the battery firmly to protect it from excessive vibration or impact.
- (2) When placing the battery in equipment, keep it away from a heat generating source (e.g., a transformer) and install it in any position (except of upside down) and as low as possible with proper ventilation.
- (3) The battery may produce a combustible gas. Avoid installation in closed compartment or near sparks (i. e., near a switch or fuse).
- (4) Using vinyl chloride sheathed wire or a vinyl chloride sheet may crack the battery container and cover. Either keep it away from the battery or use a non-plasticizing vinyl chloride material.
- (5) Never bend the terminal nor solder directly to it.
- (6) Avoid using the battery in the following places:
 - ✓ Areas exposed to direct sunlight
 - ✓ Areas where there is excessive radioactivity, infrared radiation, or ultraviolet radiation
 - ✓ Areas filled with organic solvent, vapor, dust, or corrosive gases
 - ✓ Areas of abnormal vibration
- (7) When connecting the battery to a charger or a load, keep the circuit switch OFF and connect the battery's positive (+) terminal to the positive (+) pole of the charger or the load and the battery's negative (-) terminal to the negative (-) pole of the charger or the load.
- (8) Never use the batteries or different capacities, batteries of different performances, or new and old batteries together.
- (9) Do not series connect more than 32 pcs of battery in a single string or parallel connect more than 4 strings. If more batteries are needed for series/parallel application as stated above, please contact us.

3 General Handling Precautions

3.1 Before Use

(1) Storage and supplementary charging

- ✓ During storage, the capacity of the battery decreases due to self-discharging. Store the battery in a cool dry place. Where the monthly average temperature exceeds 25°C (77°F) (below 30°C or 86°F), carry out supplementary charging every 3 months. Where the monthly average temperature falls below 25°C (77°F), carry out supplementary charging every 6 months.
- ✓ When using a stored battery, always carry out supplementary charging before use.
- ✓ For supplementary charging, please refer to Table 1.

Table 2 Supplementary charging reference

Charge Method	Charge Time (h)	Ambient Temperature (°C)
Constant Charge Voltage at 2.45 V/cell	6-12	5 -35
Constant Charge Current at 0.05CA	6-12	

(2) Transporting

- ✓ When transporting the battery, never vibrate or impact it excessively.
- ✓ We recommend transporting the battery in an upright position.
- ✓ When transporting a battery connected to equipment, secure it firmly and keep the circuit open.

3.2 Daily Inspection and Servicing

- (1) When the following abnormalities are observed, discover the cause and replace any defective batteries:
 - ✓ Any voltage abnormalities
 - ✓ Any physical defects (e.g., a cracked or deformed container cover)
 - ✓ Any electrolyte leakage
 - ✓ Any abnormal heat generation
- (2) Clean any dust contamination with a wet cloth. Never use organic solvents (e.g., gasoline or thinners), and never use chemicals on the battery, for any other purpose. Otherwise the container or cover may develop cracks. If you need to use any chemical on the battery, please contact us for more information.
- (3) When installing the battery as an emergency power supply for fire-fighting equipment, inspect it according to the Fire-fighting Equipment Poser Supply Inspection Standard or Inspection Procedure.

3.3 Other Precautions

- (1) The battery may produce a combustible gas. To prevent a rupture, never place the battery near a fire.
- (2) Never short the terminals. Shorting may cause the battery to burn.
- (3) Never disassemble or reassemble the battery.
- (4) Never attempt to reverse charge the battery. This not only fails to charge the battery, but also diminishes its performance and may cause the electrolyte to leak.

4 Life of the Battery

Generally the battery's effective life is 3 to 5 years for standby use and 260 cycles (100% depth of discharge) or more for cycle use. The effective life may be shortened when the proper conditions are not maintained (i.e., for charging, discharging, working temperature, and storage). In order to ensure that battery normal performance is maintained, please replace battery unit prior to expected end-of-life date.

For Example: GP/HC/HR/EVX series battery should be replaced according to the average operating temperature. Please see below for recommended change period:

Ambient temperature	Change period
25°C (Room temperature)	within 3 years
30°C	within 2.5 years
40°C	within 1.4 years