PowerSafe® OPzV

OPERATION GUIDE FOR HYBRID APPLICATIONS

EnerSys®
Power/Full Solutions

RESERVE
POWER

Hybrid Application - Definition

For the understanding of this guide, a "Hybrid" application is characterised as one where the battery is continuously charged and discharged in a controlled cycle.

A typical example would be:-
- A 12 hour cycle where both the load is supplied and the battery is recharged by a generator,
- Followed by: 12 hours without generator power, where the battery supplies the load.

1. General Operating Instructions

1.1 Operating Temperature Range
The recommended operating temperature range for PowerSafe OPzV technology in hybrid applications is -10°C to +35°C. Optimum life and performance are achieved at +20°C.

In hybrid applications it is important that the maximum battery temperature does not exceed +35°C and that the lifetime average temperature does not exceed +30°C.

1.2 Storage
PowerSafe OPzV technology has a shelf life of 6 months when stored at +20°C. Higher temperatures increase the rate of self-discharge and reduce storage life.

Figure 1 gives the relationship between storage time, open circuit voltage (OCV) and state of charge as a function of temperature.

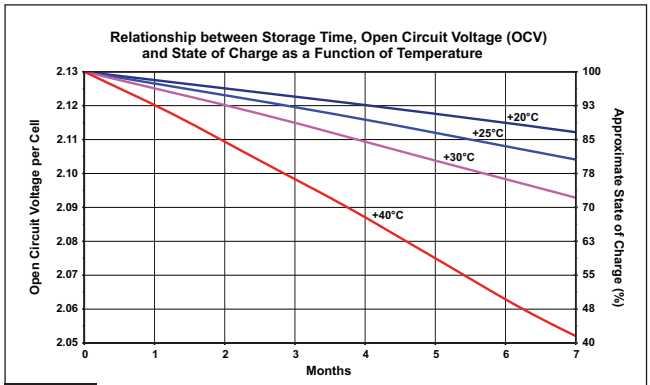


Figure 1

1.3 Freshening Charge
PowerSafe OPzV batteries must be given a refreshing charge:
(a) When the maximum storage time is reached or
(b) When the OCV approaches 2.10Volts/cell, whichever occurs first.

The refreshing charge should be conducted using constant voltage (adjusted to the temperature) e.g. 2.25Vpc at 20°C with 0.4 - 1.0 C_{10}Amps current limit for a minimum period of 96 hours. Alternatively, a refresh charge can be conducted using an applied constant voltage of 2.40 volts/cell for 24-48h maximum.

The maximum storage times between refresh charge and recommended OCV audit frequency is given in the table below.

Temperature (°C / °F)	Storage Time (Months)	OCV Audit Interval (Months)
+20 / +68	6	2
+30 / +86	3	1
+40 / +104	2	0.5

1.4 Commissioning
Prior to commencement of cyclic duty, the battery must be given a commissioning recharge. This shall consist of an applied constant voltage equivalent to 2.40 Volts/cell for a period of 24 hours.

1.5 Current Limit
The current limit range should be between 0.1 to 1.0C_{10}A.

1.6 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.

2. Cyclic Operation

2.1 Cyclic Performance
PowerSafe OPzV technology in hybrid application with daily cycle needs to be recharged at 2.40Vpc (at 20°C). This voltage should not be maintained continuously for more than 24h.

The preferred recharge regime returns OPzV technology to full state of charge prior to commencement of the next discharge cycle. Operating at partial state of charge will be considered on a case by case basis but caution is advised with this type of regime as the available cycle life (compared to full state of charge) will be reduced.

Figure 2 shows the cyclic capability of PowerSafe OPzV products.

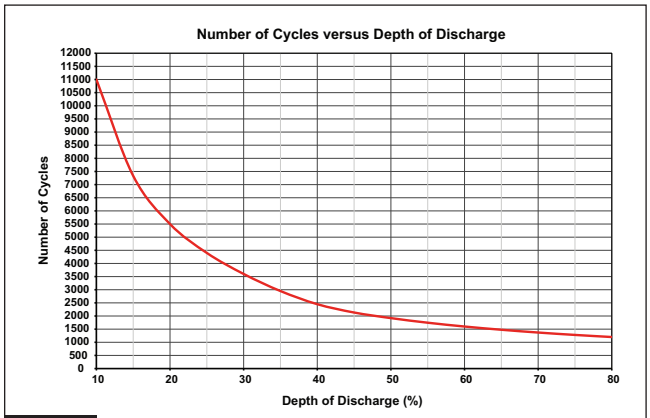


Figure 2

Operating at temperatures >+20°C will reduce the available number of cycles. Figure 3 illustrates the effect of derating as a function of temperature.

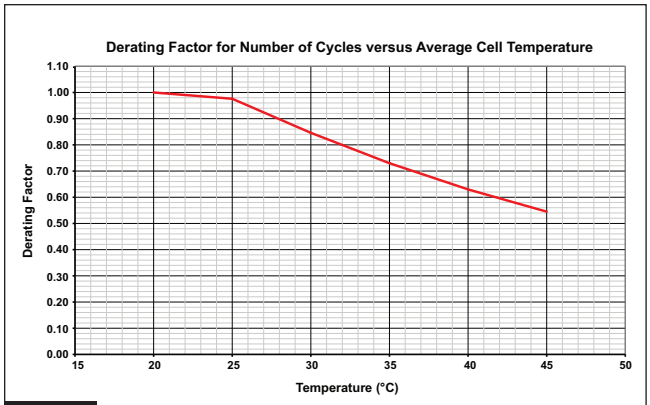


Figure 3

2.2 Discharging
In order to correctly control the depth of discharge during the discharge phase, it is necessary to count the discharged Ah with an instrument capable of +/-1% accuracy across the full range of anticipated discharge currents in service.

Although published tables of discharge characteristics show end voltages down to 1.60 volts per cell, the voltage values shown in figure 4 are recommended as the end of discharge voltage relative to discharge rate, in order to avoid any over-discharge of the battery.

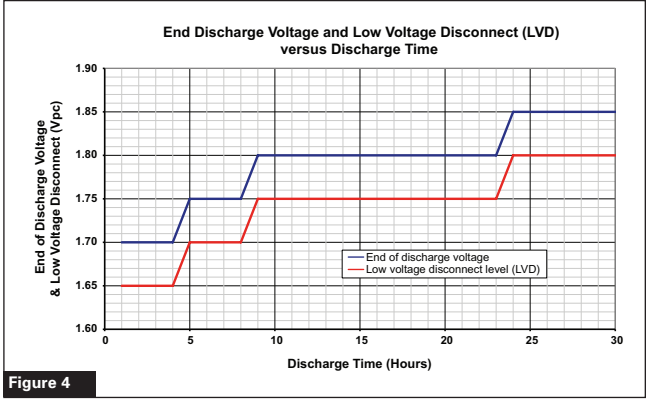


Figure 4

The low voltage disconnect level ("LVD") should be set to 50mV per cell below the recommended end discharge voltage.

2.3 Recharge

Optimum cycle life is obtained when the recharge cycle is carefully controlled. Guidelines for time to full state of charge as a function of depth of discharge and charge current are given in figure 5.

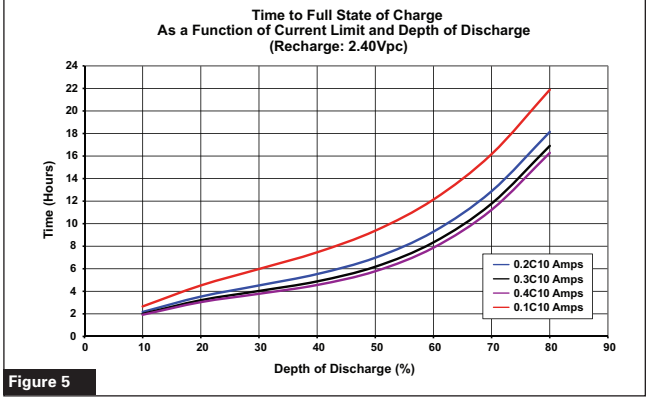


Figure 5

Alternatively, as a simplified control measure, the battery should be charged until rectifiers reach voltage limit, plus an additional 9.5 hours.

2.4 Recharge Voltage

The time to reach full state of charge is also a function of temperature. Temperature compensation for charge voltage should be applied at the rates shown below and in figure 6.

Temperature (°C)	Charge Voltage (Vpc)
0	2.45
+10	2.43
+20	2.40
+30	2.37
+35	2.35

Where the rectifier voltage cannot be adjusted to values >2.40volts/cell to compensate for temperatures below 20°C, the time to full state of charge will be increased. For additional information and guidance on this, please contact your EnerSys® representative.

Important Note:

The 2.40Vpc recharge must NEVER be applied for more than 24 hours continuously. This will cause a severe reduction in battery life and cyclic performance.

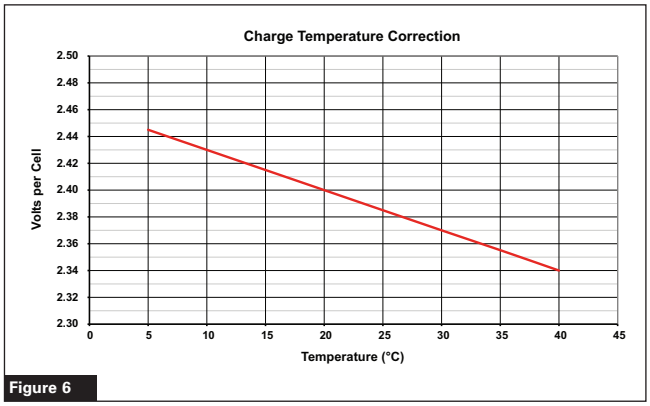


Figure 6

2.5 Data Recording

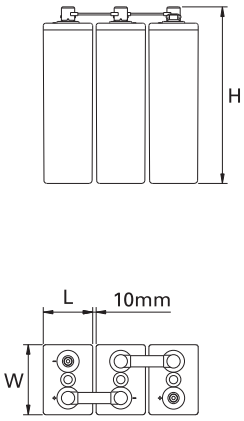
In order for any warranty claim to be valid, the user must provide by means of regular data logging the following information.

Start of Discharge	Date & time Battery voltage Battery temperature
Discharge	Ah+ reinjected during discharge (e.g. from wind or solar) Over-discharge time (time when battery operates below 1.80Vpc) Average temperature Minimum battery voltage Maximum current
End of Discharge	Date & time Battery temperature "Discharge Time, Ah"
Start of Charge	Date & time Start of charge current Battery temperature
Charge	Average temperature Minimum/maximum current Charge voltage
End of Charge/ After Charge (Equalization)	Date & time Battery voltage End of charge current Battery temperature "Charge time, Ah & Energy"
Cycle Data	Time with temperature <10°C Time with temperature between 40°C & 45°C Time with temperature between 45°C & 50°C Time with temperature between 50°C & 55°C Time with temperature >55°C

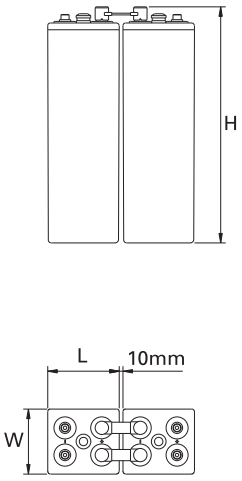
3. General Specifications

PowerSafe® OPzV Cell Types	Nominal Voltage (V)	Terminal Pairs	Nominal Capacity (Ah) 10 hr rate to 1.80Vpc @ 20°C	Nominal Capacity (Ah) 8 hr rate to 1.75Vpc @ 77°F	Nominal Dimensions (mm) Length	Nominal Dimensions (mm) Width	Nominal Dimensions (mm) Height	Typical Weight (kg)	Short Circuit Current (A)	Internal Resistance (mΩ)
4 OPzV 200	2	1	215	215	103	206	403	19.5	2195	0.95
5 OPzV 250	2	1	265	265	124	206	403	23.5	2737	0.76
6 OPzV 300	2	1	320	320	145	206	403	28.0	3175	0.66
5 OPzV 350	2	1	385	385	124	206	520	31.0	3410	0.61
6 OPzV 420	2	1	465	465	145	206	520	36.5	4043	0.51
7 OPzV 490	2	1	540	540	166	206	520	42.0	4607	0.45
6 OPzV 600	2	1	705	705	145	206	695	50.0	3796	0.55
8 OPzV 800	2	2	940	940	210	191	695	68.0	5200	0.40
10 OPzV 1000	2	2	1170	1170	210	233	695	82.0	6460	0.32
12 OPzV 1200	2	2	1410	1410	210	275	695	97.0	7675	0.27
12 OPzV 1500	2	2	1600	1600	210	275	845	120.0	7510	0.28
16 OPzV 2000	2	3	2110	2110	212	397	820	165.0	10048	0.21
20 OPzV 2500	2	4	2640	2640	212	487	820	200.0	12606	0.17
24 OPzV 3000	2	4	3170	3170	212	576	820	240.0	14964	0.14

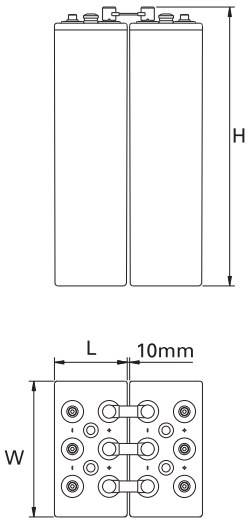
Notes:
The electrical values shown in the table relate to loadings from a fully charged condition at ambient temperature of +20°C.
Height shown is overall height, including connectors and shrouds.



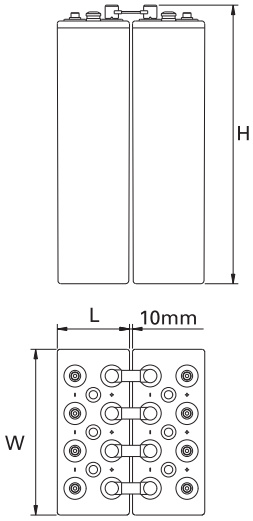
4 OPzV 200 - 6 OPzV 600



8 OPzV 800 - 12 OPzV 1500



16 OPzV 2000



20 OPzV 2500 - 24 OPzV 3000

EnerSys
Power/Full Solutions

EnerSys
2366 Bernville Road
Reading, PA 19605
USA
Tel: +1-610-208-1991
+1-800-538-3627
Fax: +1-610-372-8613

EnerSys EMEA
EH Europe GmbH
Löwenstrasse 32
8001 Zurich
Switzerland

EnerSys Asia
152 Beach Road
Gateway East Building
Level 11
189721 Singapore
Tel: +65 6508 1780

Contact:

www.enersys-emea.com

© 2012 EnerSys®. All rights reserved.
Trademarks and logos are the property of EnerSys® and its affiliates unless otherwise noted.

Publication No: EN-OPzV-OGH-003 - December 2012 - Subject to revisions without prior notice. E.&O.E.