ANK BATTERY

LEGENDARY POWER

MODULAR SERIES

Lithium Ion (LiFeP04)

Batteries for Solar Energy Storage

LEGENDARY POWER

Batteries are so ubiquitous today that they're almost invisible to us. Yet they are a remarkable invention with a long and storied (and at times dangerous) history and an equally exciting future.

1800

BIRTH OF THE BATTERY

The first battery was invented in 1800 when Alessandio Volta created a device known as a 'voltaic pile'. His invention would undergo various improvements in the early days of its existence.

1859

IMPROVEMENTS

French scientists created what is today considered the 1st rechargeable lead-acid battery. More than a century and a half later, this battery is still in use and is the preferred chemistry for engine starting applications.

1912

A BRIGHT IDEA

The idea of a lithium-based battery was born in labs. It would take 60 years of hard work until the idea would become a reality.

1970

BIRTH OF LITHIUM

The first primary (non-rechargeable) lithium cell hits the market.

1991

FIRE!

In 1991, Sony introduced a lithium-ion laptop battery, marking the beginning of a turbulent era for the fledgling lithium-ion battery industry. Cameras, vaporizers, cell phones, airplanes and more were part of a drum roll of recalls for safety reasons. This made it clear that a technological breakthrough would be required for a sustainable lithium-ion future.

2004

BREAKTHROUGH

In 2004, a team of researchers led by Professor John Goodenough discovered that adding nano-particles of iron and phosphate to the internal plating stabilized the battery's chemical reaction. These chemical changes proved to be the breakthrough needed to transform a volatility-beleaguered battery into the battery of choice for safe, reliable and long-term energy storage. The new additive was quickly adapted and dubbed 'Lithium-Iron Phosphate', now known as LiFeP04.

ARK BATTERY

2017

THE ARK BATTERY

ARK Battery sets sail on a journey to research and develop a solar energy battery solution for off-grid Amish communities in East Central USA.

ARK BATTERY

LEGENDARY POWER

WHERE WE COME FROM

In 2017, ARK Battery embarked on a journey to research and develop a solar energy battery solution for off-grid Amish Communities in East Central USA. As a team of off-grid solar system installers, ARK Battery's founders realized that a dependable, maintenance-free battery was the missing link in making renewable energy systems smooth and reliably autonomous. Little did we know how daunting our task would be!

NETWORKING

Relationships are priceless at ARK Battery and from the start, we have made it our top priority to network with reputable professionals to help us design and build the best LiFePO4 solar battery. Today's battery market features many suppliers that source their batteries from a myriad of suppliers on Alibaba.com or similar websites and slap on their own logo to form their 'battery company'. This leads to potential dangers such as a low-amperage BMS (or no BMS at all), batteries labeled as 'LiFePO4', but containing other, less stable lithium chemistries, 'B' grade cells, bad connections, undersized cables and insufficient balancing. Poorly constructed batteries are a fire-hazard! More than 1,500 factories and corporations offer lithium-related services, but only a few offer the combination of thorough, technical product knowledge, high quality and integrity. ARK Battery has joined forces with these elitists and designed a high-performance battery solution that is suitable for rigorous, off-grid cycling and ensures that our customers receive an outstanding product and performance.

PRODUCTION

Most of the components in an ARK Battery are manufactured with automated equipment to ensure consistent, high quality. Each individual cell is relentlessly tested for flaws or material deficiencies. This testing process spans 1-2 months before the cells are considered qualified for the market. In assembly-line fashion, cells are laser-welded together. Tightly secured, the BMS, monitoring device and balancer are installed, cabling and fusing are completed and finally, with the closing of the lid and one last round of testing, the battery is ready for many years of hard work.

OUR JOURNEY

Our journey has taken us on many highs and lows, across oceans and through the school of hard knocks. We have been ripped off, faced dead ends and discovered many battery components that don't work. But ultimately, our journey has enabled us to present to the marketplace a premium, long-lasting and powerful LiFePO4 lithium battery. We do not consider our journey complete and we hope that our next stop will be at your doorstep to present Legendary Power for your energy storage needs.

48V 200AH (10.2 KWH)

24V 200AH & 48V 100AH (5.1 KWH)

THE ARK BATTERY FAMILY

	ARK 512100	ARK 512200	ARK 256200
Nominal Battery Voltage	48	48	24
Actual Voltage	51.2	51.2	25.6
Amp Hours	100	200	200
KWH	5.1	10.2	5.1
LCD Display	Yes	Yes	Yes
Max Continuous Charge/ Discharge Amps	100	140	140
Breaker Size (Amps)	125	160	160
Min Temp	32°F	32°F	32°F
Max Temp	115°F	115°F	115°F
Max Charge Volts	57.6	57.6	28.8
Rcmnd Charge Volts	57.2	57.2	28.6
Float Volts	54.4	54.4	27.2
BMS Protected	Yes	Yes	Yes
Cell Chemistry	LiFe PO4	LiFe PO4	LiFe PO4
Cell Format	Prismatic	Prismatic	Prismatic
Certifications	UL 1642 & UL 1973 UN 38.3	UL 1642 UN 38.3	UL 1642 UN 38.3
Warranty	5 year full	5 year full	5 year full

Visit arklithium.com/literature for spec sheets.

ARK BATTERY FLEX RACKING

FLEX RACKING
ARK Battery Flex Racking is laser-formed from 3/16 and 1/4" steel and supports battery stacks up to seven high.

MODULAR DESIGN!
Modular design! Flex racking supports adding additional ARK Batteries to your bank down the road. The assembly hardware is included with each battery.

BASE

STACKING

RACKING WITH BATTERIES

"THANK YOU so much! I truly appreciate your availability, your professionalism, your knowledge, and especially your attitude."

JAMES I., RICHLAND, OR

WHY ARK BATTERY

SUPERIOR USABLE CAPACITY

While we recommend discharging no further than 20% state of charge, ARK Batteries can be safely discharged to 0% with only a small impact on cycle-life.
(See page 13)

FAST CHARGE/DISCHARGE

ARK Batteries can be charged in less than half the time required to charge lead acid batteries. And while rarely applicable for solar applications, a 1C charge and discharge are permitted.

LIFEPO4 BATTERIES ARE 99% EFFICIENT

Most other types of batteries have 10-30% efficiency losses (discharge power available vs. charged power)

5X THE LIFE OF MOST LEAD-ACID BATTERIES

Our LiFePO4 battery can be discharged down to 20% and still retain 80% of its original capacity after 5,000 cycles.

IMPACTIV BALANCING ADDS UP TO 30% MORE LIFE

*We are the **only** lithium LiFePO4 company in the **USA** to use IMPACTIV balancing.*

"We installed two of the 100 amp hr 48 Volt Ark Lithium Batteries and they are performing excellent. These are installed with a VFX 3648 Outback Inverter and Charge Controller with 2.3 KW of Solar."

WAYNE E., MILLERSBURG, IN

WHY ARK BATTERY

STABLE VOLTAGE

The voltage of an ARK Battery is not subject to the fluctuations seen in most other battery types when under heavy load.

LIGHT WEIGHT

ARK Batteries weigh only 30% of their lead-acid counterparts.

MAINTENANCE-FREE

ARK Batteries require no maintenance of any kind, such as equalizing or adding water.

FLEXIBLE INSTALLATIONS

ARK Batteries can be installed in an upright position or horizontally in a rack or cabinet. There are terminals on the front and back to simplify the cabling process for either position.

FIELD SERVICEABLE*

You probably won't need this one, but in the event of a battery failure, all of the internal electronic components in an ARK Battery are field replaceable. Additionally, you can stock spare parts as backup for catastrophic events such as an EMP strike.

*Parts may only be replaced with approval from ARK Battery.

SAFETY

We're not in the firecracker business. ARK Battery believes in redundant safety. We use a 5-tiered safety system to regulate and maintain your energy investment.

1: SAFE CHEMISTRY

2: PRESSURE VENTS ON EACH CELL

3: BMS MONITORING

4: BREAKER

5: SOLID STEEL CASE

TAKE A LOOK

UL 1973 CERTIFICATIONS (ARK10048)

BREAKER

CARRYING HANDLES

BATTERY RATINGS

BATTERY TERMINALS

FUEL GAUGE

Shunt-based LCD displays battery percentage, battery volts, charge/discharge amps, charge/discharge watts, and more!

CARRYING HANDLES

DOUBLE TERMINALS

Double terminals on back for cabinet installation.

DETACHABLE FLANGE KIT

Detachable flange kit for vertical installation.

EFFICIENCY

Efficiency is the name of the game. Coming from an off-grid way of life, we breathe efficiency. We have designed our batteries to be unbelievably efficient from every possible aspect.

COST EFFICIENCY

ARK Battery has the lowest cost per lifetime KWH on the market! See page 4 for a comparison of different battery types.

CELL TYPE EFFICIENCY

We use prismatic cells in all our batteries to improve overall efficiency. Our prismatic cell batteries have fewer connections, lower resistance and use less space than cylindrical cell counterparts.

BALANCING EFFICIENCY

We use a balancing system called IMPACTIV balancing that channels power back and forth between cells as needed. Traditional balancing systems dissipate (waste) power from cells with the highest voltage.

INSTALLATION EFFICIENCY

ARK Batteries are designed by installers for installers. We have implemented features such as terminals on two sides, handles, field reversible covers and much more for an easy and time-effective installation process.

SELF-CONSUMPTION EFFICIENCY

All electronic components in our battery are completely shut down when the breaker is off to reserve the power for your energy needs.

STORAGE EFFICIENCY

Most batteries have a round trip (charging power vs. available discharge power) of only 80-90%. Power is lost through charging inefficiencies, self-discharge, heat losses and other factors. ARK Batteries are nearly 100% efficient. What you put in, you can draw out!

SPACE EFFICIENCY

Our space-efficiency rule is simple; “Up instead of out.” ARK Batteries can be installed up to seven high in our racking system providing a 35kwh bank that uses a floor space of 20” x 27” using our 5kwh model. A 70kwh bank can be installed with our 10kwh models using a floor space of only 29” x 35”.

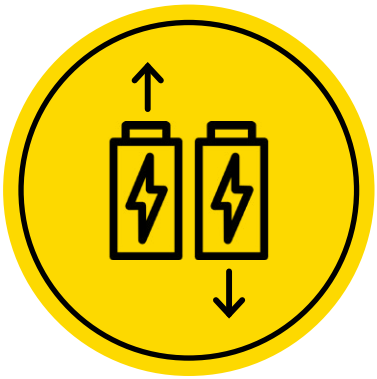
“I just want you to know that I have not been this excited about a product in a long time.”

JONNY V., GAIN SOLAR SERVICES

ARK BATTERY APPLICATIONS

OFF-GRID LIVING

GRID-TIE WITH BATTERY BACKUP



PEAK/DEMAND CHARGE SHAVINGS

EASY INSTALLATIONS

Compatible with all major inverter and charge controller brands.

Sol-Ark LIMITLESS POWER

OutBack POWER™

Schneider Electric

MAGNUM ENERGY

MidNite SOLAR, inc

victron energy BLUE POWER

We are continuing to develop programming/settings guides for ARK Battery and major inverter brands. Please contact us for availability or check for downloads at **arklithium.com/literature**

IMPACTIV BALANCING

Every ARK Battery is equipped with a special balancing system to ensure that all cells are charged and discharged equally. This serves the same purpose as 'equalizing' does for a lead-acid battery. While LiFePO4 batteries may not be equalized externally, it is critical that all cells within maintain the same voltage. An 'imbalanced' battery will result in nuisance BMS shut-offs, lower capacity and a drastically reduced cycle life.

Most batteries in today's market come with a small balancing system known as passive balancing. In passive balancing, a set of resistors begin to dissipate (burn off) power from any cell that has an individual voltage higher than 3.6V. This dissipation typically occurs at 50-100 ma (5% to 10% of 1 amp). We have found this balancing method to be ineffective to meet the stringent requirements of cell balancing. In short, it is too slow as well as inefficient.

IMPACTIV balancing, used in all ARK Batteries channels extra power from high-volt cells to low-volt cells, and deploys additional dissipative consumption should a cell reach critically high voltage.

PASSIVE BALANCING

Dissipates a small amount of power (usually $^{1}/_{10}$ Amp or less) when a cell reaches a critically high level.

IMPACTIV BALANCING

Transfers current (power) from highest cells to lowest cells to keep all cells equal.

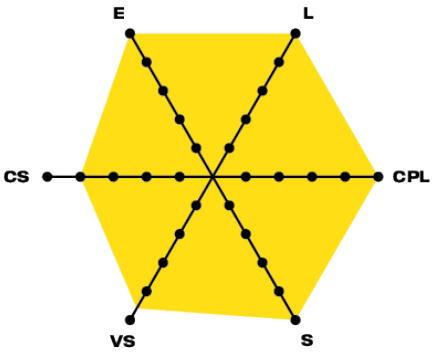
IMPACTIV balancing kicks in any time that a single cell's voltage varies from the rest of the pack. This can be a higher voltage (top-balancing during charge) or a low cell (bottom balancing, during discharge). A special extra boost is applied if a cell's voltage reaches 3.55V. Balancing is performed at up to 20 times the speed of passive balancing while maintaining a much higher efficiency and adding up to 30% to your battery life.

BATTERY COMPARISONS

This simple, yet thorough comparison of different battery types allows you to see at a glance which battery presents the best value. Comparisons are based on ratings from U.S. Battery, Full River Battery and Systems-Sunlight, respectively.

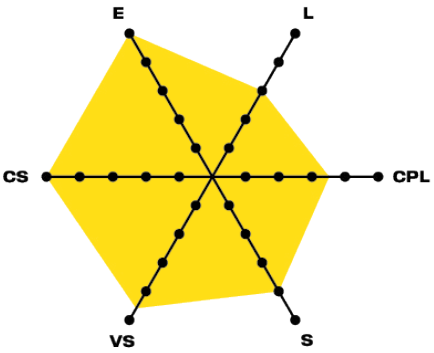
All calculations are based on cycling to 50% capacity retention for fair comparisons.

LiFePO4



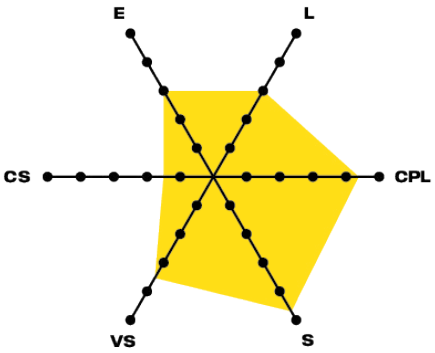
Efficiency	**5.0**
Longevity	**5.0**
Cost Per Lifetime KWH	**5.0**
Safety	**5.0**
Voltage Stability	**4.8**
Charge Speed	**4.0**

LITHIUM NMC



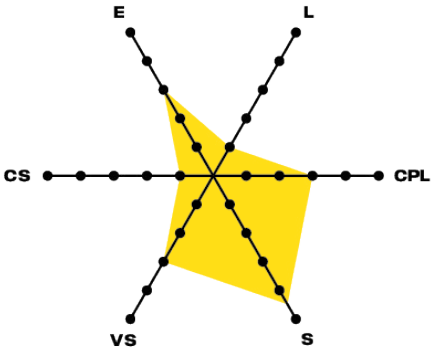
Efficiency	**5.0**
Longevity	**3.0**
Cost Per Lifetime KWH	**3.5**
Safety	**4.0**
Voltage Stability	**4.5**
Charge Speed	**5.0**

INDUSTRIAL LEAD ACID



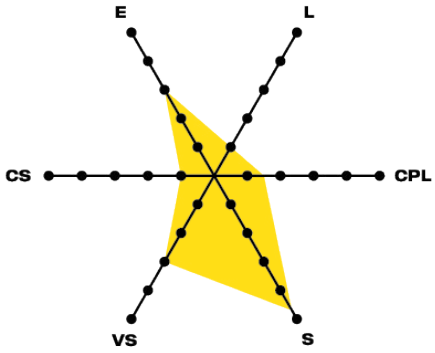
Efficiency	**3.0**
Longevity	**3.0**
Cost Per Lifetime KWH	**4.3**
Safety	**4.8**
Voltage Stability	**3.5**
Charge Speed	**1.5**

SCRUBBER (L16)



Efficiency	**3.0**
Longevity	**1.0**
Cost Per Lifetime KWH	**3.0**
Safety	**4.5**
Voltage Stability	**3.0**
Charge Speed	**1.0**

AGM

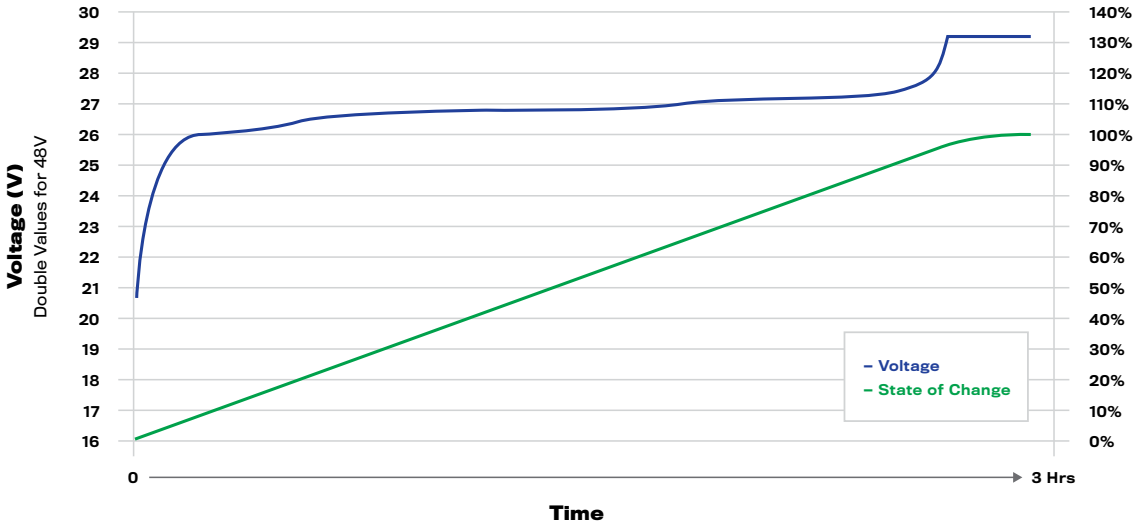


Efficiency	**3.0**
Longevity	**1.0**
Cost Per Lifetime KWH	**1.5**
Safety	**4.8**
Voltage Stability	**3.0**
Charge Speed	**1.0**

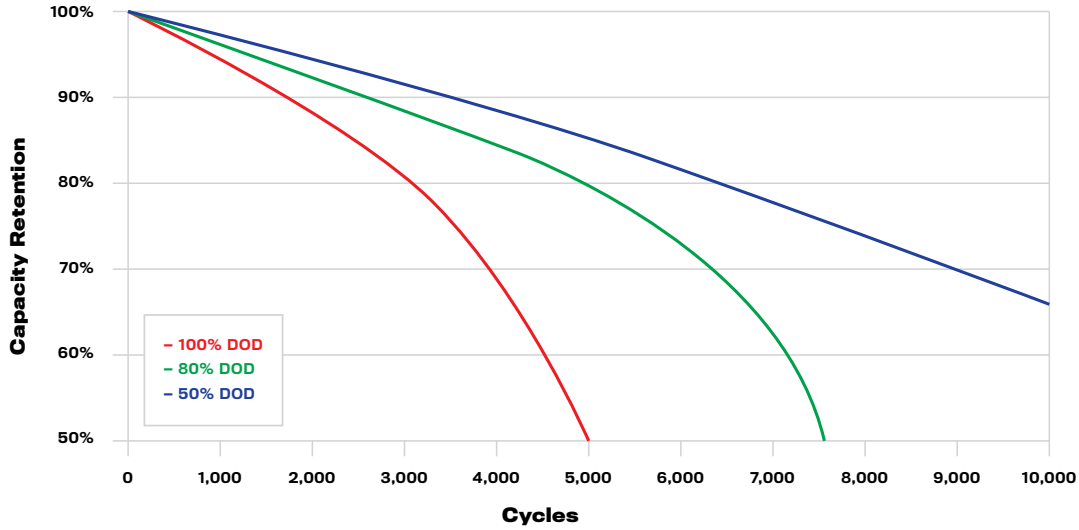
Please contact us if you would like to see a more detailed version of these comparisons. Or, check if it is available for download at **arklithium.com/literature**

BATTERY CHARACTERISTICS

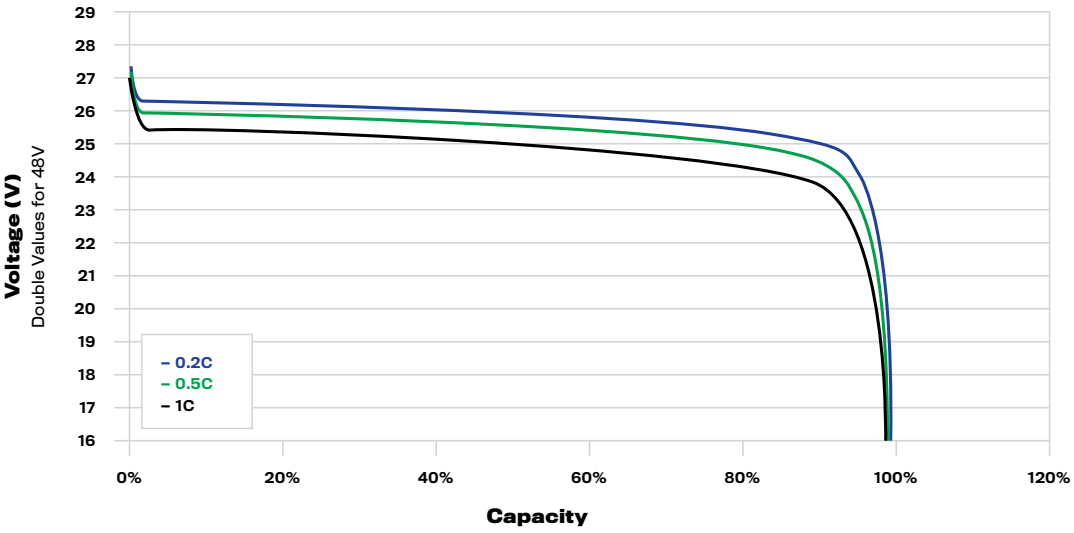
Charge Voltage and State of Charge (SOC) Charge 0.33C @ 25˚C (77˚F)



Cycle Life, Depth of Discharge (DOD) and Capacity Retention Charge/Discharge 0.5c @ 25˚C (77˚F)



Discharge Voltage Characteristics at Various Rates 25˚C (77˚F)



CASE STUDY

Residential Off-Grid Solar System

2,700 Square Feet + Basement

3.8 KW Solar
Sol-Ark 12K Inverter
14 KW Backup Generator
5 - ARK 51.2V 100AH Batteries

This System Can Power:

- Laundry
- Vacuum Cleaner
- Coffee Maker
- 4-Zone Radiant Heat System
- Bosch Mixer
- Lights Throughout
- Fridge
- Electric Bike Charging
- Clothes Iron
- Well Pump
- Freezer
- Water Softener

System Features:

- Expansion-friendly. More batteries will be added in the future.
- 2 – 2.5 days autonomy
- 15-year life design
- Maintenance-free*
- No hazardous fumes or gases

**Generator requires oil changes.*

PHOTO GALLERY

3x3, 900AH Battery Bank using the most flexible racking solution on the market

Powering a toy distribution warehouse

"Back in the sticks" getaway cabin

The system at Ark Battery facility in Sugarcreek, Ohio

1,000AH and Sol-Ark

Residential off-grid

Spoiled pups! Powering a kennel.

Mission Compound: La Source, Haiti

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