



AMPPOWER

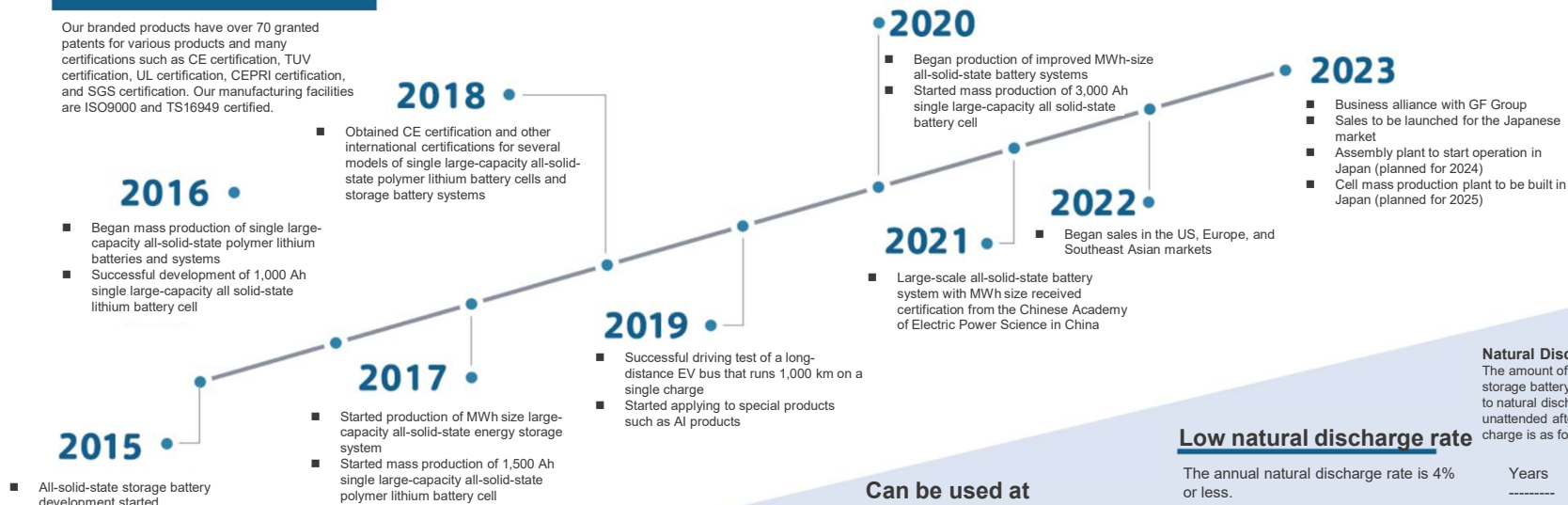
**World's first
single large-capacity
all-solid-state lithium battery**



Confidential © 2024 gf. Z Co., Ltd.

DEVELOPMENT HISTORY

Our branded products have over 70 granted patents for various products and many certifications such as CE certification, TUV certification, UL certification, CEPRI certification, and SGS certification. Our manufacturing facilities are ISO9000 and TS16949 certified.



TECHNOLOGY FEATURES

Highly safe

The internal resistance of the battery cell is less than 0.2 $\mu\Omega$, and the cell structure is solid, so there is no risk of leakage or explosion and almost no heat is generated. In addition, since the system consists only of series connections, no cooling system is required, and individual cells can be monitored and controlled after the system is formed.

Single large-capacity all-solid-state cell

We have already succeeded in commercializing and mass-producing cells with a large capacity of 3,000 Ah. Cells with various features can be developed and mass-produced according to the application.

High charge/discharge efficiency

Charge/discharge efficiency is 99% or more for 150 kWh, and 96% or more for 250 kWh and 500 kWh.

Can be used at low to high temperatures

The performance of this product, which can operate normally in environments ranging from -70 °C to 85 °C, expands the possibilities of its application.

* Rapid charging and discharging at 8 C to 10 C under -40 °C is possible, and the charge/discharge efficiency is 98% or higher.
* Can be used normally even when left in a high temperature environment of 85 °C for 7 days.
* Maintains at least 80% of normal performance at 70 °C and more than 300 charge-discharge cycles

High energy density

It has an energy density of up to 400 Wh/kg, contributing to the miniaturization and weight reduction of various products.

Long operating life

The number of possible charge/discharge cycles can be set to 11,000 or more according to the application of the energy storage system. It allows for repeated use over a long period of time.

Low natural discharge rate

The annual natural discharge rate is 4% or less.

Low degradation rate

Retains more than 80% charge/discharge performance over 20 years.

High depth of discharge

The depth of discharge is 100%. Even if completely discharged, it can be charged and discharged again, making it a reliable power source for disaster reserves.

Rapid charge/discharge

Products with C-rates up to 180C are mass-produced. Charging and discharging at ultra-rapid rates is possible.
* When a large-capacity EV charger is used to charge an electric vehicle, it can travel 500 km on a 5-minute charge.

Natural Discharge Rate
The amount of remaining storage battery capacity due to natural discharge when left unattended after a single charge is as follows:

Years	Battery level
Year 1	96.00%
Year 2	92.16%
Year 3	88.47%
Year 4	84.93%
Year 5	81.54%
Year 6	78.28%
Year 7	75.14%
Year 8	72.14%
Year 9	69.25%
Year 10	66.48%
Year 15	54.21%
Year 20	44.20%
Year 25	36.04%
Year 30	29.34%
Year 35	23.96%
Year 40	19.54%
Year 45	15.93%
Year 50	12.99%
Year 60	8.64%
Year 70	5.74%
Year 80	3.81%
Year 90	2.54%
Year 100	1.69%

Supplementary data for (4)
Remaining storage capacity
due to natural discharge

Years	Battery level
Year 1	96.00%
Year 2	92.16%
Year 3	88.47%
Year 4	84.93%
Year 5	81.54%
Year 6	78.28%
Year 7	75.14%
Year 8	72.14%
Year 9	69.25%
Year 10	66.48%
Year 15	54.21%
Year 20	44.20%
Year 25	36.04%
Year 30	29.34%
Year 35	23.96%
Year 40	19.54%
Year 45	15.93%
Year 50	12.99%
Year 60	8.64%
Year 70	5.74%
Year 80	3.81%
Year 90	2.54%
Year 100	1.69%

Supplementary data for (8)
Power Conversion Efficiency by
Capacity

150kWh: 99% or more
250kWh: 98% or more
500kWh: 98%

(1) Highly safe

The internal resistance in the cell is very stable at **0.2 $\mu\Omega$ or less**. The cells generate little heat and can be stored safely and reliably. **No cooling motor is required.**

(2) Large-capacity solid polymer cell

Not only did we develop cells with a large-capacity of **3,000 Ah**, but we also succeeded in **mass-producing** them at a low cost.

(3) Available in low to high temperatures

The performance of the battery, which can operate normally in environments ranging from **-70°C to 85°C**, expands the possibilities of storage battery applications and regions where they can be used. The discharge rate at **-40°C** is 98% compared to the discharge rate at room temperature.

Supplementary data for (3)
Discharge rate at each temperature relative to discharge rate at room temperature
-40°C: 98%
-50°C: 95.55%
-60°C: 87.16%
-70°C: 77.43%

(4) Low natural discharge rate

Annual **natural discharge rate is 4% or less**. Even without any charging or discharging, it can retain 66% or more of its performance over 10 years, making it suitable for disaster prevention equipment.

(5) Long life

Cell degradation rate is **20% or less over 20 years**. The system can be charged/discharged **more than 11,000 times** at full charge/discharge. If a lower depth of discharge is used, the system can be used **more than 20,000 times**.

(6) High energy density

The **cells alone have an energy density of up to 400 Wh/kg**. In particular, the energy density as an energy storage system is very high.

Supplementary data for (6)
Energy Density by Main Application
◆ Batteries for passenger car (Assumed 300 to 1,000 km)
Energy density = 250 to 300 Wh/kg
System energy density = 208 to 250 Wh/kg
◆ Batteries for taxi (5-minute quick charge)
Energy density = 120 to 150 Wh/kg
System energy density = 110 to 130 Wh/kg
◆ Batteries for bus and heavy truck
Energy density = 190 to 210 Wh/kg
System energy density = 160 to 185 Wh/kg
◆ Batteries for aircraft
Energy density = 200 to 330 Wh/kg
System energy density = Max. 300 Wh/kg
◆ Storage battery system
System energy density = 160 to 185 Wh/kg

*With an energy density of 377.55 Wh/kg, the battery is used in special robotics and space applications.

(7) Rapid charge/ discharge

The maximum C-rate is **180C**, which allows **charging and discharging at ultra-rapid rates**.

*Portable small batteries are usually rated at 1 C. 180 C is for special products.

(8) High power conversion efficiency

The power loss created by the internal resistance of the storage battery when using the stored electricity is very small, and the effective capacity is very large. (**99% or more for 150 kWh**)

(9) High depth of discharge

The **maximum depth of discharge is 100%**, allowing for full discharge and charging, so that even if the battery has not been charged for a long time, it can still be used well.

APPLICATION AREAS

Can be produced to order according to customer needs



APPLICATION AREAS

Successfully mass-produced and commercialized in North America, Europe, and China.



Conventional lithium battery



* The value of each item may vary depending on the specifications.

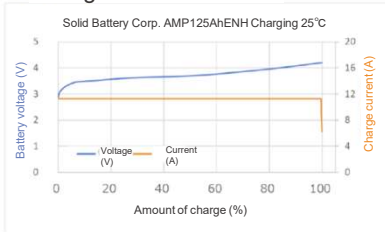
	Conventional lithium battery	All-solid-state
Electrolyte	Liquid	All-solid-state
Safety	Risk of liquid leakage, heat generation, and ignition	No liquid leakage, no heat generation, no ignition
Capacity per cell	30 Ah	3,000 Ah (100x)
Energy density	100 to 200 Wh/kg	200 to 400 Wh/kg (2x)
Self discharge rate	4 to 5% per month	Less than 4% per year (1/10)
Operating temperature	-20°C to 60°C	-70°C to 85°C
C-rate	10	180 (18x)
Internal resistance	0.17 mΩ	0.0002 mΩ or less (1/850)
Life span	10 to 15 years	20 to 30 years (2x)
Charge/discharge cycle	3,000 to 5,000	11,000 (2x)
Charge/discharge depth	30% to 80%	0% to 100%
Cooling device	Required	Not required
System utilization rate	50% to 60%	More than 98% (2x)

Cell Evaluation Report

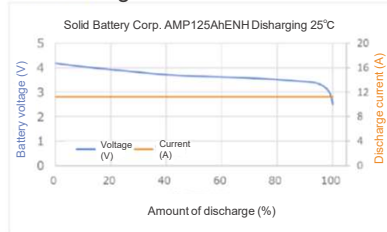
The cell performance evaluation by EXIO Group (TSE 1951) conducted on April 28, 2023 is as follows. This cell is used in the AMPJC 7.5KWH household storage battery system.

Battery Overview		
Battery type	Lithium storage battery	
Manufacturer	Solid Battery Inc.	
Valuation object	Single-cell battery	Model No. AMP125AhENH
Results Ambient temperature: 25 °C, Humidity: RH 40%		
Battery capacity (Ah)	136	
Discharge power (Wh)	502	
Charging/discharging efficiency (%)	98.5	
Self-discharge current (C)	427	
Specific energy (Wh/kg)	200	
Energy density (Wh/l)	8.0 x 10 ⁻⁵ or less (=10 mA)	
Size (mm) *excluding tabs	W:260 x D:476 x H:9.5 (=1.176 l)	
Weight (kg)	2.50	
Charging conditions 1 C = 125 A		
CC-CV: 0.09 C 4.2 V	End of current: 0.05 C	
Discharging conditions		
CC: 0.09 C	End of voltage: 2.50 V	

Charge characteristics



Discharge characteristics



AMPOWER's large-capacity solid polymer lithium batteries are highly regarded for their energy density, cell capacity, and ultra-low temperature characteristics that far exceed those of conventional mass-produced batteries. It was included in China's National Science and Technology Achievement Database in 2018 by the Ministry of Industry and Information Technology (MIIT) and its specific contents are available on the China's National Science and Technology Achievement website.



ISO9001 Certification

TS16949

CE Certification

Quality Management System Certification



China Electric Power Research Institute (CEPRI)



BO300AhN



BO750AhM



BO1100AhF



9070140

Ultra-low temperature battery cell



370Wh/kg

Evidence of energy density



30255165

Evidence of 180C rate



BO100Ah

■ CCIC Certification Report

Cells produced at AMPOWER Group's Shenzhen factory undergo various inspections by CCIC, an international third-party certification organization, and are constantly subjected to rigorous performance evaluations by third parties.

强制性检测报告

一、B0300AhN 试验报告

1. B0300AhN 试验报告编号 QU17E11BA3001.....	05
2. B0300AhN 试验报告编号 QU17E11BA3002.....	08
3. B0300AhN 试验报告编号 QU17E11BA3003.....	28
4. B0300AhN 试验报告编号 QU18E11BA3001.....	41
5. B0300AhN 试验报告编号 QU18E11BA3002.....	48
6. B0300AhN 试验报告编号 QU18E11BA300.....	68

二、B0500AhF 试验报告

1. B0500AhF 编号 QU16E11BA5001.....	81
2. B0500AhF 编号 QU16E11BA5002.....	88
3. B0500AhF 编号 QU16E11BA5003.....	108
4. B0500AhF 编号 QQU17E11BAP011.....	118
5. B0500AhF 编号 QQU17EP1BAP011.....	127
6. B0500AhF 编号 QU18E11BA5001 (2018. 12).....	147
7. B0500AhF 编号 QU18E11BA5002 (2018. 12).....	154
8. B0500AhF 编号 QU18E11BA5003 (2018. 12).....	174

三、B0750AhM 试验报告

1. B0750AhM 编号 QU18E11BA7504.....	191
2. B0750AhM 编号 QU18E11BA7502.....	198
3. B0750AhM 编号 QU18E11BA7503.....	218
4. B0750AhM 编号 QU18E11BAP032.....	231
5. B0750AhM 编号 QU18EP1BAP032.....	251

四、B01100AhF 试验报告

1. B01100AhF 试验报告-9991.....	260
2. B01100AhF 试验报告-9992.....	263
3. B01100AhF 试验报告-9993.....	283
4. B01100AhF 试验报告-9991 (2018. 12).....	296
5. B01100AhF 试验报告-9992 (2018. 12).....	303
6. B01100AhF 试验报告-9993 (2018. 12).....	323
7. BO-32V-1100AhF QU18E11BAP021 (2018. 12).....	336
8. BO-32V-1100AhF QU18EP1BAP021 (2018. 12).....	356

委托送检检测报告

一、能量密度电芯试验报告

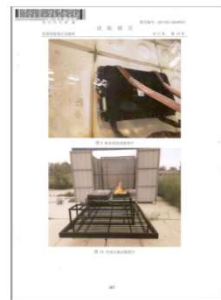
1. 编号BF-2017-4066(300Wh/kg).....	365
2. 编号BF-2017-4067(310Wh/kg).....	373
3. 编号BF-2017-4068(320Wh/kg).....	381
4. 编号BF-2017-4069(330Wh/kg).....	389
5. 编号BF-2018-4009(370Wh/kg).....	397

二、低温电池试验报告

1. BO9070140-低温电芯试验报告-编号 BF-2017-4083.....	406
2. BO9070140-低温电芯试验报告-编号 BF-2018-4005.....	416
3. BO18800435F-低温电芯试验报告-编号-BF-2018-4006.....	426

三、倍率电池试验报告

1. 30255165-倍率电芯试验报告-编码-BF-2017-4084.....	434
2. BO18800435F-180能量密度-编号-BF-2018-4034.....	442
3. BO100Ah-80C高倍率-编号-BF-2020-4013.....	455



■ CE Certification Report (example)

AMPOWER Group cells are also CE certified.

