

The Battery Life Saver electronic device 3 Year Limited Warranty Program

This Battery Life Saver electronic device is warranted to the original purchaser only, to be free of defects in materials and workmanship for three years from the date of purchase without additional charge. The warranty does not extend to subsequent purchasers or users. Battery Life Saver electronic device will not be responsible for any amount of damage in excess of the retail purchase price of the product under any circumstances. Incidental and consequential damages are especially excluded from coverage under this warranty. This warranty does not apply to damage to units from misuse or incorrect installation. Misuse includes wiring or connecting to improper polarity power sources. This product cannot damage your battery. Battery Life Saver electronic device will not replace any batteries under this warranty .

RETURN/REPAIR POLICY: Contact Battery Life Saver customer service before returning any defective product. Product that is returned to Battery Life Saver within 30 days of the date of purchase will be replaced free of charge. If such a product is returned more than 30 days but less than three years from the purchase date, Battery Life Saver will replace it free of charge, upon determining that the unit is defective. The customer is responsible for the shipping charges on all returned items after 30 days.

LIMITATIONS: This warranty does not cover batteries, defects resulting from normal wear and tear (including chips, scratches, abrasions, discoloration or fading due to usage or exposure to sunlight), accidents, damage during shipping to our service facility, alterations, unauthorized use or repair, neglect, misuse, abuse, failure to follow instructions for care and maintenance, fire, flood and Acts of God .

STATE LAW RIGHTS: This warranty gives you specific legal rights. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the exclusions or limitations stated herein may not apply. This warranty gives the purchaser specific legal rights; other rights, which vary from state to state, may apply .

TO REQUEST WARRANTY SERVICE FOR THIS PRODUCT: Contact Battery Life Saver Customer Service by telephone, fax, e-mail or mail to receive an RMA number . We suggest that you keep the original packaging in case you need to ship the unit. When returning a product, include your name, address, phone number, dated sales receipt (or proof of purchase) and a description of the reason for return. After examining the unit, we will make every effort to replace it within four weeks.

Please contact Battery Life Saver for an RMA number to return item.

ATTN.: CUSTOMER SERVICE / BATTERY LIFE SAVER
P.O. Box 726, Clearwater, FL 33755

PH: 727-446-8400. Fax: 727-446-8900. e-mail: bls@batterylifesaver.com
WARRANTY IS NON -TRANSFERABLE AND NON -REFUNDABLE.

Caution: Surface can get very hot!



Battery Solutions & Innovations, Inc.

Manufactures of the Battery Life Saver electronic device

User's Manual for Models: BLS-12/24B, BLS-12/24BW, BLS-48BW

Manufacturer Contact Information

Mailing address:	Physical address:
P.O. Box 726	936 Cleveland Street Suite C
Clearwater, FL 33757	Clearwater, FL 33755

Phone: 727-446-8400 Fax: 727-446-8900
Email: bls@batterylifesaver.com



*ingenuity for
the benefit
of the planet*

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Caution: Surface can get very hot!

Troubleshooting

The Battery System performance is decreasing after installing the BLS.

The most common cause for this is a shorted or open cell in one or some of the batteries in the system. The surrounding batteries will be improving, but the one or two bad batteries will start to drain the good batteries quicker, causing for a decrease in performance. Follow the instructions in this manual to find a short or open cell, then replace the bad battery or batteries with another used battery. The BLS does not affect the batteries adversely, but makes it very evident there is a short or open cell in one of the batteries.

I installed the BLS and have yet to see an improvement in the batteries.

The BLS gradually breaks down the sulfates in a battery. It will not change the condition of a battery instantly. The amount of time needed depends on the condition of the battery and how often you cycle the battery (charge and discharge) with the BLS attached. Usual time is between 2 and 6 weeks with normal use, but it can vary.

The BLS drained my batteries. In order for the BLS to work, it draws a small amount of power from the batteries. Typically, if you leave the BLS on a battery or system without charging for more than 5 days. If this happens, simply charge the battery or battery system. If the battery or system does not charge, review the section in this manual "How to Revive a Dead Battery".

The LED (light) is not coming on. The LED in the Battery Life Saver is not very bright. Cover the BLS with your hand to make sure that the light is really not working. Make sure the connections to the battery terminals are secure. Check to see if the BLS is connected to the proper batteries. If the light still does not come on, please contact Customer Service.

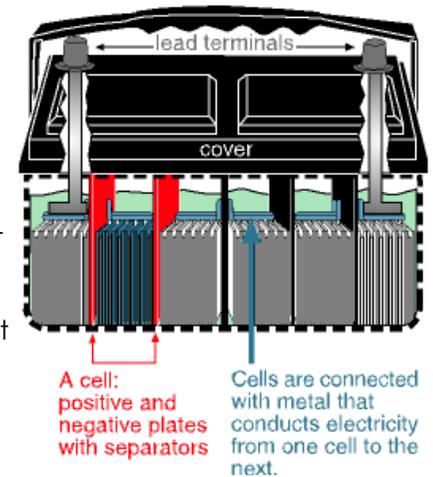
Customer Service: 727-446-8400

Understanding Batteries & The Battery Life Saver

The Battery Life Saver electronic device will extend the life of any lead-acid battery and can rejuvenate "dead" batteries to a like new condition. But how does it work? To understand the technology behind the BLS, we must first understand how a battery works.

How a Battery Works

In a normal battery we have three basic elements: one plate made of lead, an electrolyte of sulfuric acid and another plate made of lead oxide. When the battery is discharged, the sulfuric acid in the electrolyte reacts with the lead and lead oxide releasing electricity, forming lead sulfate. This leaves a watery electrolyte solution. When a battery is completely discharged, what is left is lead sulfate and water. When you recharge the battery, the electrical current causes the lead sulfate to break apart. This returns the system to the original elements of lead and lead oxide on the plates and sulfuric acid in the electrolyte, *for the most part.*



What's the problem? Why do batteries fail?

When the battery is recharged, a small amount of lead sulfate maintains its sulfate configuration (sulfate crystal).

These sulfates crystals cannot be reconverted using a regular electric current. Every time the battery is discharged, more of these crystals are produced and the electrolyte solution becomes more watery. Like layers of snow on a garden they continue to accumulate until you can no longer see the garden. These crystals interfere with the flow of electricity in and out of the battery. The battery will take longer to charge and a charge will last less time. A perfectly good battery will seem dead because lead sulfate has built up on the plates.

Understanding Batteries & The BLS Continued

The BLS is the Solution

The Battery Life Saver electronic device solves this problem by dissolving the buildup of lead sulfate crystals. The BLS sends a low frequency wave² through the battery, targeting the lead sulfate crystals (even those that could not be dissolved by recharging), converting them back into lead and sulfuric acid. Each crystal is like a tiny radio receiver. In fact, when the radio was invented, a lead sulfate crystal was used for the receiver. The BLS action gradually restores the battery back to its original condition and allows the electrical charge to be drawn from the battery. The BLS also works constantly, during both charge and discharge states. Sulfation occurs on both plates and in order to desulfate the whole battery, a desulfator should work during both charge and discharge states.

Battery Safety Precautions

DANGER OF EXPLODING BATTERIES

Lead acid batteries contain sulfuric acid and produce explosive mixtures of hydrogen and oxygen. Because self-discharge action generates hydrogen gas even when the battery is not in operation, make sure batteries are stored and worked on in a well ventilated area. ALWAYS wear ANSI Z87.1 (U.S. standard) approved safety glasses and face shield or splash proof goggles when working on or near batteries:

- Always wear proper eye, face and hand protection.
- Keep all sparks, flames and cigarettes away from the battery.
- Never try to open a battery with non-removable vents.
- Keep removable vents tight and level except when servicing electrolyte.
- Make sure work area is well ventilated.
- Never lean over battery while boosting, testing or charging.
- Exercise caution when working with metallic tools or conductors to prevent short circuits and sparks.
- Always read and follow all precautionary labels on the product

SAFE CHARGING

- Never attempt to charge a battery without first reviewing the instructions for the charger being used. In addition to the charger manufacturer's instructions, these general precautions should be followed:
- Always wear proper eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Keep vents tight and level.
- Turn the charger and timer "OFF" before connecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal and black negative (-) lead to the negative (-) terminal. If the battery is still in the vehicle, connect the negative lead to the engine block to serve as a ground. Be sure the ignition and all electrical accessories are turned off. (If the vehicle has a positive ground, connect the positive lead to the engine block.)
- Make sure that the charger leads to the battery are not broken, frayed or loose.
- Set the timer, turn the charger on and slowly increase the charging rate until the desired ampere value is reached.
- If the battery becomes hot, or if violent gassing or spewing of electrolyte occurs, reduce the charging rate or turn off the charger temporarily.
- Always turn the charger "OFF" before removing charger leads from the battery to avoid dangerous sparks.
- Always read and follow all precautionary labels on the product
- Battery acid, or electrolyte, is a solution of sulfuric acid and water that can destroy clothing and burn the skin.
- Use extreme caution when handling electrolyte and keep an acid neutralizing solution - such as baking soda or household ammonia mixed with water - readily available.
- If the electrolyte is splashed into an eye, immediately force the eye open and flood it with clean, cool water for at least 15 minutes. Get prompt medical attention.
- If electrolyte is taken internally, drink large quantities of water or milk. DO NOT induce vomiting. Get prompt medical attention.
- Any spill, neutralize with baking soda, then clean with abundant water.

How to Revive a Dead Battery

Precautions

Be very careful in working with batteries. Batteries contain sulfuric acid that is very harmful.

Follow the safety precautions advised by your battery company, including protective eye gear, clothing, and gloves.

Important - Charge and Discharge Cycle

Before you start, make sure that the battery is not empty. Use distilled water to cover the plates. Reverse osmosis filtered water is second best. Regular tap water contains minerals and other materials that are not good for your battery.

To restore batteries in a battery bank you must cycle (charge & discharge) the batteries with the BLS attached. The best way to do this is to install the BLS and simply use the system as normal, make sure to charge the system regularly.

For batteries that are not installed in a system, cycle the batteries with the BLS attached. Start by fully charging the batteries. Attach the BLS, and let the BLS slowly drain the batteries for 18-24 hours. Then, fully charge the batteries with the BLS attached. Continue this process until the batteries reach a optimal or good working condition.

What if the charger will not even start because the battery voltage is too low?

Some modern "smart" chargers will not even operate on a battery that has too low a voltage. They just assume that the battery is no good. Do not despair - you can restore such a battery. But you will either have to use an old-fashioned manual charger or trick your charger. Or, connect a good working battery in parallel to the low voltage battery to get the charger to start.

What if the battery has a dead cell?

A "dead" cell could mean an open cell, a shorted cell, or a badly sulfated cell. 80% of the time a "dead" cell is a sulfated cell. A **sulfated cell** is one that has accumulated too much lead sulfate on the plates. The lead sulfate robs the acid, weakening it, and causes the plates to lose conductivity. The Battery Life Saver totally handles sulfated cells by dissolving the lead sulfate that has accumulated and keeping more from accumulating. A **shorted cell** is one that has had many lead particles shed from the plates and fall to the bottom of the cell, creating a circuit. A primary reason for shedding is the force of gravity on heavy lead sulfate crystals that form and attach to the lead particles of the plates. An **open cell** has connection points that have been burned out typically from charging at too high a rate*. The Battery Life Saver will not fix an open or shorted cell. However, eliminating the accumulation of lead sulfate will greatly slow down the shedding.

* This is why we do not recommend to equalize batteries. When you equalize a battery, you are overcharging it to eliminate part of the sulfates covering the plates. The problem is those sulfates go to the bottom of the battery and get lost for ever.

Testing for a Bad Battery

The Battery Life Saver™ electronic device will not help a battery or batteries that have an open or shorted cell. In order to tell if a battery as an open or shorted cell, simply perform the following tests. You will need a voltmeter and a hydrometer to perform both of these tests. *IMPORTANT: Please review our Safety Precautions on page 9 before handling or testing any battery!*

Safety First! Wear protective clothing, goggles and gloves when handling batteries.

Step 1: Physical & Mechanical Inspection

A mechanical inspection is really important as it can save you from future battery trouble. Replace cracked or broken batteries, clean or replace rusted or broken connections. On flooded/wet batteries check the water levels. The water level should be high enough to just cover the plates. Use only distilled water and do not overwater as it can spill and electrolyte is corrosive.

Step 2: Preparing the Tests

a.) Turn off any instruments or accessories that will drain the battery or battery system during testing.

b.) Charge the battery or battery system until it is fully charged .

c.) If the system has multiple batteries connected, we recommend to disconnect them from each other. Let the batteries sit for 4 to 12 hours, the longer the better. This important because if you measure the voltage immediately after charging, you will not be measuring the true voltage of the battery.

Step 3: Testing for a Short Cell

a.) With a voltmeter, measure the voltage of each individual battery.

b.): Reference the chart on the next page to determine if a battery has a shorted cell.

**Testing procedures and short cell chart
continued on the next page.....**

Testing for a Short or Open Cell continued

Battery	Voltage Reading of a Short Cell
6 Volt	Below 4.3 volts
8 Volt	Below 6.5 volts
12 Volt	Below 10.6 volts

Example: If a 6 volt battery is reading below 4.3 volts it has a short cell .

Step 4: Testing for an Open Cell in a Flooded/Wet cell battery

-If you have the sealed type batteries, this test method cannot be used.
 -Use a temperature compensating battery hydrometer for this test. ¹

a.) With the hydrometer, measure and record the specific gravity of each battery cell. (Example: Battery #1— Cell 1= 1.250, Cell 2=1.275, Cell 3= 1.275). Fill & drain the hydrometer a few times before pulling a sample.

b.) Compare the specific gravity readings between each battery. If a battery has a difference of more than .05 between the cells, that battery has an open cell.

Example readings: Three 6 volt batteries

	Cell #1	Cell #2	Cell #3	Condition
Battery A	1.250	1.225	1.250	Recoverable
Battery B	1.275	1.250	1.225	Recoverable
Battery C	1.200	1.250	1.275	Open Cell

Battery C has an Open Cell because the difference between Cell #1 and Cell #3 is .075, more than .05.

Any battery that has a Short or Open Cell needs to be replaced. If you have been using the BLS or plan on using the BLS you only need to replace the bad battery with another used or new battery. Now you are ready to start using the BLS... .

1. If your hydrometer is not temperature compensating, add .004 to readings for every 10° F above 80°F and subtract .004 to readings for every 10°F below 80°F.

Installing the BLS

Attention: If you are installing the BLS on a used or older batteries, please review the previous two pages: “Testing a for a Short or Open Cell.”

Installation:

- 1) Identify the First and Last battery in the system, in other words, in parallel with the charging source. The First battery's positive terminal is connected to the positive lead from the battery charger (or controller). The Last battery's negative terminal is connected to the negative lead from the battery charger (or controller).
- 2) Connect the red wire from the BLS to the positive terminal of the First battery. Connect the red/black wire from the BLS to the negative terminal of the Last battery. Securely fasten the terminals to the battery post.

Using the BLS: The BLS is constantly working. It draws a small amount of current (250mA) from the batteries to operate. Ideally, the BLS should be left connected at all times during normal operation. When installing the BLS on solar or wind battery banks, simply attach the BLS directly to the batteries and use the system as normal. If the batteries are not installed in a system, follow the instructions on page 8 of this manual.

MOUNTING

The BLS can be mounted permanently by using two number 8 screws and nuts, self tapping screws, or tie wraps. It is best to attach the BLS to something metallic to help dissipate the heat. If possible, mount it with the fins vertical to in-sure good cooling. The BLS is weatherproof.

BATTERY STORAGE

When batteries are to be stored for extended periods, use BLS with a trickle charger to maintain the battery or batteries in good condition. If you are not going use a trickle charger, disconnect or turn off the BLS while the batteries are stored. When possible, charge the batteries once per month with BLS attached for 24 hours. It is very important not to let the battery sit for an extended period without a charge and the BLS attached, because lead sulfate will build up.