PowerSafe OPzV

Operation Guide For Hybrid Applications

DESCRIPTION OF A HYBRID POWER SYSTEM

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 supplied the load.

In this application, cyclic control is required to ensure that the battery achieves its 12 hour discharge, and is fully recharged by the generator in 12 hours, ready for the next discharge.

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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 is attained at +20°C.
In hybrid applications it is important that the maximum short term battery temperature does not exceed +35°C and that the lifetime average temperature does not exceed +30°C.

1.2. Storage

OPzV technology has a shelf life of 6 months when stored at 20°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:

6 months at 20°C
4 months at 30°C
2 months at 40°C

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%	2.13V/cell
70%	2.09V/cell
50%	2.06V/cell
20%	2.02 V/cell

OPzV batteries must be given a refreshing charge:
(a) when maximum storage time is reached
or
(b) when the 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°C with 0.4 C10Amps current limit for a minimum period of 96h.

1.4. Charge Current Limit

Limitation of the charging current is not required under float charge condition at 2.25Vpc. At higher charge voltages. The charge current shall be limited to 0.4C10.

1.5. Disposal

Lead acid 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

Type	Nominal Capacity (Ah)	
	10 hr rate to 1.80Vpc @ 20°C	8 hr rate to 1.75Vpc @ 77°F
4 OPzV 200	215	215
5 OPzV 250	265	265
6 OPzV 300	320	320
5 OPzV 350	385	385
6 OPzV 420	465	465
7 OPzV 490	540	540
6 OPzV 600	705	705
8 OPzV 800	940	940
10 OPzV 1000	1170	1170
12 OPzV 1200	1410	1410
12 OPzV 1500	1580	1580
16 OPzV 2000	2110	2110
20 OPzV 2500	2640	2640
24 OPzV 3000	3170	3170

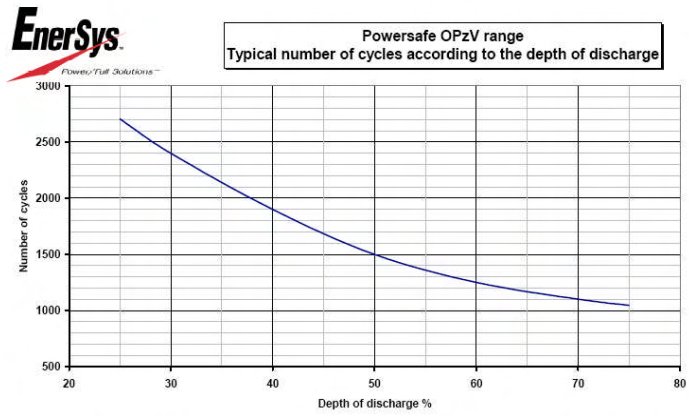
2. CYCLIC OPERATION

2.1. Cyclic Performance

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 more than 24h.

OPzV technology must be returned to full state of charge using EnerSys recommended charge regime options prior to commencement of the next discharge cycle. Operating at partial state of charge will significantly reduce the cycle life obtained.

The graph below show cycling capability of OPzV products:



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

Discharge Time (t)	End voltage (volt)
1 h < t < 5 h	1.70 V
5 h < t < 8 h	1.75 V
8 h < t < 24 h	1.80 V

The low voltage disconnect level (“LVD”) is recommended to be set at 50mV per cell below the above figures.

2.3. Recharge In Cycling Application

In order to achieve long life, performance and reliability, as well as the expected cycle life, it is important that the recharge cycle is carefully controlled. In order to ensure full recharge, without excessive damaging over-charge, the following rule can be applied:

"The batteries should be charged until the time where the rectifiers "exit" current limit, plus an additional 9.5 hours” (see graph page 4 for further details).

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.

0°C	2.45Vpc
+10°C	2.43Vpc
+20°C	2.40Vpc
+30°C	2.37Vpc
+35°C	2.35Vpc

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:

When controlled recharge phase is finished, and if the next discharge cycle is not immediately started, then either:-
a) the recharge voltage must be reduced to the recommended float voltage (2.25Vpc at 20°C)
or
b) the battery must be disconnected from the charger.

The 2.4Vpc recharge must NEVER be applied continuously for more than 24 hours. This will cause a severe reduction in battery life and cyclic performance.

2.5. Recharge Current

The available recharge current should be in the range 0.2C10 - 0.4C10 Amps. For example, for 10 OPzV 1000, C10 =1170 Ah, therefore recharge current must be in the range 235 - 470 Amps. Consult your EnerSys representative for advice regarding cyclic application battery recharge at lower currents.

2.6. Data Recording

In order for the warranty to be valid, the user must provide, by means of routine regular data logging, the following data:

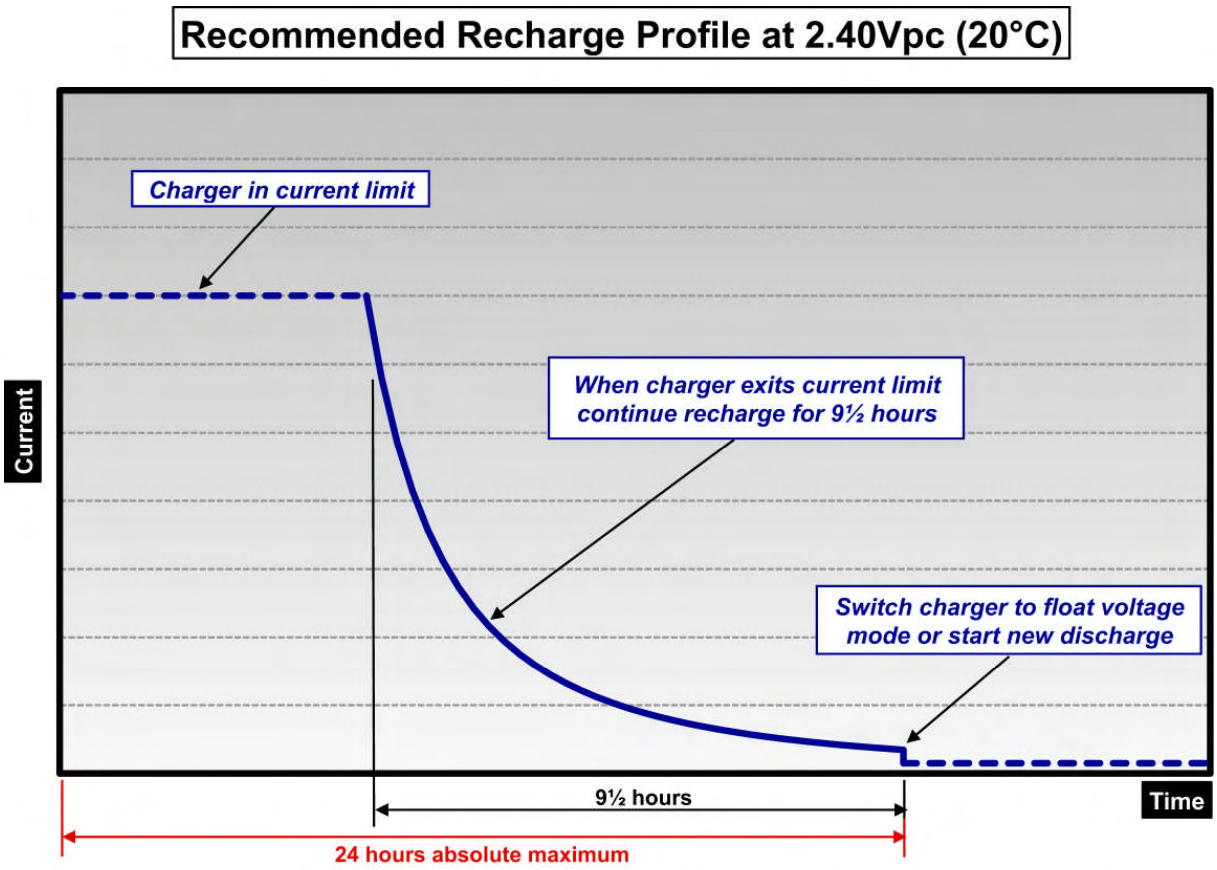
a. The number of cycles performed and the depth of discharge ("dod") of each cycle.

b. The duration of each discharge and charge cycle and the Ah in and out.

c. Full details of the recharge voltage/current profile for the last 50 cycles.

d. A full history of the ambient and battery surface temperatures, recorded at regular intervals throughout battery operation and life.

e. The time and date of each "event" (an "event" is defined as the start /stop of the battery discharge, the start/stop of the battery recharge, the start stop of any generator input power or other input power source, etc).



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