OutBack POWER™

member of The alpha Group™

EnergyCell OPzV Batteries

User's Manual

About OutBack Power Technologies

OutBack Power Technologies is a leader in advanced energy conversion technology. Our products include true sine wave inverters/chargers, maximum power point tracking charge controllers, and system communication components, as well as circuit breakers, accessories, and assembled systems.

Contact Information

Address:	Corporate Headquarters 17825 - 59th Avenue N.E. Suite B Arlington, WA 98223 USA	European Office Hansastrasse 8 D-91126 Schwabach, Germany
Telephone:	+1.360.435.6030 +1.360.618.4363 (Technical Support) +1.360.435.6019 (Fax)	+49.9122.79889.0 +49.9122.79889.21 (Fax)
Email:	Support@outbackpower.com	
Website:	http://www.outbackpower.com	

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Important Safety Instructions

READ AND SAVE THESE INSTRUCTIONS!

This manual contains important safety instructions for the EnergyCell OPzV battery. These instructions are in addition to the safety instructions published for use with all OutBack products. Read all instructions and cautionary markings on the EnergyCell OPzV battery and on any accessories or additional equipment included in the installation. Failure to follow these instructions could result in severe shock or possible electrocution. Use extreme caution at all times to prevent accidents.

WARNING: Personal Injury

- Some batteries can weigh in excess of 100lb (45kg). Use safe lifting techniques when lifting this equipment as prescribed by the Occupational Safety and Health Association (OSHA) or other local codes. Lifting machinery may be recommended as necessary.
- Wear appropriate protective equipment when working with batteries, including eye or face protection, acid-resistant gloves, an apron, and other items.
- Wash hands after any contact with the lead terminals or battery electrolyte.

WARNING: Explosion, Electrocution, or Fire Hazard

- Ensure clearance requirements are strictly enforced around the batteries.
- Ensure the area around the batteries is well ventilated and clean of debris.
- Never smoke or allow a spark or flame near the batteries.
- Always use insulated tools. Avoid dropping tools onto batteries or other electrical parts.
- Keep plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
- Wear complete eye and clothing protection when working with batteries. Avoid touching bare skin or eyes while working near batteries.
- If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye, immediately flood it with running cold water for at least 20 minutes and get medical attention as soon as possible.
- Never charge a frozen battery.
- Insulate batteries as appropriate against freezing temperatures. A discharged battery will freeze more easily than a charged one.
- If a battery must be removed, always remove the grounded terminal from the battery first. Make sure all devices are de-energized or disconnected to avoid causing a spark.
- Do not perform any servicing other than that specified in the installation instructions unless qualified to do so.

Additional Resources

These references may be used when installing this equipment. Depending on the nature of the installation, it may be highly recommended to consult these resources.

Institute of Electrical and Electronics Engineers (IEEE) guidelines: IEEE 450, IEEE 484, IEEE 1184, IEEE 1187, IEEE 1188, IEEE 1189, IEEE 1491, IEEE 1578, IEEE 1635, and IEEE 1657 (various guidelines for design, installation, maintenance, monitoring, and safety of battery systems)

Delivery and Storage

Receiving Inspection

Inspect the shipment for missing components. Verify the contents with the packaging documents. Inspect each package or pallet for integrity and electrolyte leakage. Record the receipt date and the inspection results, and notify OutBack Power of any damage. Take photographs if necessary.

Storage

- » Store the batteries in a dry, clean, cool, and well ventilated location. Do not expose the cells to direct sunlight as damage to the container and cover may occur.
- » Do not stack one pallet above the other. Avoid storing unpacked cells / monoblocs on sharp-edged supports.
- » Storage on a pallet wrapped in plastic material is permitted except in rooms where the temperature fluctuates significantly, or if high relative humidity can cause condensation under the plastic cover. With time, this condensation can cause a whitish hydration on the poles and lead to high self-discharge by leakage current.
- » Protect the batteries from any risk of electric shock resulting from short-circuiting by a conductive object or from a building up of conductive dust.
- » It is recommended to have the same storage conditions within a batch, pallet or room.
- » As the batteries are supplied charged, storage time is limited. In order to easily charge the batteries after prolonged storage, it is advised not to store them more than 6 months at 20°C, 4 months at 30°C, 2 months at 40°C. A refreshing charge is needed after this period. Failure to observe these conditions may result in significantly reduced capacity and service life.
- » Record dates and conditions for all charges during storage.

Unpacking and Handling

- » Never lift cells by the terminal posts. Lifting cells with weight above 25kg has to be made with lifting belts. Never drag or roll the battery.
- » Do not apply force to the safety valve during handling.
- » The batteries are fully charged before shipment. Do not short-circuit the batteries.
- » Check for evidence of leakage. All cells with visible defects such as cracked jars, loose terminal posts, or other unrecoverable problems shall be rejected.

Installation

Room and Installation Design

Important:
All aspects of the installation must be in accordance with the applicable rules and governmental regulations of the local area.

- The battery should be installed in a clean, dry environment. Avoid placing the battery in a warm place or in direct sunlight. The location or arrangement of cells should result in no greater than a 3°C temperature differential between cells within a series-connected string at a given time. Avoid conditions that result in spot heating or cooling, as temperature variations will cause the battery to become electrically unbalanced.
- Ensure the installation allows adequate air flow around each cell or monobloc for better cooling. Keep 10mm distance between cells or blocks.
- The layout of the room must allow easy access to the batteries.
- Provide adequate space and illumination for inspection, maintenance, testing, and cell/battery replacement. Space should also be provided to allow for operation of lifting equipment and proper measurement (cell voltage and temperature).

Racks and Mechanical Stability

EnergyCell OPzV battery racking is recommended for proper installation. Calculations should be made to ensure that floor loading capabilities are not exceeded. Seismic forces must be considered when applicable. The installation should provide adequate structural support and be as free of vibration as possible.

Cells in Parallel Strings

Valve-regulated cells may be connected in parallel to give higher current capability. In the case of parallel connected strings, use batteries of the same capacity, design and age only with a maximum of 4 parallel strings. If more than 4 strings are required, consult a technical support representative at OutBack Power. The resistance of the cables in each string must be the same. In addition, each string should be equipped with disconnect capabilities for maintenance and safety purposes.

Preliminary Inspection

1. Check for evidence of leakage. All cells with visible defects such as cracked jars, loose terminal posts, or other unrecoverable problems should be rejected.
2. Before installation, if the surface of the battery container is dirty, wash the container with soapy water.
3. Conduct Open Circuit Voltage (OCV) measurements on each individual cell or monobloc battery to verify their compliance with the following variation and absolute voltage criteria:
   - The OCV must not deviate from average more than ±0.025V for 2V cells.
   - The OCV must not be lower than 2.05V for 2V cells.
4. Consult a technical support representative at OutBack Power if the battery compliance cannot be verified.

Installation

Electrical Connections

1. Ensure that the cells are wired with the correct polarity.
2. Verify that all contact surfaces are clean. If required, clean with a brass brush/pad. The inserts and connections can be lightly lubricated with silicone grease.
3. Torque the terminal screws to 22Nm.

Note:
For systems where the total battery voltage is measured at the controller, use oversized cables to the battery in order to minimize the voltage drop.

4. Electrical connections to the battery, as well as between cells on separate levels or racks, should be made to minimize mechanical strain on battery terminal posts.
5. Check the battery's total voltage. It should match the number of cells / monoblocs connected in series. If the measurement is not as expected, recheck the connections for proper polarity. Batteries with a nominal voltage > 75V require an EC conformity declaration in accordance with the low voltage directive (73/23/EEC), which confirms that the CE marking is applied to the battery. The company installing the battery is responsible for the declaration and applying the CE marking.
6. For future identification, apply individual cell/unit numbers in sequence starting from one end of the battery. Also apply identification numbers for the parallel strings.
7. Connect the battery to the DC power supply, with the charger switched off, battery fuses removed and the load disconnected, ensuring that the polarity is correct.

Instrumentation

For large installations, consider permanent instrumentation for measurements and alarm. These include voltmeter, amp-meter, Ah counter, high and low voltage indicators, ground fault detector(s) and temperature sensor(s) for the battery and the ambient air. For smaller installations use portable test equipment. The temperature sensors must be fixed on the battery units (side wall or negative pole).

Operation

Charging

Commissioning Charge

The initial charge is critical to future battery operation and the battery's service life. It is performed as a full charge (described in the next section). Keep the records in the battery's logbook.

Full Charge

The full charge is a prolonged charge at elevated voltage, performed under the supervision of the user. It lasts until certain full charge criteria are fulfilled but not outside certain minimum and maximum duration limits. It is used mainly as a commissioning charge after installation, a corrective equalizing charge, a preparation charge before a capacity test, or a refresh charge during long storage period

During charge, the battery temperature must be continuously monitored. If the battery temperature exceeds 45°C, the charge will be interrupted until the battery cools down.

Case 1) With external charger of IU - characteristic. For the commissioning charge the current must be limited to 1*I10 Amps.

Battery Temperature	Voltage Settings	Minimum and Maximum Charging Times	Full Charge Criteria
0 - 10°C	2.38 - 2.45V	48 - 72h	When the individual cell voltages have not risen for a period of 4 hours
15 - 30°C	2.35 - 2.40V	36 - 72h	
30 - 40°C	2.32 - 2.35V	24 - 48h	

Table 1, Case 1

Case 2) With external charger of IUI or I - characteristic. Using an IUI or I charger that can charge the battery with constant current at elevated voltage, higher than 2.60Vpc up to 2.80Vpc.

Bulk Charge Current Limitation	Voltage Settings for U-Phase	Gassing Charge Current Limitation	Minimum and Maximum Charging Times at Gassing Phase	Full Charge Criteria
2.0*I10	2.33 - 2.40V	0.12*I10 (1.2A per 100Ah Nominal Capacity)	5 - 8h	When the individual cell voltages have not risen for a period of 1 hour

Table 2, Case 2

Case 3) Using the solar controller. Connect the battery to the controller and leave it for 1-2 weeks while the application load is disconnected. Full charge criteria are not applicable here. Use the following voltage settings:

On-Off Controllers	-20 - 0°C	0 - 35°C	>35°C
High Disconnect Voltage (Vr)	2.55V	2.45V	2.40V
Low Restart Voltage (Vrr)	2.35V	2.30V	2.25V
Constant Voltage Controllers	-20 to 0°C	0 - 35°C	>35°C
Regulation Voltage (Vr)	2.45V	2.37V	2.33V

Table 3, Case 3

Equalizing

Functional Equalizing

During a cycling operation, the target is to achieve an almost complete recharge (100% state of charge) after every discharge cycle, otherwise a permanent capacity decrease will threaten the battery's service life. This is not always possible in stand-alone applications where the RES source depends on the weather conditions. A scheduled (functional) equalizing charge should be given at regular intervals to protect the battery from sulphation and lagging cells.

- Equalizing frequency is adjusted according to the charge deficit. The less complete the daily recharge is, the more frequent the equalizing is required.
- The charge duration is fixed.
- The voltage settings are the same values used for a normal recharge.

Corrective Equalizing

Equalizing charges are also required after incidents of excessive stress for the battery (deep discharges with inadequate charges) or when the individual cell or bloc voltages show excessive deviation from the average (lagging cells and sulphation problems). Should the voltage in individual cells/bloc deviate from the average value more than the following limits, perform an equalizing charge:

Battery State	2V Cells
Floating, after the first 6 months of operations	-0.1V / +0.2V
At end of normal charge, while the current is stable, after the first 6 months of operation	-0.2V / +0.35V
During discharge, while Depth-of-Discharge is between 5 and 20%	±0.04V
During discharge, while Depth-of-Discharge is between 20 and 60%	±0.06V
At rest, 24h after a functional equalizing charge	±0.025V

Table 4, Battery State Deviation

Corrective Equalizing is performed as a Full Charge

If the voltages are still out of the limits, contact an OutBack Power technical support representative.

Normal Operation Charging

The following charging voltage settings are optimum values, so the battery is not heavily undercharged or overcharged. A good indicator to check this, is the percent of overcharge per cycle (charging factor) within a long period of operation (a month to a year). Deviations from these charging factors signals the user to check the charging settings and the overall system operation:

- » >107% for Stand-alone systems with maximum daily depth-of-discharge less than 5%
- » 105% to 110% for Stand-alone systems with maximum daily depth-of-discharge more than 5%

Settings for Stand-Alone Systems

The settings shall be adjusted according to battery temperature. Temperatures are averaged over one month:

Controller Type	Setting	-20 - 0°C	0 - 15°C	15 - 35°C	>35°C
Constant Voltage One Step	Vr	2.50V	2.45V	2.40V	2.35V
Constant Voltage Two Steps	Absorption Maximum 2h per Day	2.55V	2.50V	2.45V	2.40V
	Float	2.45V	2.40V	2.35V	2.30V
On - Off	High Voltage (Vr)	2.55V	2.50V	2.45V	2.40V
	Low Voltage (Vrr)	2.35V	2.30V	2.30V	2.25V

Table 5, Settings for Stand-Alone Systems

For systems with oversized PV array and low maximum daily depth-of-discharge (<5%), use lower settings. Functional equalizing charges are required in periods with marginal "Array to Load ratio" (less than 1.3). Typical frequency is 1 to 6 times per year.

Absorption Time	4 - 6h	6 - 8h	8 - 10h	10 - 12h
Equalizing Every	7 Cycles	14 Cycles	21 Cycles	28 Cycles
If One Cycle = One Day	One Week	Two Weeks	Three Weeks	Four Weeks

Table 6, Functional Equalizing Frequency

A functional equalizing lasts 24 hours with voltage settings the same as above.

Operation

Discharging

No restriction on the discharge current is required, provided the connections are properly sized and the battery temperature stays within the allowable limits.

For discharge rates lower than I10, the maximum daily depth-of-discharge is expressed as a percentage of the C10 DIN value. The maximum allowable depth-of-discharge (MDOD) is 80% of the maximum available capacity, for all systems unless otherwise approved by OutBack Power.

Overdischarge Protection

The MDOD limit control should not be implemented solely through control systems based on Ah-counters. Monitoring the battery voltage against the low-voltage disconnect setting should always be included. The maximum daily depth-of-discharge limit control - for hybrid applications - can be measured either by Ah-counters control units or/and by battery voltage monitoring.

The graphs at the end of this manual give the battery voltage to depth-of-discharge relation as a guidance for the initial low voltage disconnect settings (first-try settings). The system designer or installer must adjust and confirm them according to the actual conditions of the system. For systems where the voltage is measured at the controller and not on the battery, the voltage drop on the connections to the battery must be considered.

For critical systems with the load directly connected on the battery, an alarm or other method of user feedback must be included to give information on the battery status when depth-of-discharge exceeds 60 to 80%.

Low-voltage Reconnect for Stand-Alone Systems

The battery voltage at which the load is reconnected after a low-voltage disconnect must be above 2.2 Vpc.

Temperature Limits

All technical data applies to the nominal temperature of 25°C. The ideal operating temperature range is 25°C ± 5°K. The recommended operating temperature range is 15°C to 35°C. Higher temperatures reduce the working life. A maximum temperature of 45°C must not be exceeded. In hybrid applications, the yearly average of battery temperature should be less than 30°C. Subzero temperatures may cause electrolyte freezing and irreversible damage when the battery's state of charge is low. The minimum safe temperature versus state of charge is given below:

SoC (% to C10 - DIN value)	0 - 20%	20 - 40%	40 - 60%	60 - 80%
Freezing Point	-40°C	-30°C	-20°C	-15°C

Table 7, Minimum Safe Temperature

The system designer/installer should consider countermeasures like thermal insulation, increasing the battery capacity, or increasing the minimum system voltage. In stand-alone systems, it is recommended to use controllers with adjustable low voltage disconnect setting to the battery temperature (higher low voltage disconnect for lower temperature).

During operation the temperature difference between individual cells/blocks battery should be below 3°C.

Current Limits

The maximum charging current during the bulk charging is 3*I10, while the battery voltage is below the gassing voltage of 2.40V x number of cells.

Ripple Currents

During recharging up to 2.40 V/cell, the effective value of the AC ripple current may temporarily reach maximum 10A/100 Ah C10 nominal capacity. After recharging and at float charge in stand-by operation or buffer operation, the effective value of the AC ripple current must not exceed 5A /100 Ah C10 nominal capacity.

Battery Maintenance

To avoid leakage currents and the associated risk of fire, keep the battery dry and clean. Clean with clear water; do not use any solvents or detergents as they can cause permanent damage to the container and lid. Avoid electrostatic charges.

Measure and record the following parameters every 6 months:

- Battery voltage
- Voltage of some cells/bloc batteries (pilot cells)
- Temperature of the container in some cells/bloc batteries (pilot cells)
- Confirm daily depth-of-discharge per cell
- Confirm max depth-of-discharge per cell does not exceed the allowed limit
- Confirm charging factor is within acceptable limits
- Confirm that charge settings correspond to the recommended ones
- Check if corrective equalizing is applied

Measure and record the following parameters every 12 months:

- Voltages and temperatures in all cells/blocks
- Connectors, racks and the ventilation

Faults

Should faults be detected in the battery or the charging device, contact an OutBack Power technical support representative. Measured data will simplify fault detection and elimination. A service contract with OutBack Power will detect faults in time.

Testing

Tests must be conducted according to IEC 60896-21. Check that the battery is fully charged. Before testing new batteries it must be ensured that a sufficient commissioning charge has been applied and the battery is fully charged.

Taking Out of Operation / Storage

If filled lead acid accumulators are to be taken out of operation for a longer period of time, they must be placed fully charged in a dry, frost-free room. To avoid damage, periodical equalizing charging or permanent float charging must be conducted.

Transport

EnergyCell OPzV cells/monoblocks are protected against short-circuiting. If properly packed, batteries are not dangerous goods according to the international regulations for dangerous goods on road and on rail (ADR and RID).

Performance Curves

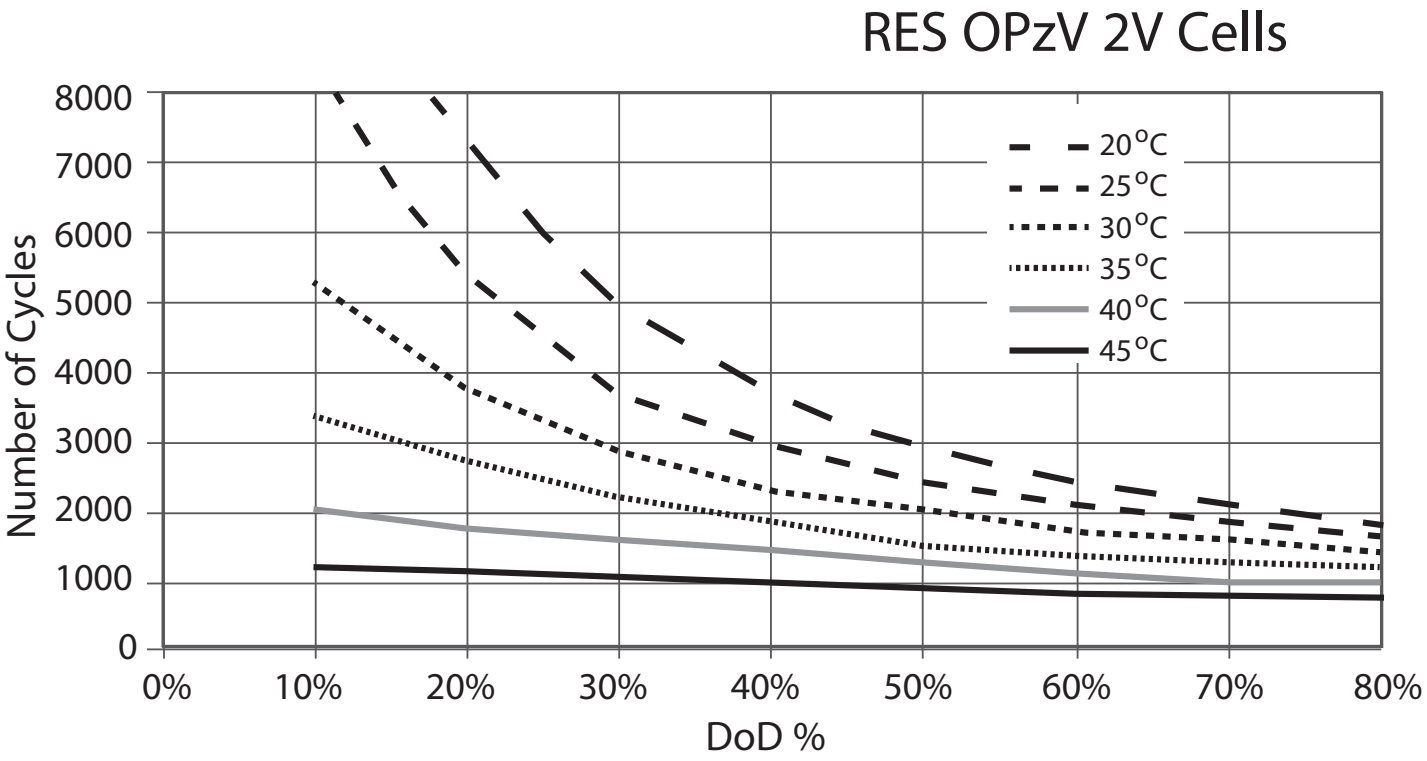

Figure 1, Expected Number of Cycles vs Depth of Discharge

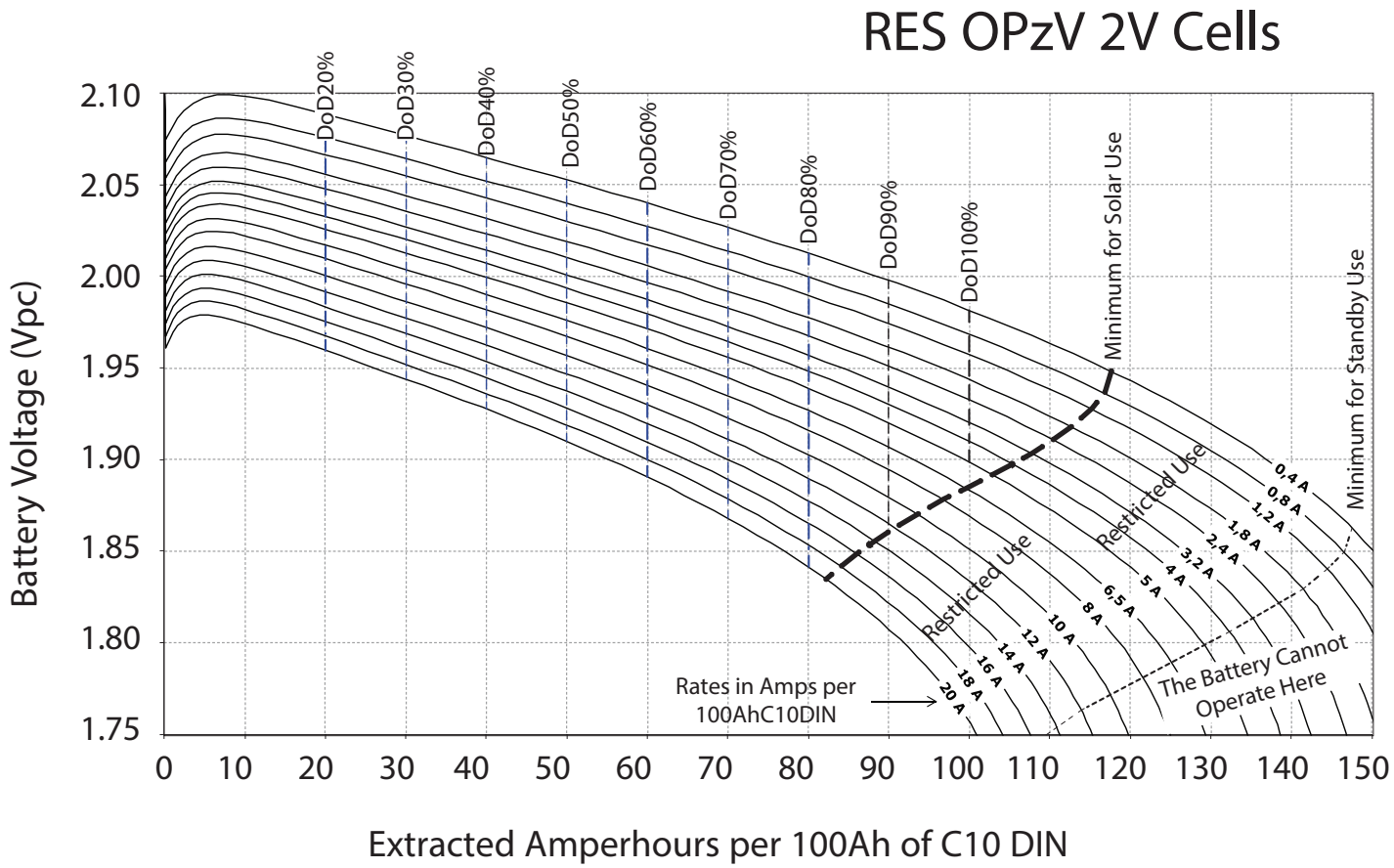

Figure 2, Guidance for the Initial Low-Voltage Disconnect Settings (25°C Reference Temperature)

Note:

- The minimum voltage, for standby use, represents the maximum available capacity.
- The minimum voltage, for solar use, represents 80% of the maximum available capacity. It is the lower low voltage disconnect setting except in special applications and after OutBack Power's approval.
- The depth of discharge 60% line, represents the minimum voltage setting to control the end of each discharge voltage in hybrid applications. It's always recommended to implement a supplementary control by Ah counter.

Performance Curves

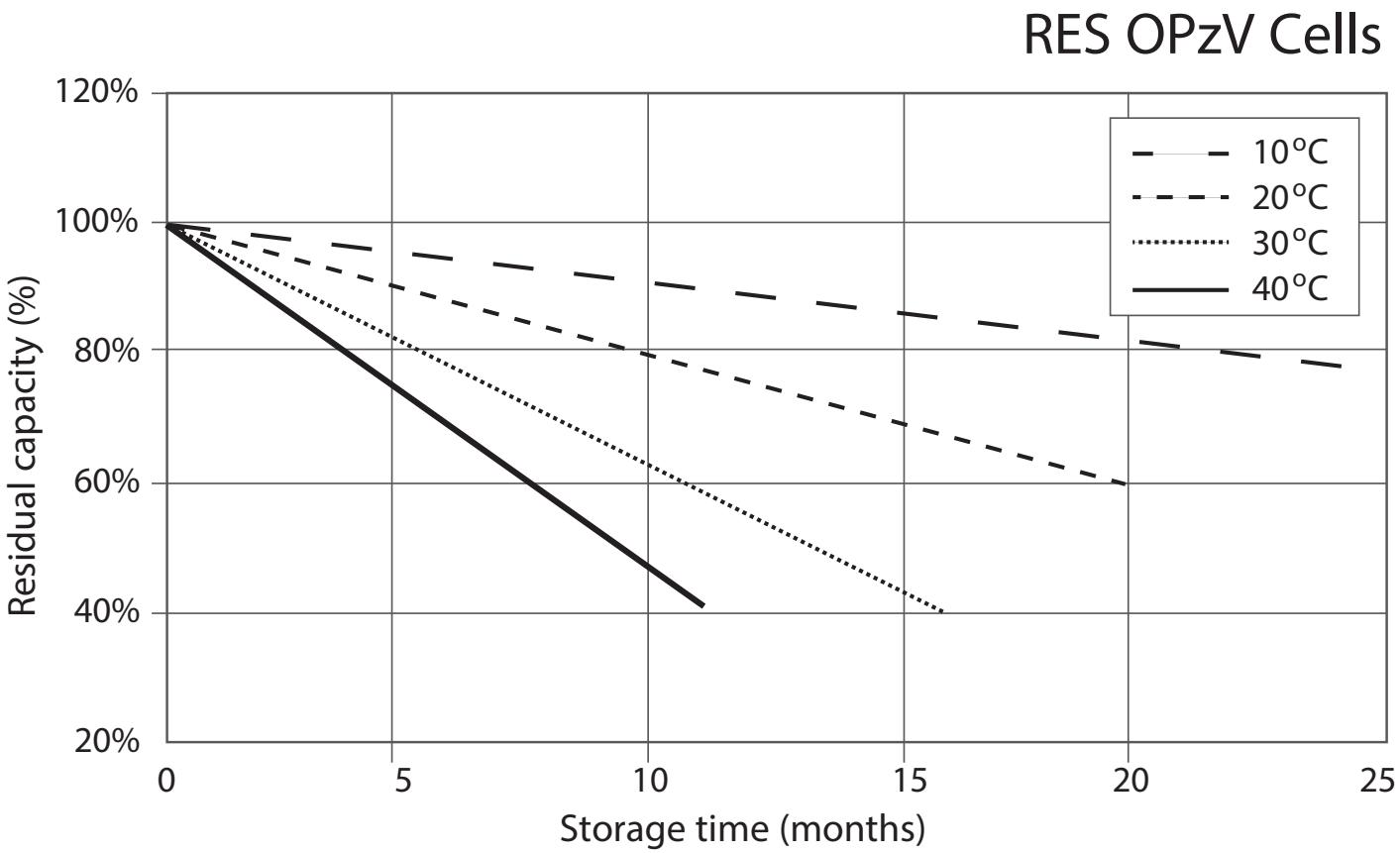

Figure 3, Self-Discharge Characteristics

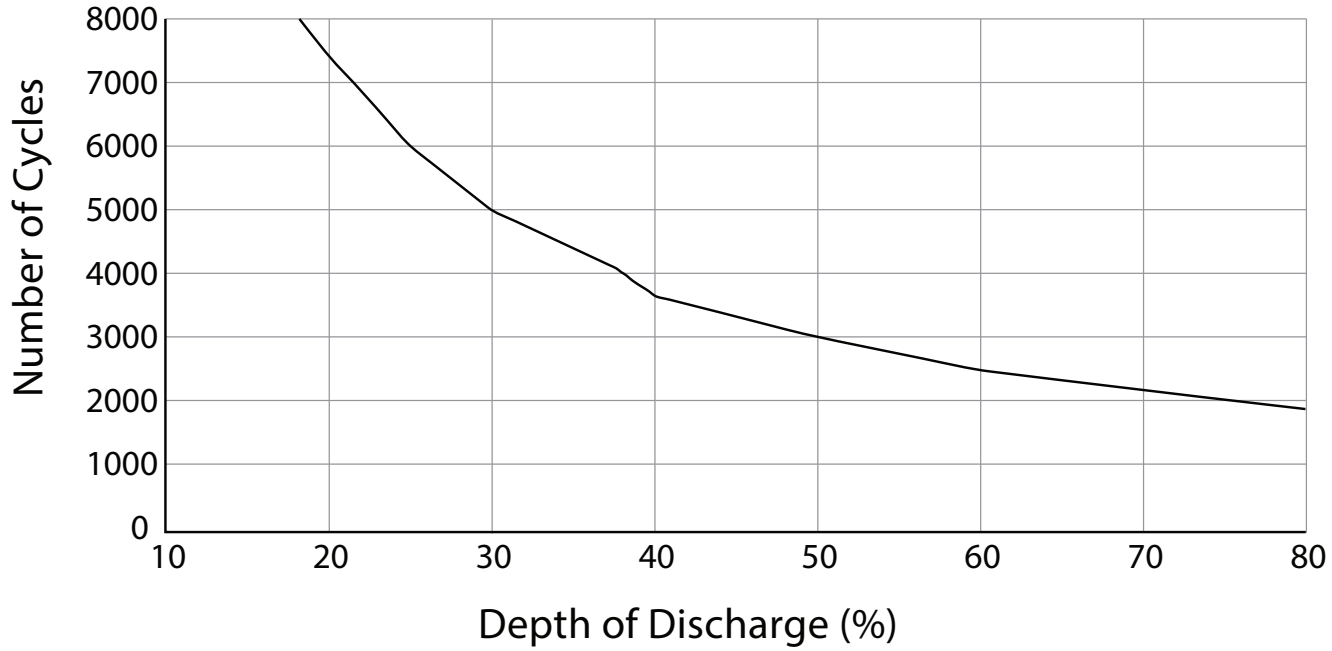

Figure 4, EnergyCell OPzV Cycle Life

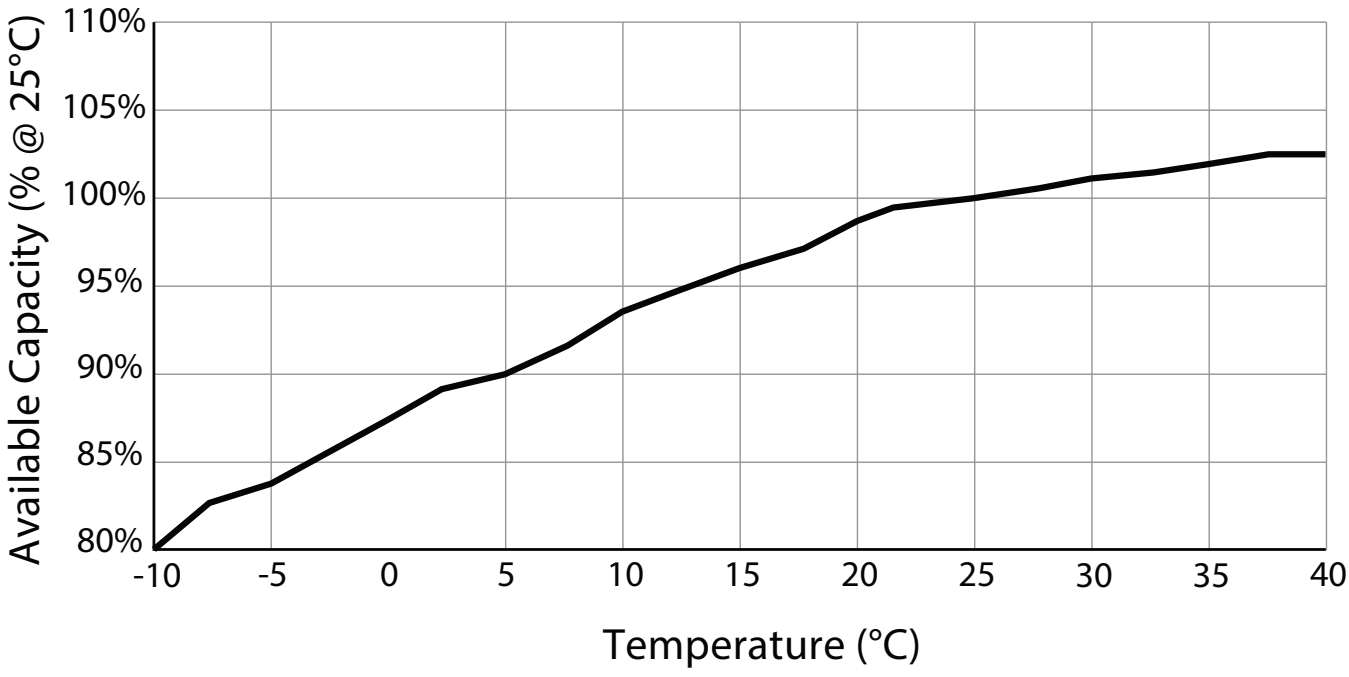

Figure 5, EnergyCell OPzV Capacity vs. Temperature Chart (Rate = 120Hr/1.85VPC)

Technical Specifications

Performance Data - Discharge Constant Current at 20°C (Amperes)											
End Voltage 2.00V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	14.73	12.98	8.99	7.86	4.59	4.45	3.30	2.51	2.12	1.55	1.10
EnergyCell OPzV 750	22.92	20.37	14.42	12.69	7.61	7.38	5.53	4.25	3.61	2.68	1.93
EnergyCell OPzV 2000	55.71	49.80	35.82	31.69	19.37	18.77	14.21	10.91	9.37	6.99	5.13
EnergyCell OPzV 3000	87.52	77.93	55.41	48.83	29.37	28.46	21.37	16.29	13.90	10.24	7.23
End Voltage 1.92V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	25.17	21.86	14.54	12.52	6.99	6.75	4.92	3.67	3.11	2.29	1.63
EnergyCell OPzV 750	41.02	35.80	24.10	20.84	11.81	11.41	8.37	6.29	5.35	3.95	2.85
EnergyCell OPzV 2000	98.74	86.50	58.80	51.02	29.27	28.30	20.90	15.79	13.48	9.99	7.20
EnergyCell OPzV 3000	155.28	135.59	91.31	78.96	44.70	43.19	31.66	23.77	20.22	14.91	10.71
End Voltage 1.90V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	27.17	23.55	15.59	13.40	7.44	7.18	5.22	3.89	3.29	2.41	1.72
EnergyCell OPzV 750	44.62	38.85	25.99	22.42	12.60	12.17	8.90	6.67	5.67	4.18	3.00
EnergyCell OPzV 2000	107.56	93.95	63.37	54.84	31.17	30.12	22.16	16.69	14.22	10.52	7.57
EnergyCell OPzV 3000	169.03	147.19	98.41	84.88	47.63	46.00	33.59	25.15	21.36	15.72	11.26
End Voltage 1.85V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	31.09	26.87	17.64	15.13	8.31	8.01	5.79	4.29	3.63	2.65	1.88
EnergyCell OPzV 750	51.82	44.93	29.74	25.57	14.18	13.69	9.94	7.40	6.27	4.60	3.29
EnergyCell OPzV 2000	125.49	109.02	72.54	62.49	34.94	33.74	24.61	18.42	15.64	11.50	8.23
EnergyCell OPzV 3000	196.84	170.58	112.62	96.73	53.43	51.56	37.37	27.80	23.53	17.23	12.29

Table 8, Performance Data - Discharge Constant Current at 20°C (Amperes)

Performance Data - Discharge Constant Current at 20°C (Amperes)											
End Voltage 1.83V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	32.27	27.85	18.24	15.62	8.55	8.25	5.95	4.40	3.72	2.71	1.92
EnergyCell OPzV 750	54.06	46.81	30.88	26.52	14.64	14.13	10.23	7.60	6.43	4.71	3.36
EnergyCell OPzV 2000	131.15	113.73	75.35	64.81	36.03	34.78	25.30	18.89	16.01	11.75	8.40
EnergyCell OPzV 3000	205.55	177.84	116.94	100.30	55.11	53.16	38.42	28.52	24.11	17.61	12.54
End Voltage 1.80V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	33.60	28.95	18.88	16.16	8.80	8.49	6.11	4.52	3.81	2.77	1.96
EnergyCell OPzV 750	56.70	48.99	32.16	27.58	15.14	14.60	10.54	7.82	6.61	4.83	3.44
EnergyCell OPzV 2000	138.00	119.36	78.56	67.43	37.21	35.91	26.03	19.38	16.41	12.02	8.57
EnergyCell OPzV 3000	216.00	186.41	121.83	104.28	56.91	54.87	39.53	29.27	24.72	18.02	12.81

Table 8, Performance Data - Discharge Constant Current at 20°C (Amperes), Continued

Performance Data - Discharge Constant Power at 20°C (Watts/Cell)											
End Voltage 2.00V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	29.21	25.80	17.99	15.75	9.30	9.00	6.71	5.13	4.35	3.20	2.28
EnergyCell OPzV 750	45.36	40.39	28.78	25.39	15.37	14.90	11.24	8.65	7.41	5.53	4.03
EnergyCell OPzV 2000	110.20	98.72	71.43	63.31	39.17	37.98	28.94	22.30	19.27	14.47	10.76
EnergyCell OPzV 3000	173.36	154.64	110.66	97.66	59.30	57.62	43.40	33.45	28.45	21.08	15.06
End Voltage 1.92V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	48.87	42.56	28.53	24.64	13.91	13.44	9.85	7.39	6.29	4.64	3.33
EnergyCell OPzV 750	79.3	69.47	47.14	40.88	23.42	22.65	16.71	12.62	10.78	8.01	5.80
EnergyCell OPzV 2000	190.87	167.69	114.94	100.03	58.07	56.19	41.77	31.74	27.17	20.27	14.70
EnergyCell OPzV 3000	300.49	263.14	178.68	154.96	88.75	85.82	63.31	47.80	40.78	30.23	21.84
End Voltage 1.90V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	52.50	45.65	30.46	26.27	14.74	14.24	10.41	7.79	6.62	4.87	3.50
EnergyCell OPzV 750	85.90	75.02	50.62	43.81	24.91	24.08	17.70	13.34	11.37	8.43	6.09
EnergyCell OPzV 2000	206.81	181.22	123.32	107.06	61.60	59.58	44.11	33.43	28.57	21.26	15.40
EnergyCell OPzV 3000	325.34	284.22	191.70	165.86	94.20	91.05	66.92	50.39	42.93	31.76	22.90
End Voltage 1.85V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	59.52	51.60	34.18	29.40	16.33	15.77	11.46	8.55	7.24	5.31	3.80
EnergyCell OPzV 750	98.71	85.89	57.40	49.51	27.80	26.85	19.61	14.69	12.49	9.21	6.63
EnergyCell OPzV 2000	238.52	208.02	139.83	120.88	68.48	66.18	48.62	36.61	31.19	23.08	16.63
EnergyCell OPzV 3000	374.58	325.85	217.31	187.29	104.81	101.22	73.86	55.28	46.95	34.57	24.80

Table 9, Performance Data - Discharge Constant Power at 20°C (Watts/cell)

Performance Data - Discharge Constant Power at 20°C (Watts/Cell)											
End Voltage 1.83V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	61.59	53.34	35.24	30.29	16.77	16.18	11.74	8.74	7.40	5.42	3.87
EnergyCell OPzV 750	102.61	89.18	59.42	51.19	28.62	27.64	20.14	15.06	12.79	9.41	6.76
EnergyCell OPzV 2000	248.33	216.25	144.79	125.00	70.44	68.06	49.86	37.46	31.87	23.54	16.93
EnergyCell OPzV 3000	389.70	338.53	224.97	193.63	107.81	104.09	75.75	56.58	47.99	35.27	25.27
End Voltage 1.80V/cell											
	10h	12h	20h	24h	48h	50h	72h	100h	120h	168h	240h
EnergyCell OPzV 450	63.90	55.26	36.39	31.21	17.22	16.62	12.04	8.95	7.57	5.53	3.95
EnergyCell OPzV 750	107.19	92.98	61.67	53.06	29.50	28.48	20.70	15.44	13.09	9.62	6.90
EnergyCell OPzV 2000	260.12	225.98	150.42	129.61	72.54	70.06	51.16	38.34	32.58	24.01	17.24
EnergyCell OPzV 3000	407.72	353.41	233.56	200.67	111.01	107.13	77.73	57.92	49.08	36.00	25.76

Table 9, Performance Data - Discharge Constant Power at 20°C (Watts/cell), Continued

OutBack POWER™

member of The alpha Group™

Corporate Headquarters
17825 - 59th Avenue N.E.
Suite B
Arlington, WA 98223 USA

European Office
Hansastrasse 8
D-91126
Schwabach, Germany

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