Electrical

Specification	106TT	115TT
Nominal Voltage	12 Vdc	
Cells per Unit	6	
Cycle Life (50% Depth of Discharge)	500 cycles	
Absorption Voltage (25°C)	14.4 to 15 Vdc	
Absorption Time	3.5 hours	
Float Voltage (25°C)	13.5 to 13.8 Vdc	
Float Time	24/7	
Equalize Voltage, Time, and Frequency	15 Vdc for 16 hours every 2 months or 25 cycles	
Re-Bulk Voltage	12 Vdc	
Maximum Charge Current (per Battery)	30 Adc	33 Adc
Temperature Compensation Factor	±3.3 mV per cell per °C	
Self-Discharge Frequency	12 months at 77°F (25°C) before a recharge is required	

Ampere-Hour Capacity to 1.75 Volts per Cell @77°F (25°C)

Model	Discharge in Hours										
	1	2	3	4	5	8	10	20	24	48	100
EnergyCell 106TT	65.5	75.2	80.7	84.0	86.5	90.4	94.0	100.0	101.2	104.6	106.0
EnergyCell 115TT	81.7	91.0	96.3	100.0	99.0	104.0	104.0	112.0	111.3	115.2	117.0

Mechanical

Specification	106TT	115TT
Terminal Type	Threaded alloy insert terminal to accept M6 × 20 mm bolt	
Terminal Hardware Torque	44.9 in-lb (5.1 Nm)	
Warranty	1 year	
Weight	66.56 lb / 30.2 kg	75.38 lb / 34.2 kg
Case Size	27	31
Dimensions (H × L × W)	8.41 × 12.78 × 6.65" 213.6 × 324.7 × 169.0 mm	8.54 × 13.5 × 6.69" 216.9 × 343.0 × 170.0 mm

Environmental

Specification	106TT	115TT
Operating Temperature (compensated)	–40 to 140°F (–40 to 60°C)	
Storage Temperature	14 to 104°F (–10 to 40°C)	

Date and Revision
August 2020, Revision A

Contact Information
Mailing Address: 1628 – West Williams Drive Phoenix, AZ 85027 USA
Web Site: www.outbackpower.com

IMPORTANT:
Not intended for use with life support equipment.

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EnergyCell TT Series Battery

Audience

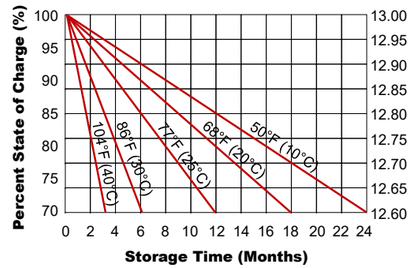
This guide is for use by qualified personnel who meet all local and governmental code requirements for licensing and training for the installation of batteries and related products. The installer should be familiar with battery test procedures. Be sure to review carefully and identify potential safety risks before proceeding. The installer must be familiar with all features and functions of this battery before proceeding. Failure to install or use this battery as instructed can result in damage to the battery that may not be covered under the limited warranty.

Product

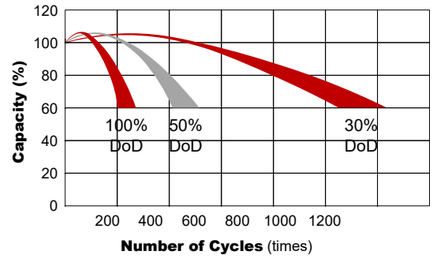
The EnergyCell™ TT is a series of top-terminal 12 Vdc valve-regulated lead-acid (VRLA) absorbed glass-mat (AGM) batteries. These batteries are for backup or light duty cycling applications.

Storage

- All lead-acid batteries experience self-discharge while in storage. This causes circuit voltage and capacity to decrease.
- The self-discharge rate is related to ambient temperature. The lower the temperature, the lower the discharge rate. Batteries should be stored in a clean, ventilated, and dry location with an ambient temperature of 32°F to 77°F (0°C to 25°C).
- It is important to track open-circuit voltage (OCV) when batteries are disconnected. If OCV is lower than 12.6V or the batteries have been stored beyond the limits shown in the **Storage Time vs. Temperature** graph, the batteries should be charged to avoid damage caused by self-discharge.
- Recharge at 14.4 Vdc for 12 hours prior to battery reaching 12.6 Vdc.
- All batteries should be fully charged before storage. Record the storage date and next supplemental charge date in a maintenance record and on the battery. See the voltage log on the next sheet.
- Upon battery deployment, verify that all batteries within each string measure in the range of +/- 0.3 Vdc of the string average while in "float" charger mode.



Storage Time vs. Temperature
100% DoD



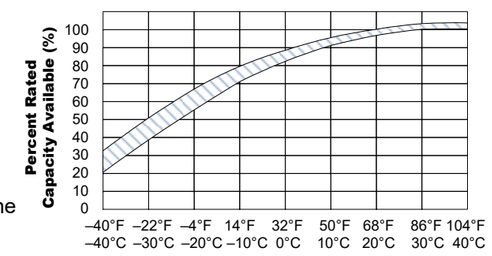
Cycle Life
at different depth of discharge (DoD) levels

Capacity

The battery's actual capacity is influenced by temperature, depth of discharge, discharge rate, and the resulting voltage.

- The higher the discharge rate, the lower the available capacity.
- The available capacity is also reduced as batteries become colder. This is related to the internal electrochemical reactions and the resistivity of the electrolyte. It is depicted in the **Capacity vs. Temperature** graph.

Note that battery cycle life is also affected by depth of discharge, as shown in the **Cycle Life** graph.



Capacity vs. Temperature

Operating Conditions

EnergyCell TT batteries are valve-regulated and sealed. They do not give off perceptible amounts of gas under normal operating conditions.

- Operating temperature range (ambient): –40°F to 140°F (–40°C to 60°C)
- Optimal operating temperature (ambient): 68°F to 77°F (20°F to 25°F)
- Ambient humidity: ≤ 95%

NOTE:
Although the battery can operate at temperatures below –4°F (–20°C), the capacity and ability to discharge will be dramatically decreased.

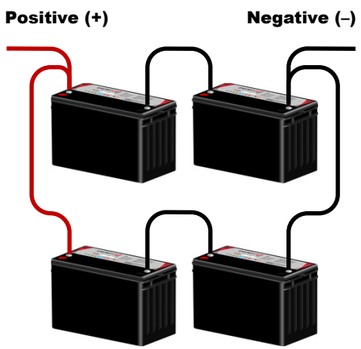
Series Strings

Batteries wired in series (negative to positive) have additive voltages. This is known as a “string”. In the example below, a string of four EnergyCell TT batteries would have a nominal voltage of 48 Vdc. However, batteries in series do not have additive amp-hours.

Series / Parallel Strings

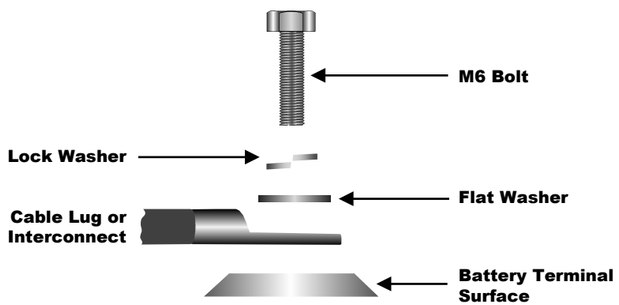
Batteries wired in parallel (positive to positive, negative to negative) have additive amp-hour capacity. Placing several strings in parallel (series / parallel) gives additive voltages **and** capacity. In the example below, the system uses four batteries, but not all are in series. This system uses pairs of batteries in series for 24 volts. Two pairs are shown in parallel for double the amp-hours.

NOTE: Consult a professional installer before connecting more than three strings in parallel.

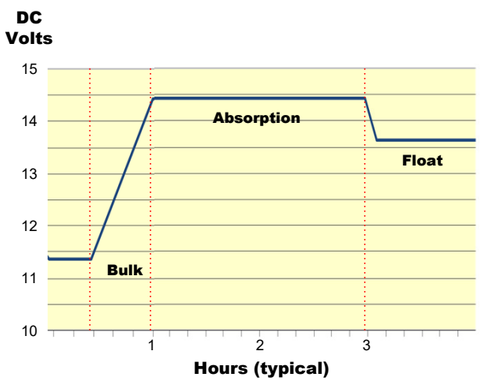


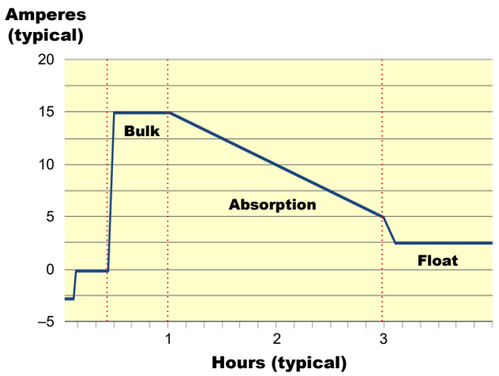
Hardware

EnergyCell TT terminals consist of a threaded hole which receives an M6 × 12 mm bolt. Terminal hardware is assembled as shown in this image.



Charging Graphs





Three-Stage Charging

EnergyCell TT batteries are usually charged using a “three-stage” charging cycle: bulk stage, absorption stage, and float stage. However, not all chargers are designed or programmed the same way. The settings should be checked and changed to match the recommendations below if necessary.

Bulk Stage

The bulk stage is a constant-current stage. The charge current is maintained at a constant high level. The battery voltage will rise as long as the current flows, raising the battery to a high voltage (usually called bulk or absorption voltage). This typically restores the battery to 85 to 90% state of charge (SoC). This battery has a recommended maximum current limit which should not be exceeded. See the **Specifications** table.

Charging Voltages (multiplied by the number of batteries in a series string)

- **Absorb Charging Voltage**: 14.4 to 15.0 Vdc
- **Equalize Charging Voltage**: 15.0 Vdc (16 hours every 2 months or 25 cycles)
- **Float Voltage**: 13.5 to 13.8 Vdc

Absorption Stage

The absorption stage is a constant-voltage stage, established upon reaching the bulk target voltage. The charger maintains this voltage as the current decreases until the batteries are full. A large current is required to reach absorption level. Less is required to maintain it there. This requirement tends to decrease as long as absorption is maintained. This decreasing current flow typically goes to a very low number (though not zero), known as “return amps”. This “tops off the tank”, leaving the battery at 100% SoC. The battery is considered to be completely full upon the following conditions: The charge rate must decrease to a level of current equal to between 1% and 3% of the total battery amp-hours **while maintaining the absorption voltage**. At this point the charger is allowed to exit the absorption stage and enter the next stage.

NOTE: Not all chargers use return amps. Many chargers absorb for a timed period (one or two hours), assuming that the current will decrease to that level. However, if it exits absorption and ends the charge before reaching return amps, the battery may not reach 100% SoC. Repeated failure to complete the charge will cause decreased battery life.

Float Stage

The float stage is a maintenance stage which provides current to counter the battery’s natural self-discharge. As with absorption, float is a constant-voltage stage which supplies only enough current to maintain the designated voltage.

Constant-Float Charging

“Constant-float” charging may be used in backup power applications where the battery is rarely discharged. When a discharge occurs, it is critical to recharge the battery as soon as possible afterward. The voltage range is listed under **Specifications**. The batteries are considered fully charged when the voltage is maintained at this level and the current drops to a low level over a long period of time. If using a battery monitor device such as an OutBack FLEXnet DC, use the settings shown to the right.

In constant-float charging, it is critical to compensate the charger settings for temperature.

Settings

- ***Battery Amp-Hours***: Based on the rated 20-hour capacity (see **Specifications**)
- ***Charged Voltage***: 14.0 Vdc (0.4 volts below absorption setting)
- ***Charged Return Amps***: 1 to 3% Adc
- ***Time***: 1 minute
- ***Charge Factor***: 97%

Temperature Compensation

Battery performance changes when the temperature varies above or below room temperature (77°F or 25°C). When a battery is cooler than room temperature, its internal resistance goes up and the battery will be undercharged. When warmer than room temperature, its internal resistance goes down and the battery will tend to be overcharged.

To compensate, a charger must have its voltages raised by a specified amount for every degree below room temperature, or lowered for every degree above room temperature. For the EnergyCell TT, the required compensation coefficient is –0.0033 volts per cell per degree C (–0.0018 V/cell/°F). This is also multiplied by the number of batteries in a string.

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Troubleshooting

Symptoms and Remedies

Symptom	Possible Cause	Possible Remedy
Reduced operating time (at 77°F / 25°C) with smooth voltage decline	Normal life cycle	Replace entire battery system when at 70% of rated capacity (or before).
Reduced operating time (at 77°F / 25°C) with steep voltage decline or plateaus	Individual cells with low capacity	Replace afflicted batteries as necessary.
Excessive initial voltage drop, even to the point of dropping the load in the first few seconds	• Battery extremely cold • Cable gauge too small • High-resistance connections • Battery bank undersized • Shorted cells	• Heat the battery. • Increase cable gauge or run parallel cables. • Clean and reassemble connections. • Add required parallel strings. • Replace afflicted batteries. Evaluate the entire string.
Cover or container crack	Handling or impact damage	Replace afflicted batteries as necessary.
Cover or container explosion	Ignition of cell internal gases due to external source, fusing, or internal conductive path or internal spark due to shorting	Replaced afflicted batteries as necessary. Evaluate the entire string.
Burned area on container; ground fault in system	Damaged container that allows electrolyte to wick to grounded rack or tray	Replace afflicted batteries as necessary. Evaluate the entire string. Clear any ground fault errors.
Permanently deformed (swollen) container	Thermal runaway, possibly caused by high-temperature environment, overcharging, excessive recharge current, shorted cells, or a combination	Replace the battery system. Correct items that led to thermal runaway.
Rotten-egg odor		
Melted grease at terminals	Hot connections due to excessive resistance from loose connections, dirty contact surfaces, or corrosion within the connection	• Clean and reassemble the connection. • Replace batteries with damaged connections.
Corrosion at terminals	Electrolyte leaking from within the battery	Disassemble and clean the connection. Coat connecting surfaces and terminal area seal with anti-oxidation grease, and reassemble the connection. If there is obvious leakage, replace batteries as necessary.

Symptom	Possible Cause	Possible Remedy
System float voltage greater than 13.8 volts per battery at 77°F / 25°C	Charger voltage set too high	Reset charger output voltage to recommended values.
System float voltage less than 13.5 volts per battery at 77°F / 25°C	Charger voltage set too low	Reset charger output voltage to recommended values. Equalize the battery system (48 to 72 hours) and perform a capacity test. If capacity loss is permanent, replace the battery system.
DC voltage measured between battery system output terminals and ground (rack or tray)	Damaged container that allows electrolyte to wick to grounded rack or tray	Replace afflicted batteries as necessary. Evaluate the entire string. Clear any ground fault errors.
Ground fault indicated by automatic measuring equipment		
Elevated battery temperature	• Elevated room temperature • Inadequate ventilation • High discharge or recharge current	• Control the room temperature. • Improve ventilation of room or battery cabinet. • Reduce current to within specifications.
High recharge current	• Charge voltage set too high • Charger current set too high • Shorted cells	• Reset charger output voltage to recommended values. • Reduce recharge current to within specifications. • Replace afflicted batteries. Evaluate the entire string.
Float current to one string is zero	Open connection in a series string	Verify with voltage checks or impedance checks of individual batteries. Repair any open or loose connections. Replace any battery with open cells.
Float current (at float voltage) exceeds 3 milliamperes per amp-hour of rated capacity at 77°F / 25°C	• Battery discharged • Shorted cells • Thermal runaway	• Recharge batteries. • Replace afflicted batteries. Evaluate the entire string. • Replace the battery system. Correct items that led to thermal runaway.
Impedance / resistance increase by 50%, or conductance declines by 50%, from original value	• Battery discharged • Battery material deteriorating • Shorted or open cells	• Recharge batteries. • Replace afflicted batteries. Evaluate the entire string. • Replace afflicted batteries. Evaluate the entire string.

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Symptoms and Remedies

Symptom	Possible Cause	Possible Remedy
Connection resistance increase 20% or more from original value	• Repetitive cycling causes heating / cooling and loosening of connection, resulting in resistance increase • Excessive resistance from loose connections, dirty contact surfaces, or corrosion within the connection	• Tighten connection to specified torque values. • Clean and reassemble the connection.
Connection hardware tightness is less than voltage decline or plateaus	Individual cells with low capacity	Replace afflicted batteries.
AC ripple voltage (p-p) is greater than 4% of the value of the DC float voltage	Poor filtering of charger output	Improve charger output filtering.
Individual battery exhibits AC ripple voltage twice that of other typical batteries in the string	Proportionately higher impedance due to deteriorating material or shorted or open cell	Replace afflicted batteries. Evaluate the entire string.

	Date:	Date:	Date:
Battery 1			
Battery 2			
Battery 3			
Battery 4			
Battery 5			
Battery 6			
Battery 7			
Battery 8			
Battery 9			
Battery 10			
Battery 11			
Battery 12			
Battery 13			
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