

PowerSafe®

Sustainable solutions






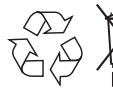





PowerSafe® OPzV

Operation Guide for Solar Applications

EnerSys®
Power/Full Solutions

Safety precautions
 Batteries give off explosive gasses. They are filled with dilute sulphuric acid, which is very corrosive. When working with sulphuric acid, always wear protective clothing and glasses. Exposed metal parts of the battery always carry a voltage and are electrically live (risk of short circuits). Avoid electrostatic charge. The protective measures according to EN 50272-2 must be observed.
 Care for your safety

	No smoking no naked flames, no sparks		Shield eyes		Note operating instructions
	Electrical hazard		Danger		Recycle scrap batteries. Contains lead.
	Electrolyte is corrosive, in case of broken containers/lids		Clean all acid splash in eyes or on skin with lot of clear water. Then visit a doctor. Acid on clothing is to be washed with water.		Risk of explosion or fire, avoid any short circuit. Metallic parts under voltage on the battery : do not lean tools or items on top of the battery.
Handling OPzV batteries are supplied in a fully charged state and must be unpacked carefully to avoid short-circuit between terminals of opposite polarity. The cells are heavy and must be lifted with appropriate equipment.	Keep Flames Away In the case of an accidental overcharge, a flammable gas may be emitted from the safety valve. Discharge any possible static electricity from clothes by touching an earth-connected part.	Tools Use tools with insulated handles. Do not place or drop metal objects onto the battery. Remove rings, wristwatch and metal articles of clothing that might come into contact with the battery terminals.			
Warranty Any of the following actions will invalidate the warranty - Non-adherence to the Installation, Operating and Maintenance instructions. Repairs carried out with non-approved spare parts. Application of additives to the electrolyte. Unauthorised interference with the battery.					

Specific Abilities

The specific abilities of this type of battery for renewable energy applications are as follows.

- **Cycling** (one "cycle" consists of a discharge, of any depth, followed by a recharge)
- **Overcharge ability**
- **Cycling in state of discharge**
- **Low rate of self-discharge**
- **No addition of water required during service life**

PowerSafe® OPzV are designed for applications where the battery must undergo repeated cycling with daily depths of discharge of up to 35% of capacity C_{120} (such as rural settlements, communications systems and lighting systems etc.).

Cell Design

The PowerSafe® OPzV cells consist of:

- **Tubular positive plates** with Lead-Calcium-Tin alloy, diecast to offer longer service life thanks to an extremely cohesive Lead-Calcium alloy grid
- Electrolyte immobilised as a gel
- **Pressure Relief Valve - One way valve with intergral flame arrestor**

Features & Benefits

- **Excellent deep discharge recovery and cyclability**
- **Up to 1600 Cycles to 60% depth of discharge**
- **Vertical or horizontal installation**
- **No topping up required**
- **Minimal mainenance required**

Capacity

Capacity is the number of Ah a battery can supply for a well-defined current and an end of discharge voltage.

Capacity varies with the discharge time, discharge rate and temperature.

Example Capacities for 6OPzV600 cell are as follows:

Discharge time	10 h	120h	240h
End voltage	1.80Vpc	1.85Vpc	190Vpc
Capacity	705Ah	895Ah	834AH

The nominal capacity of PowerSafe® OPzV cells for renewable energy applications is given as follows:

Capacity Ah	Current A	Discharge period h	End voltage V/cell
C_{120}	I_{120}	120	1.85V

Discharge Rate: Is the ratio of discharge current divided by battery capacity

Depth of Discharge (DOD): Capacity removed from the battery compared to total capacity. It is expressed as a percentage.

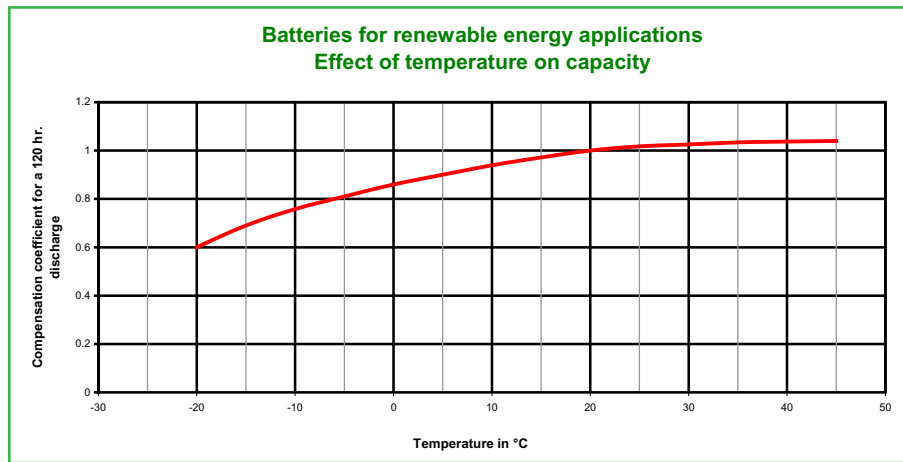
Daily cycle: The battery is normally used with a daily cycle as follows: Charge during the day hours and discharge during night hours.

Typically daily use is between 2 to 20% DOD.

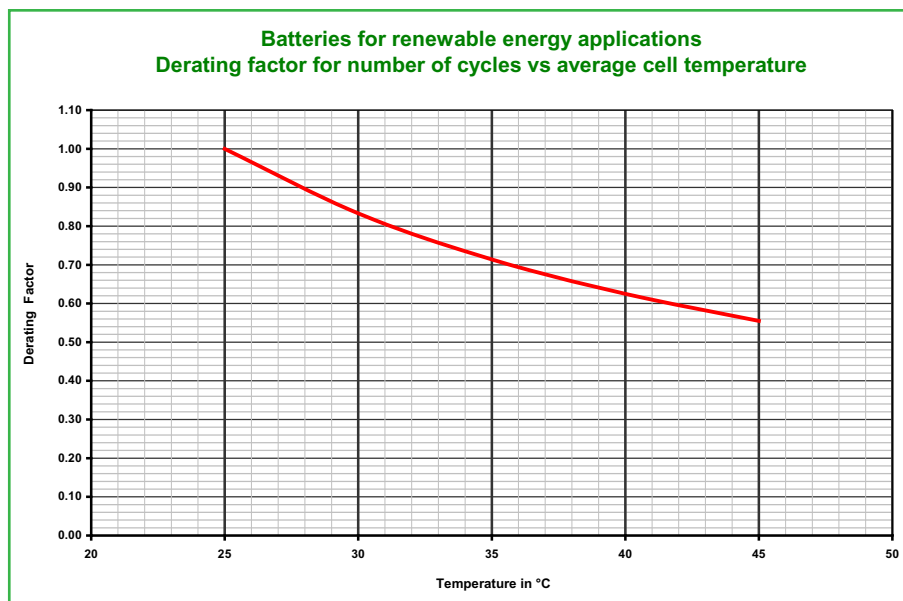
Effect of Temperature

On capacity: Correction factors of the capacity, according to the temperature are shown in the curve below.

If the temperature is other than 25°C, the correction factors must be applied to the installation rating in order to secure an optimum service life.



On the number of cycles: A rise in temperature brings about a decrease in the number of cycles (see below).



Charge Efficiency

The charge efficiency is the ratio between the quantity of Ah delivered during the discharge and the quantity of Ah necessary to restore the initial state of charge.

State of Charge (SOC)	Ah Efficiency
90	> 85
75	> 90
<50	> 95

1 GENERAL OPERATING INSTRUCTIONS

1.1 Operating Temperature Range

The recommended operating temperature range for PowerSafe® OPzV technology is -15°C to 40°C (Humidity <90%). Optimum life and performance is attained at +25°C. All technical data relates to the rated temperature of +25°C.

1.2 Storage

Store the battery at a dry, clean and preferably cold and frost-free location. Do not expose the cells to direct sunlight, otherwise defects on container and cover may occur.

Limit values for storage conditions: Temperature range of -20°C to +45°C, Humidity <90%

The self-discharge rate of OPzV batteries is a function of the temperature.

Temperature	25°C	30°C	40°C
Monthly self-discharge rate	3%	4%	8%

PowerSafe® OPzV technology has a shelf life of 5 months when stored at 25°C. Higher temperatures increase the rate of self discharge and therefore reduce storage life.

This table gives the **maximum** storage period before refresh, at the given average storage ambient temperature:

Average storage ambient temperature	Maximum storage time
20°C	6 months
25°C	5 months
30°C	4 months
40°C	2 months

The table hereafter gives an indication of the state of charge of the cells from a reading of the open circuit voltage. Batteries must typically be recharged when they fall to ~75% state of charge.

State of charge	Voltage
100%	2.13 Vpc
70%	2.09 Vpc
50%	2.06 Vpc
20%	2.02 Vpc

PowerSafe® OPzV batteries must be given a refreshing charge:

- a. when maximum storage time is reached, or
- b. when the open circuit voltage (OCV) approaches 2.10Volts/cell whichever occurs first

1.3 Freshening Charge

The refresh charge should be conducted using constant voltage (adjusted to the temperature) eg. 2.25Vpc at 20-25°C with 0.1 C₁₀ Amps current limit for a minimum period of 96h.

1.4 Commissioning Installation & ventilation

The electrical protective measures and the accommodation and ventilation of the battery installation must be in accordance with the applicable “local” national standards, rules and regulations.
Low ventilation requirement according to EN 50272-2.

The battery should be installed in a clean, dry area.

Avoid placing the battery in a hot place or in front of a window (no direct sunlight). Battery racks are recommended for proper installation. Place the cells on the rack and arrange the positive and the negative terminals for connection according the wiring diagram.

Check that all contact surfaces are clean. Tighten terminal screws, taking care to use the correct torque loading (Tab.1). Fit the covers supplied for protection against direct contact.

Terminal screw	Torque
M10	23 - 25 Nm

Follow the polarity to avoid short circuiting of cell groups. A loose connector can cause trouble in adjusting the system, erratic battery performance, and possible damage to the battery and/or personal injury.

Commissioning

The initial charge is extremely important as it will condition the battery service life. So the battery must be fully recharged to ensure that it is in an optimum state of charge.

Case 1: Using a constant voltage charger. Cells here will need to be recharged at a constant voltage of between 2.35 and 2.40 Vpc at 25°C for a minimum of 48h and a maximum of 72h with a current limited to 0.10C₁₀.

Case 2: With no external source available for recharging. Connect the battery to the solar panel regulator and leave at rest for 1 to 2 weeks. For this charge, set the regulator to the following values:

	T°C	Voltage
Low charge-restart voltage	0 to 20°C	2.30V
	20 to 40°C	2.30V
High charge-disconnect voltage	0 to 20°C	2.50V
	20 to 40°C	2.45V

End-of-charge reading

The battery is charged once open-circuit voltage (OCV) readings after 24h of rest are in conformity with the values shown on the above table. Each cell must register less than a 2% divergence from the average OCV reading.

1.5 Disposal

Lead acid PowerSafe® OPzV batteries are recyclable. End of life batteries must be packaged and transported according to prevailing transportation rules and regulations. End of life batteries must be disposed of in compliance with local and national laws by a licensed battery recycler.

1.6 Products Covered by this Guide

General Specifications

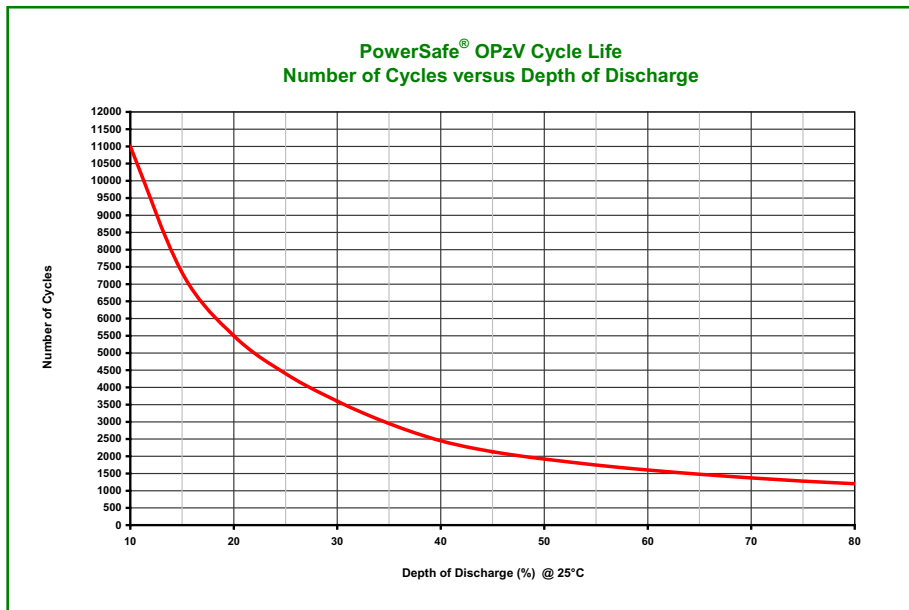
	Nominal Voltage (V)	Number of Terminals	Nominal Capacity (Ah)		Nominal Dimensions						Typical Weight		Short Circuit Current (A)	Internal Resistance (mΩ)
			10 hr rate to 1.80Vpc @20°C	120 hr rate to 1.85Vpc @25°C	Length		Width		Height		kg	lbs		
					mm	in	mm	in	mm	in				
4 OPzV 200	2	2	215	273	103	4.06	206	8.12	403	15.88	19.5	43	2195	0.95
5 OPzV 250	2	2	265	343	124	4.89	206	8.12	403	15.88	23.5	51.9	2737	0.76
6 OPzV 300	2	2	320	413	145	5.71	206	8.12	403	15.88	28.0	61.8	3175	0.66
5 OPzV 350	2	2	385	484	124	4.89	206	8.12	520	20.49	31.0	68.4	3410	0.61
6 OPzV 420	2	2	465	574	145	5.71	206	8.12	520	20.49	36.5	80.5	4043	0.51
7 OPzV 490	2	2	540	678	166	6.54	206	8.12	520	20.49	42.0	92.6	4607	0.45
6 OPzV 600	2	2	705	895	145	5.71	206	8.12	695	27.38	50.0	110.3	3796	0.55
8 OPzV 800	2	4	940	1187	210	8.27	191	7.53	695	27.38	68.0	150	5200	0.40
10 OPzV 1000	2	4	1170	1491	210	8.27	233	9.18	695	27.38	82.0	180.8	6460	0.32
12 OPzV 1200	2	4	1410	1796	210	8.27	275	10.84	695	27.38	97.0	213.9	7675	0.27
12 OPzV 1500	2	4	1580	1967	210	8.27	275	10.84	845	33.29	120.0	264.6	7510	0.28
16 OPzV 2000	2	6	2110	2629	212	8.35	397	15.64	820	32.31	165.0	363.8	10048	0.21
20 OPzV 2500	2	8	2640	3272	212	8.35	487	19.19	820	32.31	200.0	441	12606	0.17
24 OPzV 3000	2	8	3170	3932	212	8.35	576	22.69	820	32.31	240.0	529.2	14964	0.14

Notes: The electrical values shown in the table relate to performance from a fully charged condition at ambient temperature of +25°C. Height shown is overall height, including connectors and shrouds.

2 CYCLIC OPERATION

2.1 Cyclic Performance

The graph below shows cycling capability of PowerSafe® OPzV products:



2.2 Discharging

As a rule, installations will be equipped with a regulator whose voltage threshold values will protect against deep discharge:

	Discharge		
	10h	120h	240h
Low voltage alarm per cell	1.92	1.92V	1.95V
Disconnect voltage per cell	1.80	1.85V	1.90V

2.3 Setting Charging Voltages

In order to ensure optimum recharge, the following setting charge disconnect and restart voltages can be applied:

	Temperature			
	-20 to 0°C	0 to 20°C	20 to 35°C	> 35°C
Low recharge-restart voltage (Vpc)	2.35V	2.30V	2.30V	2.25V
High recharge-disconnect voltage (Vpc)	2.55V	2.45V	2.40V	2.35V

3 SERVICE LIFE

Under normal operating conditions, the battery lifetime largely depends on the temperature and depths of discharge.

Influence of temperature

See curve page 3.

Example of an Powersafe® OPzV battery cycling with 20% daily:

Average temperature of cells	Number of cycles at 25°C	Compensation coefficient	Estimated average number of cycles at average temperature
25°C	5500	1	5500
30°C	5500	0.83	4565
35°C	5500	0.71	3905

Influence of depth of discharge

See curve (item 2.1), relative to number of cycles according to DOD at 25°C.

Example of an PowerSafe® OPzV battery at 25°C:

Daily depth of discharge	Number of cycles at 25°C	Compensation coefficient
15	7333	> 18 years
20	5500	>15 years

4 MAINTENANCE CHECKS DATA RECORDING

PowerSafe® OPzV cell are VRLA batteries and do not have to be topped up.

- Do not open the valve. Opening could cause lasting damage to the battery and is prohibited.
- The containers and lids should be kept dry and free from dust. Cleaning must be undertaken with a dampened cotton cloth without additives and without manmade fibres or addition of cleaning agents, never use abrasives or solvents. Avoid electrostatic charging.
- Every 6 months, check total voltage at battery terminals and battery room temperature.
- Keep a logbook in which the measured values can be noted as well as time and date of each event like discharge tests etc.

**“We shall be the best in the industry by being
easy to do business with, while supplying
the highest quality products and services
on time and in the most cost-effective manner.”**

PowerSafe[®]
OPzV

www.enersys-emea.com

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