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We create high power energy

KSB

KOREA SPECIAL BATTERY CO., LTD.

Company Introduction

Korea Special Battery Co., Ltd. is a defense company which develops and produces batteries for the submarine and torpedo.

The key products of company include lead-acid batteries for 209 class, 214 class, 3000 ton class submarines and silver oxide batteries for heavyweight torpedo (White Shark, SUT/ SST4) and lightweight torpedo (Blue Shark). We produce lead-acid batteries (SG battery) which are proper for storage of renewable energy for civilian consumption. We are planning to manufacture a cell system and pack system.

We make efforts in developing new weapon systems with our own technologies and technical cooperation with world famous battery manufacturing companies. In connection with a government and government-funded research institutes, we are focusing on the development of batteries related to the renewable energy.

As a leading company for the defense and renewable energy industries, Korea Special Battery Co., Ltd. will be a leading company and play a critical role in the field of special batteries.

Greetings

We have a slogan "Korea Special Battery Co., Ltd constructs a new weapon system for underwater vehicles and becomes a leader in the renewable energy/system industries, thus contributing to the social development of the nation." and challenges the bright future.

With selection and concentration R&D, establishment of foundation for sustainable growth and construction of creative organizational culture, transparent management system, we will make all efforts in meeting the demands of the market. We will also promise that we will do our best as a leading company in defense and renewable energy industries.

Thank you

Members of Korea Special Battery Co., Ltd.

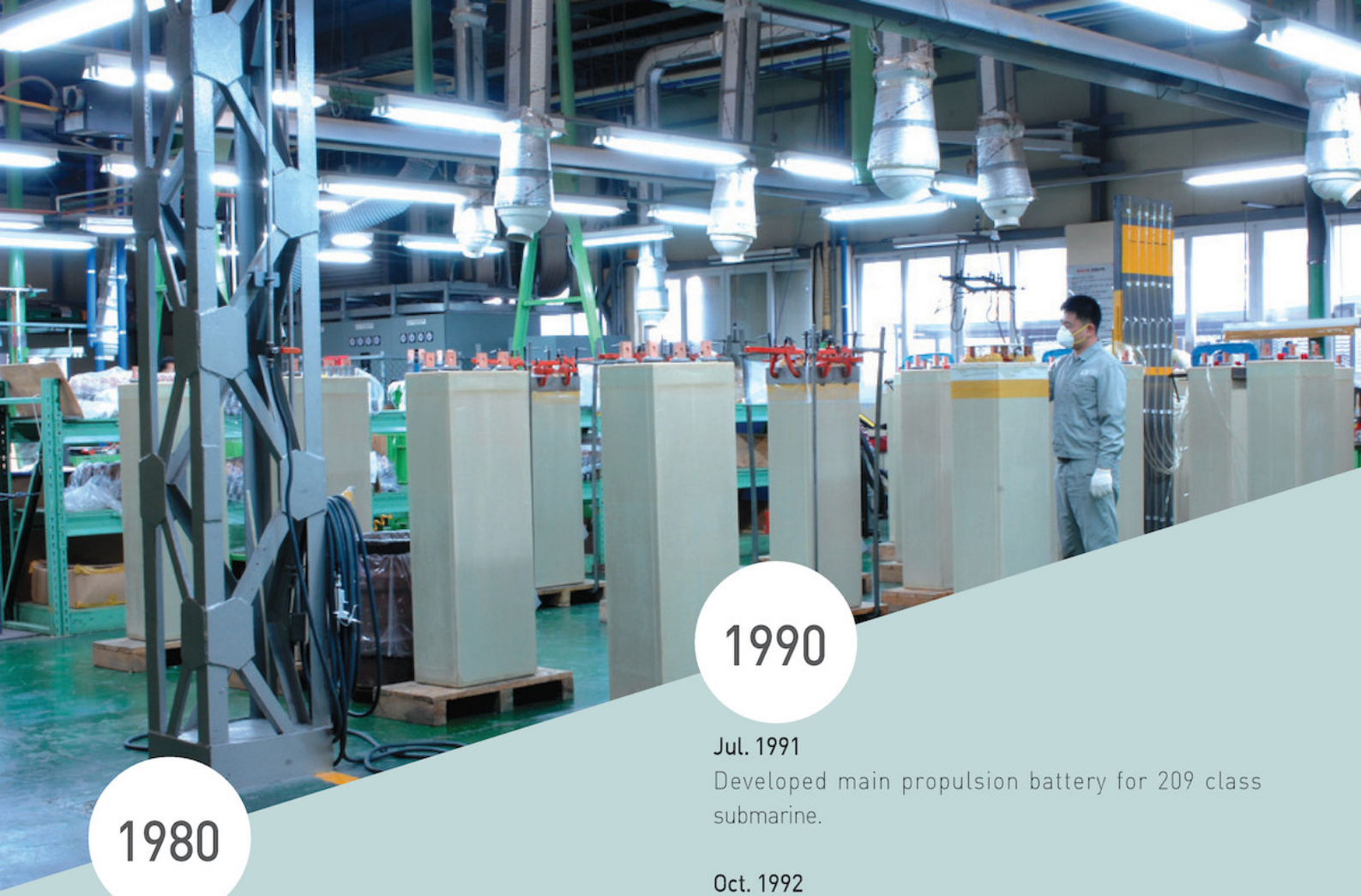
1960

Jul. 1961
Jinhae Battery plant was established.

1970

Sept. 1978
Changed the corporate name to Sebang Global Battery Co., Ltd.

HISTORY OF COMPA



1980

Jun. 1980
Developed a lead-acid battery for midget submarine (Dolphine Class).

Jul. 1988
Technical tie with HAGEN of Germany.

1990

Jul. 1991
Developed main propulsion battery for 209 class submarine.

Oct. 1992
Technical tie with SAFT of France

Mar. 1997
Sebang Global Battery Co., Ltd. splited off the special battery department.

Aug. 1997
Obtained certificate of R&D center from the Korea Industrial Technology Association.

Nov. 1997
Designated as a defense company (Ministry of Communication and Industry)

Dec. 1997
Developed the gel type maintenance free sealed lead -acid battery (SG) for solar power.

Jun. 1998
Developed the silver oxide-zinc battery for heavy weight torpedo (White Shark).

2000

Aug. 2001
Developed silver oxide-aluminum battery for lightweight torpedo (Blue Shark).

Dec. 2001
Developed the silver oxide-zinc battery for heavyweight torpedo (SUT/SST4).

Nov. 2003
Technical tie with GERMANOS of Greece.

Jun. 2004
Developed main propulsion battery for 214 class submarine.

2010

May 2011
Changed the company name to Korea Special Battery Co., Ltd.

Aug. 2015
Developed main propulsion battery for Jangbogo - III (Batch-I) submarine.

Oct. 2015
Acquired DQ mark for battery for 209 class submarine battery (from Defense Agency for Technology and Quality)

Aug. 2016
Developed a BMS(Battery Monitoring System) for Jangbogo-III (Batch-I) submarine

Certificates & Intellectual property rights

Certificates

1) Certificate of Research Center, President of Korea Industrial Technology Association, No. 19971373, Aug. 1, 1997
2) Certificate of new technology, Ministry of Science and Technology. No. 1142, Dec. 6, 2001
3) Certificate of innovative SME (INNO-BIZ): SMBA, No. 6011-2370, Nov. 15, 2006
4) Certificate of environmental mark, Korea Environmental Industry Technology Institute, no. 4950, Apr. 20, 2007
5) Certificate of company of renewable and recycling energy, Ministry of Commerce, Industry and Energy, No. 2007-1613, Nov. 29, 2007
6) KS Q ISO 9001 : 2009/ISO 9001 : 2008, 2011.09.30. Sept. 30, 2011
7) KS I ISO 14001 : 2009/ISO 14001 : 2004, 2011.09.30. Sept. 30, 2011
8) Certificate of DQ mark, Defense Agency for Technology and Quality, DTaQ-CDQ-28, battery type (45PS13K), Oct. 22, 2015

Intellectual property rights

1) Patent No. 10-0403156, Manufacturing method of propulsion battery for underwater vehicles, Oct. 2003
2) Patent No. 10-0462724, Propulsion apparatus for Torpedo, Dec. 2004
3) Patent No. 10-0747626, Fabrication method of zinc electrode and fabrication apparatus of zinc electrode, Aug. 2, 2007
4) Patent No. 10-0779529, Silver oxide - zinc battery, Nov. 20, 2007
5) Patent No. 10-0832375, A gel electrolyte of Long Life Valve regulated sealed lead acid battery for Solar and Wind Power, Aug. 2008
6) Patent No. 10-0855507, Silver oxide-Zinc primary battery which applied the zinc mesh cathode which it treated amalgam and the manufacturing method, Aug. 2008
7) Patent No. 10-0880653, The battery for underwater self-propelled body, Jan. 2009

Others

1) Certificate of R&D (heavyweight torpedo for submarine/midget submarine), Minister of National Defense No. 308, Dec. 15, 1999
2) Certificate of R&D for primary battery for (heavyweight torpedo KPB-47), Minister of National Defense No. 386, Jan. 3, 2003
3) Certificate of R&D (cell accumulation battery K120/40SHV-1), Minister of National Defense No. 393, Jan. 3, 2003
4) Certificate of R&D (aluminum - silver oxide battery), Minister of National Defense No. 373, Oct. 21, 2005
5) Certificate of R&D (battery for 214 class submarine, Minister of National Defense No. 391, Oct. 21, 2005

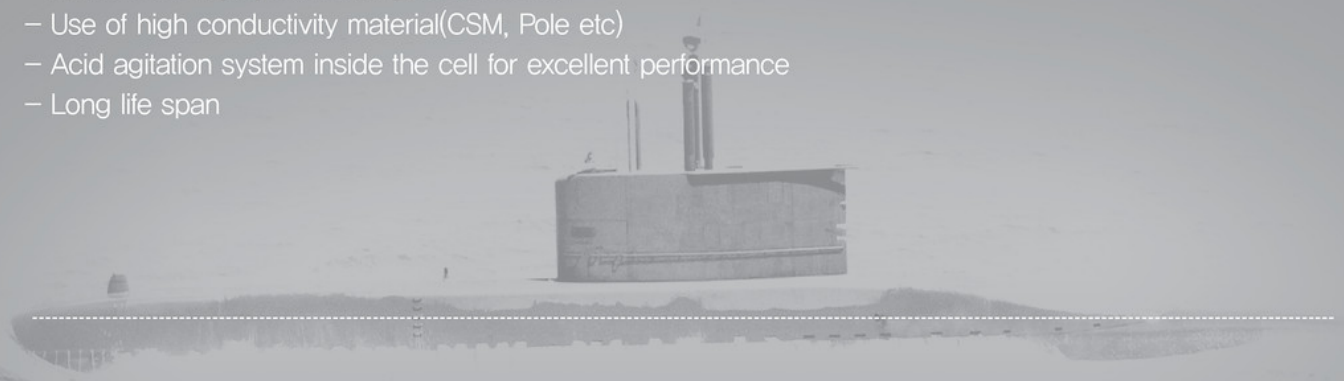
Battery for
Submarine

Propulsion batteries for submarine have

- High power density
- High reliability and safety
- High capacity
- Excellent life span

Design Features

- Single decker type
- Long positive tubular plate / CSM(copper stretched metal) Negative plate
- Very low H2 evolution during operation
- Internal cooling system with great efficiency
- Use of high conductivity material(CSM, Pole etc)
- Acid agitation system inside the cell for excellent performance
- Long life span



Main developments and productions

209 class

214 class

3000 ton class

※ Physical and Electrical properties can be changed by each customer's requirements.

Battery for Submarine

209 class

Specifications

Dimension (mm)	Length (L)	290
	Width (W)	450
	Height (H)	1,336
	Total height (TH)	1,421
Weight (kg)		517±2%

214 class

Specifications

Dimension (mm)	Length (L)	290
	Width (W)	297
	Height (H)	1,426
	Total height (TH)	1,511
Weight (kg)		350±2%

3000 ton class

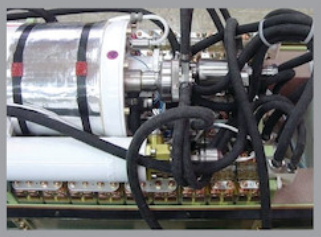
Specifications

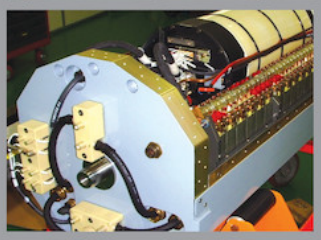
Dimension (mm)	Length (L)	324
	Width (W)	359
	Height (H)	1,449
	Total height (TH)	1,534
Weight (kg)		483±8

Battery for
Torpedo

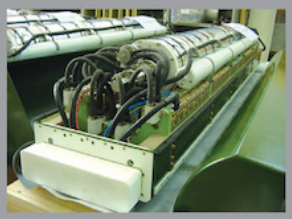
The Torpedo battery is noted for high-rate capability and high energy density because of its high electrochemical energy, the optimized design and using the excellent properties of the materials.

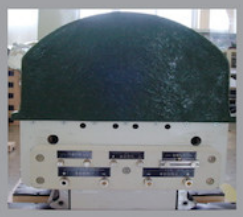
The combat battery consists of the battery cell block and activation system. it is activated within a few seconds by a fire signal, and can be used immediately. The exercise battery is possible to discharge and charge within the specified life cycles.





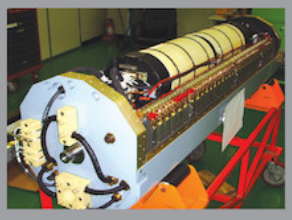
Combat battery for heavyweight torpedo (White Shark)

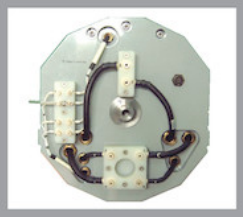




Type of battery		Silver oxide-zinc battery
Dimension (mm)	Length (L)	2,107
	Width (W)	369
	Height (H)	403
Output (kW)		100
Weight (kg)		340

Combat battery for heavyweight torpedo (SUT)





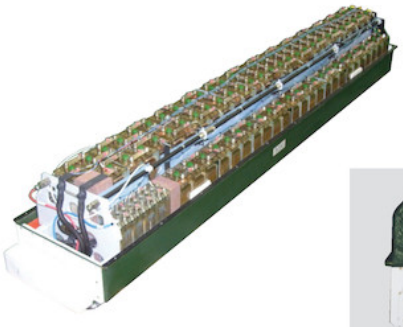
Type of battery		Silver oxide-zinc battery
Dimension (mm)	Length (L)	1,733
	Width (W)	476
	Height (H)	466
Output (kW)		100
Weight (kg)		402

Battery for lightweight torpedo (Blue shark)

Type of battery		Silver oxide-aluminum battery
Dimension (mm)	Length (L)	1,002
	Diameter (ø)	324
Output (kW)		100
Weight (kg)		100

Battery for Torpedo

Exercise battery for heavyweight torpedo (White shark)



Type of battery		Silver oxide–zinc battery
Dimension (mm)	Length (L)	2,107
	Width (W)	369
	Height (H)	403
Output (kW)		100
Weight (kg)		340

Exercise battery cell for heavyweight torpedo (White shark)

Type of battery		Silver oxide–zinc battery	
		Propulsion cell	Auxiliary cell
Dimension (mm)	Length (L)	68	24
	Width (W)	80	80
	Height (H)	170	158
	Total height(TH)	184	171
Weight (g)		1,260	518

Exercise battery cell for heavyweight torpedo (SUT)

Type of battery		Silver oxide–zinc battery	
		Propulsion cell	Auxiliary cell
Dimension (mm)	Length (L)	68	35
	Width (W)	80	80
	Height (H)	170	165
	Total height(TH)	184	178
Weight (g)		1,405	583

Battery Monitoring System

BMS

Battery monitoring system (BMS) is to regularly measure and monitor the state of the battery. It measures and controls the state of battery and puts the data into the database, thus keeping the battery at the optimal state. Korea Special Battery Co., Ltd. supplies the most suitable and reliable battery monitoring system.

Applications

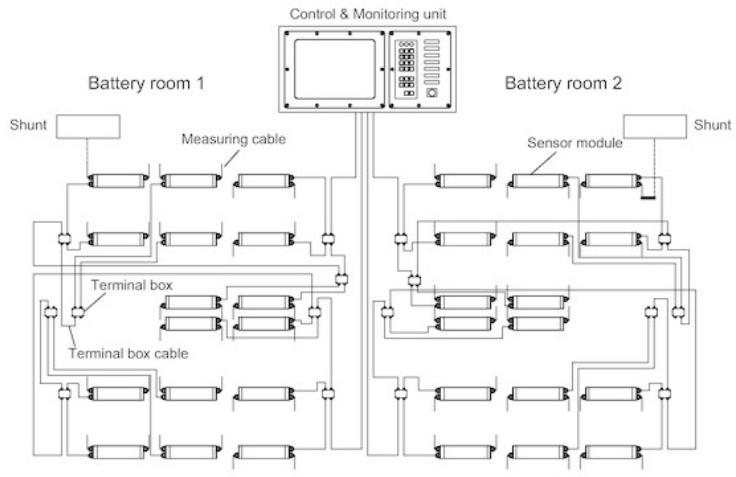
Propulsion battery for submarine/midget submarine

Battery for energy storage device

Specifications

Classification	Specification
Input power	AC115V 1Ph/3Ph, 60Hz
Consumption power	≤ 600VA
Operating temperature	IEC 60092-504 (0~55℃)
Humidity	MIL-STD-810G Method 507.5 Humidity
Shock	MIL-S-901D
EMI/EMC	MIL-STD-461F
Protection	IP23 (Control & Monitoring unit) /IP56 (Equipment inside the battery room)

System configuration



Battery Monitoring System
BMS

Control & Monitoring unit

Input power		AC 115V 1Ph/3Ph, 60Hz
Dimension (mm)	Length (L)	670
	Width (W)	300
	Height (H)	325
Weight (kg)		34
Protection		IP23

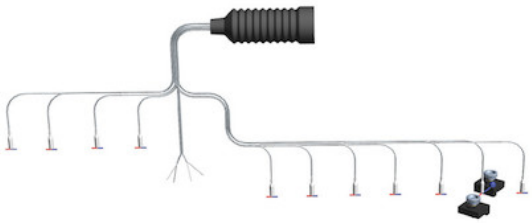
Sensor module

Input power		AC 54V 1Ph, 60Hz
Dimension (mm)	Length (L)	716
	Width (W)	122
	Height (H)	52
Weight (kg)		10
Protection		IP56
Explosion proof		Ex q [ib] II C T4

Terminal box

Dimension (mm)	Length (L)	160
	Width (W)	75
	Height (H)	56
Weight (kg)		0.6
Protection		IP56
Explosion proof		Ex e II T6

Measuring cable



Protection	IP56
Type	7 types in all
Cable	Customized cable for ship

List for monitoring

Measurements	· Voltage of each single battery cell · Acid temperature of 36 pilot cells · Current of each partial battery
Calculations	· Arithmetic average value of all cell voltages and acid temperature measurements · Extreme values of all measured cell voltage and temperature measurements with corresponding cell numbers · Power of each partial battery · Voltage of each partial battery · Charge and discharge battery capacity in ampere–hours of each partial battery
Predictions	· Residual discharging time and charging time · Residual capacity
System setup and adjustments	· Charge factors and condition factor · Date and time

Energy storage device

SG Battery

As a gel type maintenance-free sealed lead-acid battery for solar/wind power station, the battery does not require maintenance until the end of its life. So, it has completely solved the problems of maintenance and repair which were the disadvantages for the liquid type lead-acid battery.

SG(Solar-gel) battery has higher volume energy density than the other similar class lead-acid battery for the power generation by 15% ~ 20%, it is now used in the solar energy power generation system.

Applications

- Power energy storage
- Storage of power from solar power/wind power generation station
- Power of hydroelectric power plant and thermoelectric power plant
- Military / security device
- Factory automation system
- Unmanned base station
- Emergency power
- Substation power

Specifications

Type	Voltage (V)	Capacity (Ah)		Length (mm)	Width (mm)	Height (mm)	Weight (kg)
		100hr	10hr				
SG1000	2	1,000	900	210	233	679	68
SG1500		1,500	1,300	210	275	679	104
SG2000		2,000	1,750	210	275	829	129
SG3000		3,000	2,750	212	487	802	200
SG4000		4,000	3,750	212	576	802	270

Energy storage device
SG Battery

Features of Product

1. High performance and high efficiency
 · Compared with other lead-acid battery, it has better volume energy density by 15% ~ 20%.
 · Excellent deep discharge and recovery charge characters.
 · Maintains the rated capacity until the end of the lifespan.

2. Easy installation
 · Various stacks such as vertical, horizontal and multiple stacks depending on the demands of the customers are possible.
 · Compared with other batteries, it has better volume efficiency and minimized installation space.

3. Maintenance-free sealed type
 · No replenish of liquid is required until the end of the lifespan as it is a complete sealed type.

4. High reliability and safety
 · No corrosion due to electrolyte leakage and acid mist as it is a completely sealed type.
 · Pressure resistance structure which does not explode by over charging.

5. Long life cycle
 · Compared with other lead-acid batteries, it has a longer life cycle by 1.5 ~ 2 times
 · 3,000 cycles or more at 50% DOD

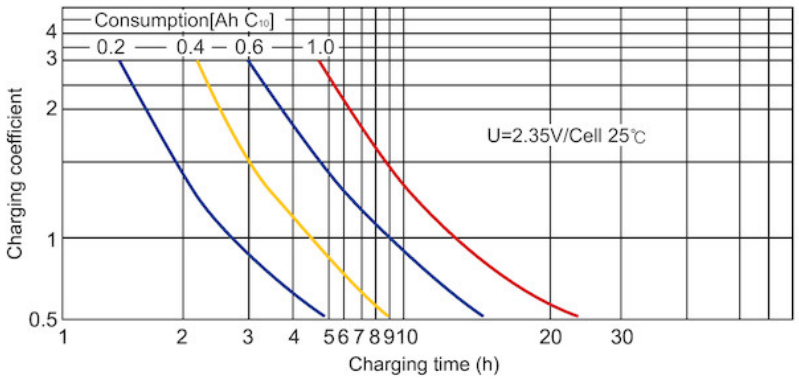
6. Wide expandability and compatibility
 · Possible to compose from small capacity to large capacity system
 · Compatible to the user's equipment

Battery Charge

▶ SG battery is charged using constant-current and constant-voltage charger for the sealed type lead-acid battery.

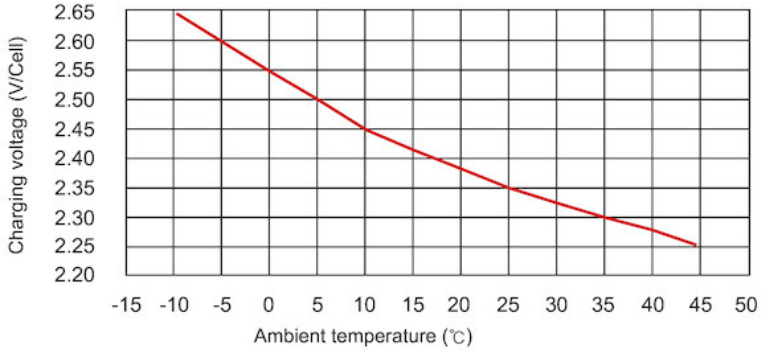
1. Setting the charging current
 · The maximum charging current for SG battery shall be applied with 1.6 x I10 (charging coefficient x 10 hour rate current).
 · The recovery charging time is subject to charging voltage and charging current as shown in the figure below.

[Time required to charge depending on the max. charging current for the depth of discharge]



2. Setting of charging voltage
 · When charging at 25℃, 2.35V/cell charging voltage is used.
 · If the temperature of the battery is out of 25℃ for long time, the charging voltage is applied to the figure below.

[Charging voltage relative to the ambient temperature]



Energy Storage System
CCESS

CCESS(Consumer Connection Energy Storage System) is an energy storage system linked to the solar energy. It is used for the area where stable power supply is needed, such as houses, small size office, building, hospital, small sized plant and electric car charging station, etc.

As CCESS is designed to store the surplus power generated by the solar energy during daytime and use that energy during peaktime, it can significantly reduce the electricity bills.

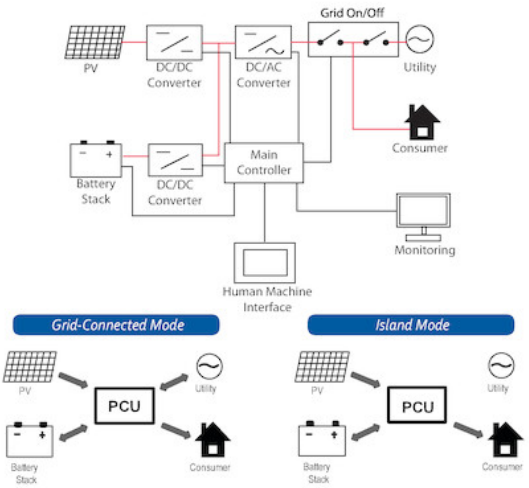
Applications

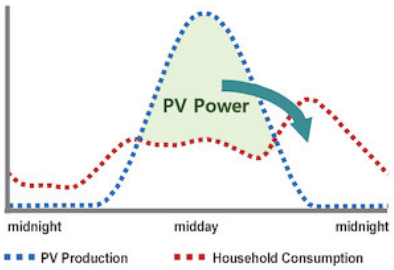
- Power energy storage
- Storage of power from solar power/wind power generation station
- Power of hydroelectric power plant and thermoelectric power plant
- Military / security device
- Factory automation system
- Unmanned base station
- Emergency power
- Substation power

Specifications

Rated capacity		14.6kWh	3kW X 4.8hr
PV input	Capacity	3.0kW	3.4kW(Max.)
	MPP Voltage	150~350VDC	450VDC(Max.)
AC output	Capacity	3.0kVA	5.0kVA(Max.)
	Voltage	220VAC/110VAC	Adjustable
	Frequency	60Hz/50Hz	Adjustable
Battery bank	Voltage	168VDC	12V(VRLA) X 14EA
	Capacity	87Ah	C10

Description of system





[Transfer of surplus power]

Energy Storage System
CCESS

Hybrid Fuel Cell System

Our hybrid fuel cell system is a high performance power supply system in which PEMFC type fuel cell and eco-friendly/high performance Ni-MH battery are combined by power management system.

When power is required at all times, the fuel cell supplies power and surplus power is stored in the Ni-MH battery. During the peak time, fuel cell and Ni-MH battery supply power thus improving the efficiency of the fuel cell system and significantly saving the initial installation cost. In addition, the Ni-MH battery plays a role as a starter of the fuel cell system and an auxiliary power for malfunction thus saving start time and assuring excellent operation stability.

Applications

- Auxiliary power for ship and emergency power generation equipment
- Emergency power generation equipment for building
- House fuel cell system
- Emergency power equipment for communication base
- UPS system for individuals or servers
- Other auxiliary power

Specifications

Type	Capacity	Fuel	Output voltage	Output frequency	Efficiency
KSBS-A-0001~10	1 ~ 10kW	Hydrogen(99.99%)	220Vac	60Hz	〉35%

Features of product

1. Excellent initial starting
   - The initial stabilization time is not required due to the battery parallel operation.

2. High performance, high efficiency and high reliability
   - Highly reliable monitoring/control system with MICOM built-in PMS control circuit.
   - Highly efficient system with the application of fuel cell Maximum Power Point Tracking control algorithm.
   - Use of high energy/high output density Ni-MH battery
   - Inverter built-in DSP type ensures a pure sine wave output of high stability, high quality and high output capacity.

3. . Improved output characteristics and long life cycle
   - The fuel cell improves the fuel cell output characteristics and realizes the long life cycle.

4. Eco-friendliness
   - Use of eco-friendly Ni-MH battery which does not contain heavy metals

5. Stability
   - Automatic power shut-off in case of short circuit, over voltage, overload or overheating.

6. Perfect maintenance and repair
   - Easy-to-install and repair design
   - Use of maintenance-free sealed type battery

7. User centered system design
   - Provision of working information of each component of the system through front side LCD/LED panel
   - Provision of RS232 interface for monitoring/control of internal fuel cell

KSB

KOREA SPECIAL BATTERY CO., LTD.

780 Ungnam-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do 51552, Korea
Tel : +82-55-239-5800 / Fax : +82-55-275-5529
E-mail : sht@ksbatteries.com
www.ksbatteries.com