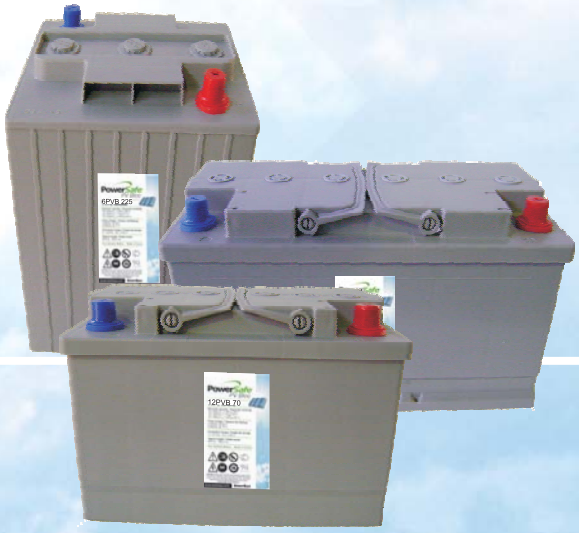
PowerSafe®

Sustainable solutions



PowerSafe® PV Bloc

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
PV Bloc 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)
- **Cycling in state of discharge**
- **Low rate of self-discharge**
- **No addition of water required during service life**

PowerSafe® PV Blocs 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® PV Bloc cells consist of:

- Positive flat plates with Lead-Calcium-Tin alloy
- Low resistance mircoporous separator
- Electrolyte immobilised as a gel
- Pressure Relief Valve - One way valve with intergral flame arrestor
- Polypropylen lid and container
- Automotive type terminals

Features & Benefits

- **Excellent deep discharge recovery and cyclability**
- **Up to 800 Cycles to 50% depth of discharge**
- **Vertical installation only**
- **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 12PVB70 bloc are as follows:

Discharge time	10 h	120h
End voltage	1.80Vpc	1.85Vpc
Temperature	20°C	25°C
Capacity	57Ah	70Ah

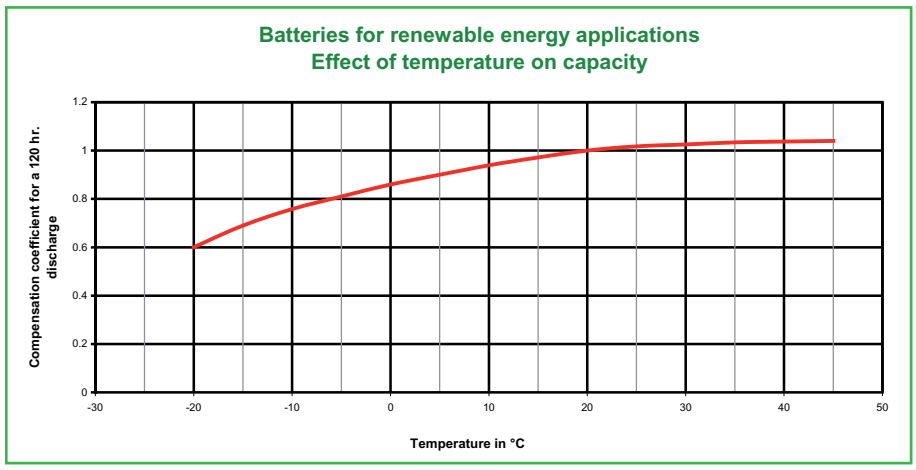
The nominal capacity of PowerSafe® PV blocs for renewable energy applications is given as follows:

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

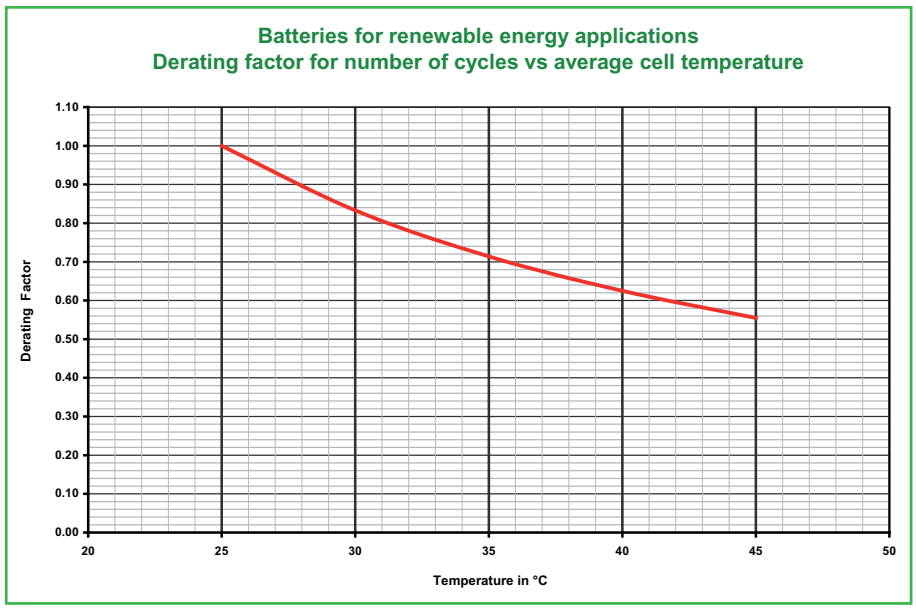
Discharge Rate: Is the ratio of discharge current divided by battery capacity
Depth of Discharge (DOD): Capacity removed from the battery compared to total capacity. It is expressed as a percentage.
Daily cycle: The battery is normally used with a daily cycle as follows: Charge during the day hours and 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® PV Bloc 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.

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

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

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

PowerSafe® PV Bloc 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
20ºC	6 months
25ºC	5 months
30ºC	4 months
40ºC	2 months

The table hereafter gives an indication of the state of charge of the cells from a reading of the open circuit voltage (OCV). PowerSafe® PV Bloc must typically be recharged when they fall to ~75% state of charge.

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

* (Multiply thess voltage by 3 for 6V bloc and by 6 for 12V bloc)

PowerSafe® PV Bloc 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. 2.27Vpc at 20-25°C with 0.1 C_{10} 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.

Check that all terminals contact surfaces are clean. Connect PV bloc with dedicated connectors following the wiring circuit.

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 0.10C_{10}.

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 per cell
Low charge-restart voltage	0 to 20ºC	2.30V
	20 to 40ºC	2.30V
High charge-disconnect voltage	0 to 20ºC	2.50V
	20 to 40ºC	2.45V

End-of-charge

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® PV Bloc 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

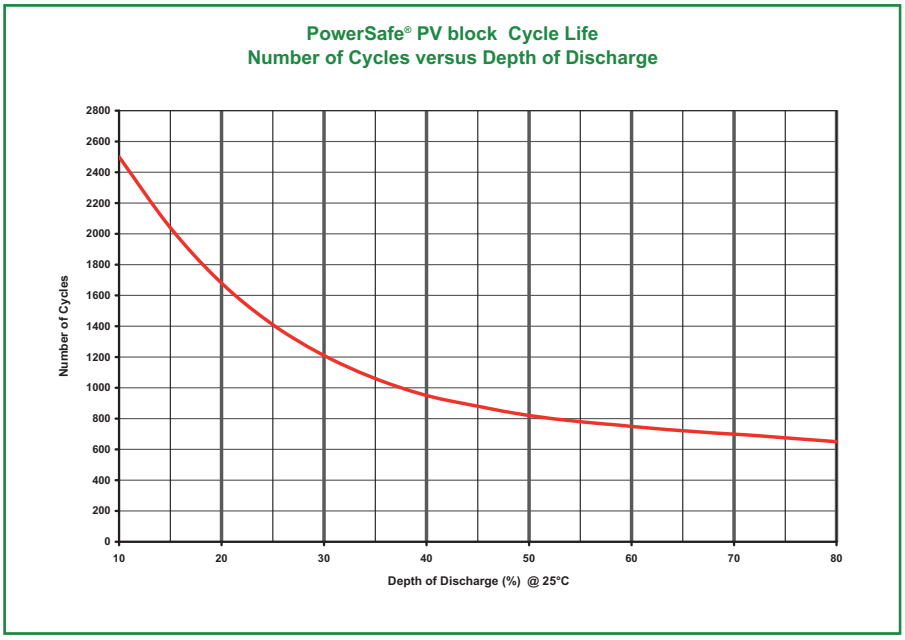
		Nominal Capacity (Ah)		Nominal Dimensions									
Type	Nominal Voltage (V)	10 hr rate to 1.80Vpc @20°C	120 hr rate to 1.85Vpc @25°C	Length mm	in	Width mm	in	Height mm	in	Typical Weight kg	lbs	Short Circuit Current (A)	Internal Resistance (mΩ)
12 PVB 70	12	57	70	277	10.9	175	6.9	189	7.4	21.0	46.0	1517	8.07
12 PVB 91	12	75	91	354	13.9	175	6.9	189	7.4	25.0	55.1	1700	7.29
12PVB 121	12	109	121	344	13.5	172	6.8	276	10.9	38.0	83.7	1865	6.62
6 PVB 225	6	195	225	244	9.6	190	10.6	270	10.6	31.0	68.3	2048	3.11

Notes: The electrical values shown in the table relate to perfomance 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® PV Bloc 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 MAINTENANCE CHECKS DATA RECORDING

PowerSafe® PV blocs 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 damped 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® PV Bloc

www.enersys-emea.com

Publication No. EN-PS-PV Bloc OG-001 - August 2011 - Subject to revisions without prior notice. E. & O.E.

EnerSys®
Power/Full Solutions
www.enersys.com

Global & Americas Headquarters

EnerSys
P.O. Box 14145
Reading
Pennsylvania 19612-4145
USA
Tel. +1-610-208-1991
Fax +1 610-372-8457

Regional Headquarters

EnerSys Europe (EMEA)
Löwenstrasse 32
8001 Zürich
Switzerland
www.enersys-emea.com

EnerSys Asia
152 Beach Road
Gateway East Building
Level 11
189721 Singapore
Tel: +65 6508 1780
Fax +65 6292 4380

Please refer to the website address for details of your nearest EnerSys office: www.enersys-emea.com