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 12 months when stored at +20°C (6 months at +30°C). Higher temperatures increase the rate of self-discharge and reduce storage life.

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 2.07Volts/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 2.40Vpc at 20-25°C 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	12	6
+30 / +86	6	3
+40 / +104	3	1.5

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.

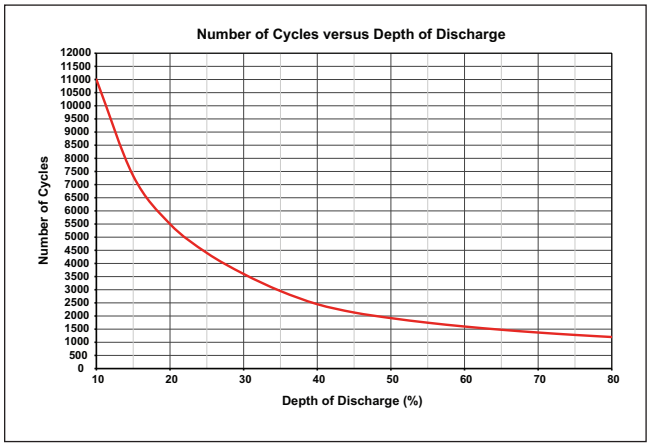
2. Cyclic Operation

2.1 Cyclic Performance

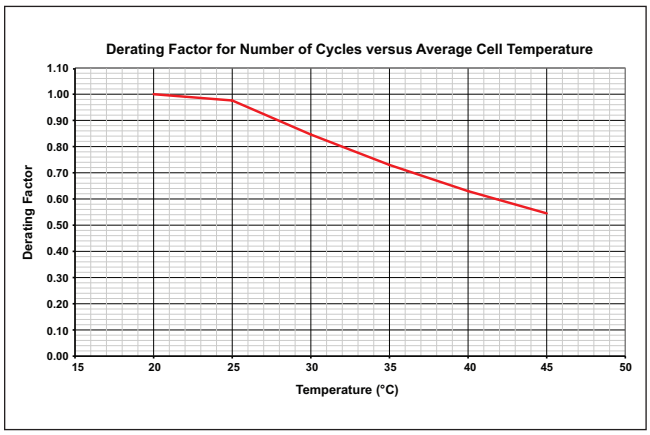
PowerSafe OPzV technology in hybrid application with daily cycle needs to be recharged at 2.40Vpc (at 20°C). This voltage should not be maintained continuously for more than 24h.

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.

The graph below shows the cyclic capability of PowerSafe OPzV products.



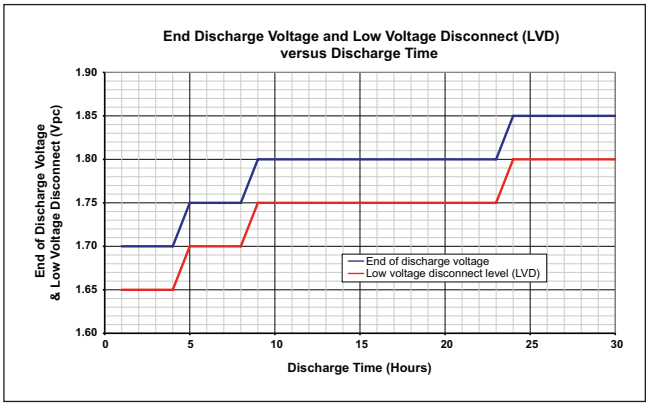
Operating at temperatures >+20°C will reduce the available number of cycles. The graph below illustrates the effect of derating as a function of temperature.



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.

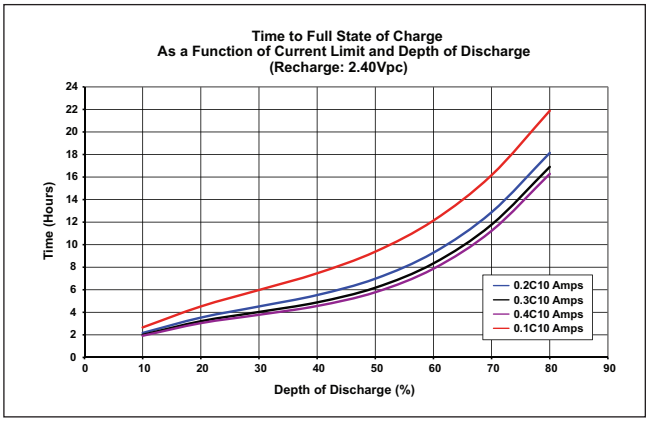
Although published tables of discharge characteristics show end voltages down to 1.60 volts per cell, the voltage values shown in the next graph are recommended as the end of discharge voltage relative to discharge rate, in order to avoid any over-discharge of the battery.



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 the graph below.



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

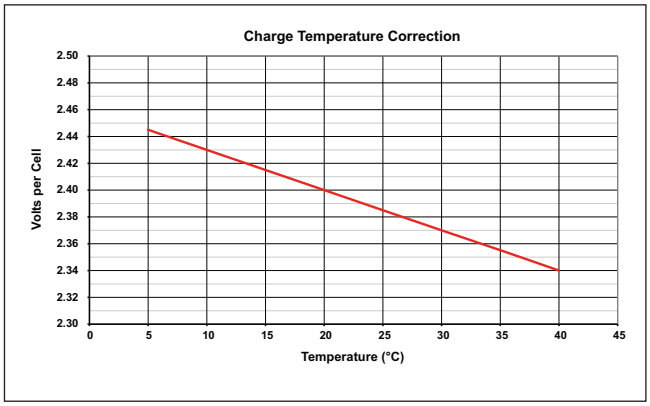
The time to reach full state of charge is also a function of temperature. Temperature compensation for charge voltage should be applied at the rates shown below and in the graph hereafter.

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.



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 <10ºC Time with temperature between 40ºC & 45ºC Time with temperature between 45ºC & 50ºC Time with temperature between 50ºC & 55ºC Time with temperature >55ºC

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