



*Introducing Hyper Lead Acid  
Battery Technology*

In many parts of the world, the on-grid power supply is unreliable with frequent power outages.

In these regions, businesses depend on battery solutions for backup power. However, due to frequent power outages in some regions, batteries are cycled regularly and are required to recharge quickly because you never know when the next outage will be. This is why Def-Con 5 (DC5) batteries in collaboration with NS-Cell Hyper System developed the highest performing Hyper Lead Acid batteries in Malaysia.

DC5 Hyper lead acid batteries are designed with PSoC compatibility, which delivers high charging efficiency and more than three times as many cycles as standard deep cycle batteries. This results in a more reliable power supply and a decrease in the cost per cycle. Our Hyper lead acid battery products are available in multiple options: e.g: front terminal, top terminal or customize to customer requirement.

The batteries are designed for various applications, including renewable energy, tele-communication, backup power and others.

**DEF-CON 5**



## **HYPER LEAD ACID BATTERIES ARE DESIGNED FOR REGIONS SUFFERING FROM FREQUENT POWER OUTAGES**

DC5 Lead Acid batteries are designed to recharge much faster than standard AGM batteries. This is particularly important in regions that don't get enough on-grid power. Hyper Lead Acid batteries have a design floating life of over 20 years at 20°C (68°F) and offer more than 2,000 cycles at a depth of discharge of 50% (DOD).

A Hyper Lead Acid battery is built with premium sealed lead-acid chemistry with added Nano-Tech ingredients to the negative electrodes. The nano-tech material components do not change the basic electrochemistry of the battery, but rather increase power and minimize sulfation, which is a chemical reaction that occurs during charging cycles. Sulfation causes ordinary lead-acid batteries to fail and that's not something to worry about with Hyper lead acid batteries.

DC5 nano-tech additives are specially engineered to enhance charge acceptance and endurance in a partial state of charge. Our technology also utilizes a higher compression which keeps the active mass in position for harsh servicing conditions.

The improved cyclic performance and fast recharging capability make DC5 Hyper lead acid batteries the perfect choice for telecom backup, electric vehicles (EV), energy storage, renewable energy and hybrid genset applications.

**DEF-CON 5**



# What is Def-Con 5 Hyper Lead Acid Batteries

Introduction: Growing demand for batteries on a global scale

Due to the rapid development of the industry, the application of batteries in transportation, communication, power, military, aviation, marine, commercial facilities as well as in the daily needs of users has become more extensive.

The performance of conventional lead based batteries is not optimal

Because of its inherent structural characteristics, traditional lead-acid batteries suffer from plate sulphation, active material loss, high water loss rate, serious acid pollution, poor low temperature performance, short life cycle, poor transport safety and other flaws. In order to overcome the structural weaknesses in lead-acid batteries, gel electrolyte has been used as replacement in gel batteries. Although it reduces acid mist, reduces water loss rate and self-discharge rate, and improves the discharge performance, it raises new problems such as poor penetration of the gel material, weak compatibility with the AGM separator and a slow reaction to the electrodes.

## By its unique technology DC5 Hyper Lead Acid batteries have a high performance

To overcome the fundamental flaws of the lead-acid, AGM and gel batteries, we instead recommend the newer and superior Hyper Lead Acid Batteries, which are ideal products to replace lead acid, AGM and gel batteries.

In line with the industrial development trend of the 21st century, Hyper Lead Acid batteries pioneered the new concept of environmentally friendlier Nano-Tech negative plate design, and marked the iconic innovation of battery technology. The excellent properties of Hyper Lead Acid batteries is well received in many countries and has successfully entered markets in Southeast Asia, Africa, the Middle East, Europe, Australia and other international markets. They are widely used in solar energy, wind energy storage systems, telecommunications, power supply / power stations, railway passenger cars, electric vehicles, beacon signal indicators and other fields. This new type of environmentally friendly product is rapidly blending into the consumer lifestyles of many industries and is widely accepted by institutions and individuals.

The proprietary technology found in Hyper Lead Acid batteries uses a special advanced technology negative nano plate formula, developed to completely replace traditional regular sulphuric lead acid batteries. This in turn improves the product's application and safety performance. The electrical properties of the battery are consistent and achieve high reliable performance + longer life. It effectively overcomes the disadvantages of plate sulphation, active material loss and water loss rate, has good low temperature and overcharge performance, and greatly improves product life

*Hyper Lead Acid batteries have longer a longer cycle-life.*

If you take the battery's 'end of life' to be the point at which it can only be charged/discharged to 80% of its original capacity, a Hyper Lead Acid battery will last for 6000 cycles at 30% DoD daily – compared to 1300 – 1400 cycles at 30% DoD for VRLA-types and 800 cycles at 30% DoD for flooded batteries.

*Hyper Lead Acid batteries are better at sitting at partial states of charge (PSOC).*

Ordinary lead type batteries work best and last longer if they follow a strict 'full charge'-'full discharge'-'full charge' regime; they do not respond well to being charged at any state in between full and empty. Hyper Lead Acid batteries are happier to function in the more ambiguous charging regions.

*Hyper Lead Acid batteries use Hyper Active Nano-Tech Materail negative electrodes.*

Nano Tech batteries use a standard lead type battery positive electrode and a Nano-Tech Material for its negative electrode. This Nano-Tech electrode is the key to the longevity of the Hyper Lead Acid batteries. A standard lead-type electrode undergoes a chemical reaction over time from charging and discharging. The Nano-Tech negative electrode reduces corrosion on the positive electrode and also helps to inhibit sulphation for the negative electrode, which in turn leads to longer life of the electrodes itself which then leads to longer lasting batteries (up to a 20 year max design life, or around 10 years daily real world life for most typically average solar farm).

### Hyper Lead Acid batteries have faster charge/discharge rates.

Standard lead-type batteries have between maximum 5-20% of their rated capacity charge/discharge rates meaning you can charge or discharge the batteries between 5 – 20 hours without causing any long term damage to the units. Hyper Lead Acid have a theoretical unlimited discharge rate and a fast charge rate also.

### Ultra High Charge vs Discharge Efficiency Level.

Standard lead-type batteries usually have around a 50% charge vs discharge efficiency, so for every 1000w of solar / generator charge power you put into the battery (per hour) 50% of that is retained and 50% is wasted. Over a day, week and year this equates to ALOT of wasted energy with standard lead acid / agm / gel batteries. In turn a Hyper Lead Acid battery operates typically between 90-92% charge vs discharge efficiency rating. This means for every 1000w of solar / generator charge power you put into the battery (per hour) then 90% of that is retained and only 10% is wasted. Over a day, week and year this means a HUGE amount of savings, especially if some of your charging power was coming from running a petrol / diesel generator (which are not cheap to run for long periods).



## Applications

Hyper Lead Acid batteries can be used in a wide range of applications where lead acid, Lead Gel batteries or AGM Batteries are used today, including, but not limited to:

- Telecommunications, Communications Exchange and Transmission Systems
- UPS Uninterruptible Power Supply, PABX and Microwave Relay Station
- Radio and Broadcasting Stations
- Power Plants and Transmission Systems
- Emergency Lighting Systems
- Railway Signal, Beacon Signalling System
- Solar Energy, Wind Energy Storage Systems
- Hotels, Auditoriums and other Applications
- Fish Finder, Boat, Electric Motors



## Advantages summarised

Compared to mainstream rechargeable industrial batteries like lead acid, lead gel and AGM batteries, Lead Carbon batteries perform as follows:

- Hyper Lead Acid batteries can be charged faster
- Hyper Lead Acid batteries can be discharged deeper (even to 100% DOD !)
- Hyper Lead Acid batteries can be charged below 7 degrees Celsius
- Hyper Lead Acid batteries can be cycled more often (2400 @ 80% DOD)
- Hyper Lead Acid batteries have ultra low gassing (only if over-charged)
- Hyper Lead Acid batteries can be used in a partial state of charge
- Hyper Lead Acid batteries can be stored for 1.5 years without top-up charging
- Hyper Lead Acid batteries require no special ventilation or cooling
- Hyper Lead Acid batteries are the most sulphation resistant batteries available today.
- Hyper Lead Acid batteries do NOT have risk of fire or explosion (unlike lithium batteries)
- Hyper Lead Acid batteries do not release any harmful, dangerous or poisonous gasses during normal charging / discharging usage.
- Hyper Lead Acid batteries will not leak any harmful or dangerous acid during normal charging / discharging usage.
- Hyper Lead Acid batteries do not require an active BMS system to protect & balance them (unlike lithium batteries do).
- Hyper Lead Acid batteries do NOT suffer from Liquid / GEL drying out inside the battery like normal AGM and GEL batteries do.
- Hyper Lead Acid batteries are one of the most ABUSE TOLERANT / RESISTANT batteries in used today
- Hyper Lead Acid batteries can easily be retrofitted (retro-fitted) to 95% of applications that use existing lead acid, agm / gel batteries already today.
- Hyper Lead Acid batteries have an operating temperature from +2 to +40 degrees Celsius

### Technical specifications

Hyper Lead Acid batteries are a range of new products that were successfully developed based on existing batteries (but aimed to be much better and longer lasting). It has better performance characteristics compared to a conventional batteries and is the result of new technical breakthroughs. The fundamental issues of serious lead acid battery acid pollution, electrode sulphation, short life cycle, poor low temperature performance and other flaws are resolved, setting a high standard of "efficiency, safety, and long-life".

### **Structure characteristics:** Special Electrolyte Composition

A unique complex technology of Nano Tech Material is used to synergize a much longer life and higher efficiency internal Anode (negative) advanced plate technology, thereby optimizing the reaction between the electrolyte and the active electrode material, effectively preventing sulphation problems / issues (supporting true PSOC - Partial State of Charge) and extending its service life. The electrolyte within the battery internally re-combines giving no leakage, making the battery safe and reliable. The battery may be installed using in a variety of orientations, making it easy to use. This opens a wide range of installation applications, since the risk of electrolyte leakage is eliminated. This reaction also improves the products safety making it less harmful to installers and users alike.

### Safety Valve

A safety exhaust valve is used that has high sensitivity, and can open or close according to the internal pressure change of the battery. Safety valves are made of corrosion-resistant, anti-aging special rubber composite, which can retain the air-tightness and liquid-tightness of batteries with long-term use and constant open and close valve pressure. The internal pressure of the batteries is maintained at optimal safety range.

### Sealing Performance

Battery compartment and cover are seals made of rubber rings and terminals that are dual-sealed. A sealing material that has small shrinkage is used to ensure that the terminal seals well.

### Hyper Lead Acid Working Principal

It forms a new active center in negative electrode by adding Nano-Tech Materials, that can reduce lead deposition over-potential, the lead sulfate will be translated into lead more easily. Growing up of lead sulfate can be suppressed efficiently through this technology.

When discharging, the positive and negative active material reacts with the acidic element of the electrolyte and becomes lead sulphate and water, causing the acid density to decrease. When charging, the acid that concentrated in the positive discharge material (during discharge cycles) is released back into the electrolyte. At this time the lead sulphate in the positive and negative plate transforms in to lead dioxide which causes the acid density in the electrolyte to increase.

With conventional lead based batteries, after charging or prior to charge completion, all the charging current is used for electrolyses of the moisture in the electrolyte. The positive plates release oxygen and the negative plate hydrogen gas. If the gas recombination efficiency of the battery is low, a large percentage of the gas will escape leaving less moisture in the battery after every charge. This action causes the electrolyte content to decrease due to water loss, raising the acidity in the battery and shortening the life of the battery. This is known as late charge fluid loss phenomenon.

Our Hyper Lead Acid batteries, besides the regular chemical reaction, the composite electrolyte has various additives that participate in the electrochemical reaction. This helps to inhabit the oxygen and hydrogen gas during the charging cycle increasing the batteries recombination rate. This in turn reduces the water loss during and after charging. When discharging, the lead sulphate can be totally transformed back into active material, prolonging the battery's use life.

Hyper Lead Acid batteries have a much higher electrical conductivity, heat resistant and acid resistant abilities than standard AGM on the market thanks to it's Nano-Tech Active Material - Negative Plates. This advanced Activated Nano-Tech Plate composition in combination with the AGM Technology can effectively protect the plates and prevent the active material from falling off during use. The electrolyte is completely absorbed and stored in the Nano-Tech Plate.

Since the Nano-Tech plate is completely saturated with electrolyte, no free liquid electrolyte will be present in the battery to spill or fall out during normal operations, therefore the battery can now be used in various directional positions without leaking (eg standing on it's end or side).





DEF-CON 5

**NS-cell**  
HYPER BATTERY



## General Features

- **DC 5 Hyper Lead Acid** composite negative plate, both capacitance and battery characteristics
- Long cycle life, excellent deep cycle discharge ability
- Excellent charge acceptance ability
- Optimized capability of instant high-current discharging
- Strong high and low temperature performance
- Precision sealing technology



Solar/Wind System



Lighting/CCTV System



Household ESS



Industrial/Commercial ESS



## Specification

Nominal Voltage	12V
Nominal Capacity	100Ah
Design life	15 years
Terminal	M8
Approx. Weight	Approx 29.5kg (65.0lbs)
Container Material	ABS
Rated Capacity	<b>100Ah</b> 10Hour Rate (10.0A to 10.8V)
	<b>81.0Ah</b> 3Hour Rate (27.0A to 10.8V)
	<b>65.8Ah</b> 1Hour Rate (65.8A to 10.5V)
Internal resistance	Full charged at 25°C: 4.8 mΩ
Max. Discharge Current	1200A(5S)
Operating Temperature	Discharge: -40 ~60°C (-40~ 140°F)
	Charge: -20 ~50°C (-4~ 122°F)
	Storage: -20 ~50°C (-4~ 122°F)
Charge Method (25 °C)	Charge current: Max.30.0A ; Recom.10.0~15.0A
	Float Charge:13.5-13.8V,recom.13.5V(-18mV/ °C)
	Equalize charge:13.8-14.1V,recom.14.1V(-24mV/ °C)
	Cycle charge:14.4-15.0V,recom.14.4V(-30mV/ °C)
Self discharge	3% of capacity declined per month at 25°C

DEF-CON 5

**NS-cell**  
HYPER-BATTERY

### Constant Current Discharge (Amperes) at 25 °C (77°F )

F.V/Time	5min	10min	15min	20min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	20h
1.85V/cell	241	152	144	115	96.2	66.8	57.3	35.0	25.9	19.9	16.9	14.0	11.5	9.70	5.26
1.80V/cell	270	168	162	123	105	68.6	59.1	36.8	27.0	20.2	17.7	14.3	12.0	10.0	5.35
1.75V/cell	302	180	174	130	110	69.6	62.0	37.5	27.3	20.6	18.2	14.5	12.1	10.1	5.38
1.70V/cell	328	192	180	138	111	71.8	65.5	38.1	27.6	21.0	18.4	14.7	12.2	10.2	5.40
1.65V/cell	342	212	184	146.6	113	74.3	66.4	38.4	27.9	22.1	18.6	15.0	12.3	10.3	5.43
1.60V/cell	352	220	189	154.8	115	78.8	67.3	38.6	28.4	22.8	18.8	15.2	12.4	10.4	5.46

### Constant Power Discharge ( Watts/cell ) at 25 °C (77°F )

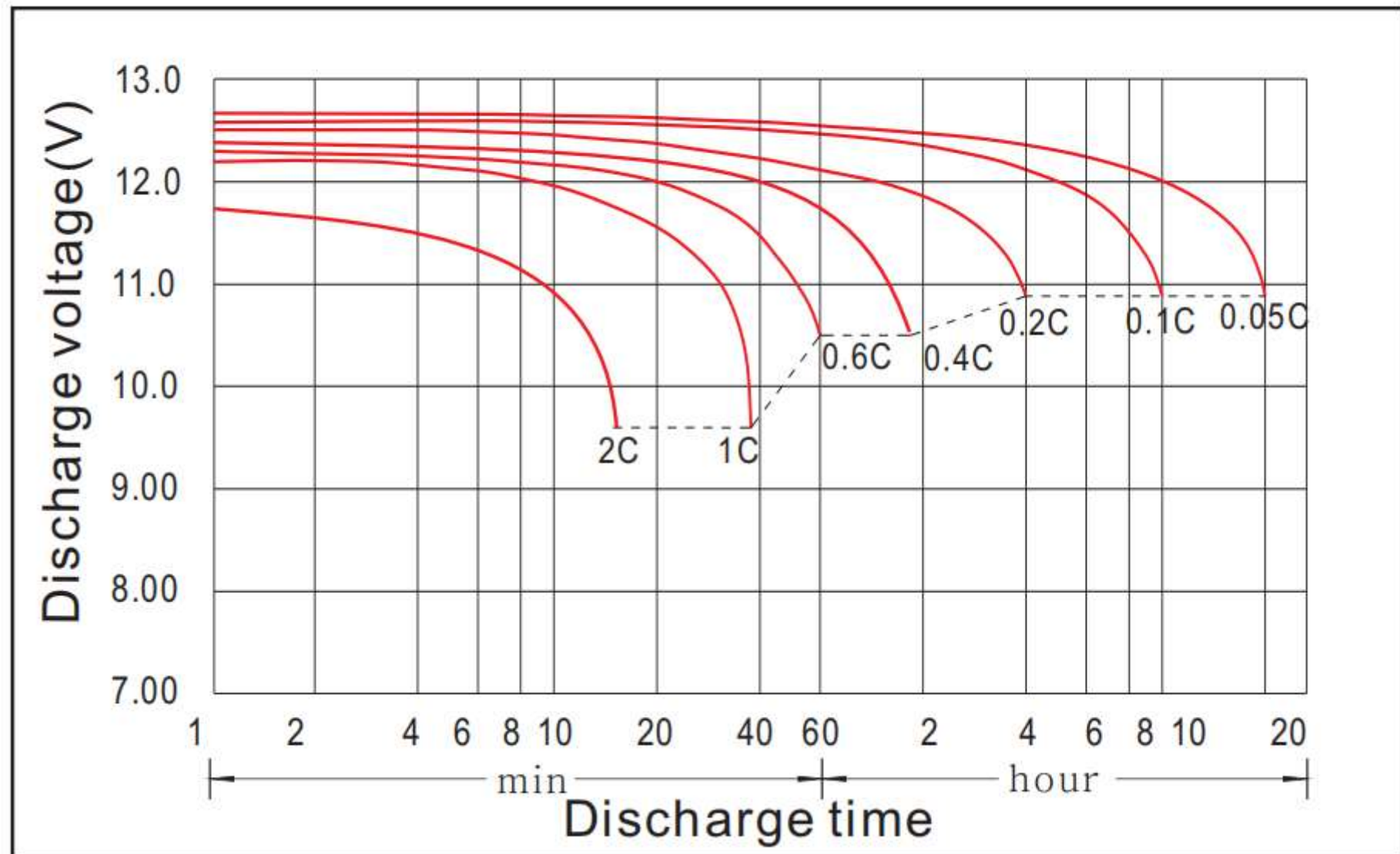
F.V/Time	5min	10min	15min	20min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	20h
1.85V/cell	441	274	277	225	188	126	117	70.0	50.0	39.3	33.7	21.4	22.8	18.9	10.5
1.80V/cell	494	312	310	236	205	132	126	73.0	53.0	39.9	35.3	22.9	23.6	19.2	10.6
1.75V/cell	538	344	328	241	210	137	127	74.0	53.0	41.0	35.7	23.4	23.8	19.4	10.7
1.70V/cell	577	366	330	252	211	143	128	74.0	53.0	41.3	35.9	23.9	24.0	19.6	10.7
1.65V/cell	580	391	334	260	212	147	129	74.0	54.0	42.2	36.2	24.3	24.1	19.8	10.8
1.60V/cell	603	418	340	270	213	152	130	75.0	54.0	43.1	36.4	24.8	24.3	20.0	10.8

DEF-CON 5





# Discharge characteristic



# Discharge characteristics

Battery Capacity Batteries under certain discharge conditions will release a certain amount of current. This amount of current released is called the capacity. The symbol used to identify the capacity is "C". The commonly used unit of measure is Amp Hours (Ah).

The battery capacity can be defined in two parts, namely rated capacity and actual capacity under different discharge conditions. The actual capacity of the battery under certain discharge conditions is calculated by the current (A) multiplied by the discharge time (h). The resulting unit is Ah.

## Battery Discharge Rate

The battery discharge rate uses rated hours to determine the discharge time. This time is influenced by the amount of current drawn from the battery. If the discharge current increases, the discharge time will decrease and also affect the rated capacity.

Hour rated discharge:

C 10 = 10 hour rated capacity (Ah)

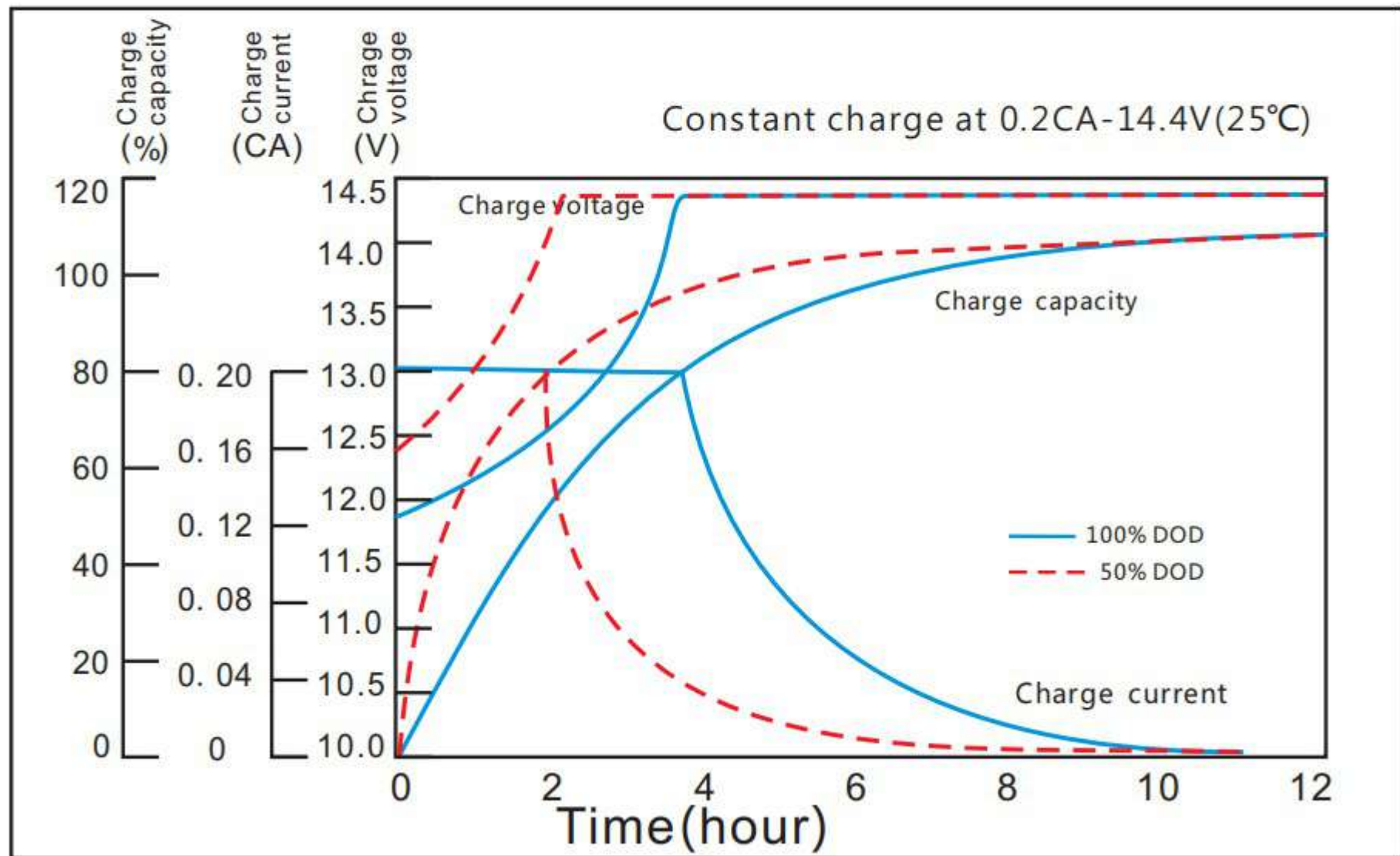
C100 = 100 hour rated capacity (Ah)

Rate of discharge:

1C = 1 multiplied by the 10 hour rated capacity used for the discharge current (A)

0.01C = 0.01 multiplied by the 10 hour rated capacity used for the discharge current (A)

# Charging characteristic

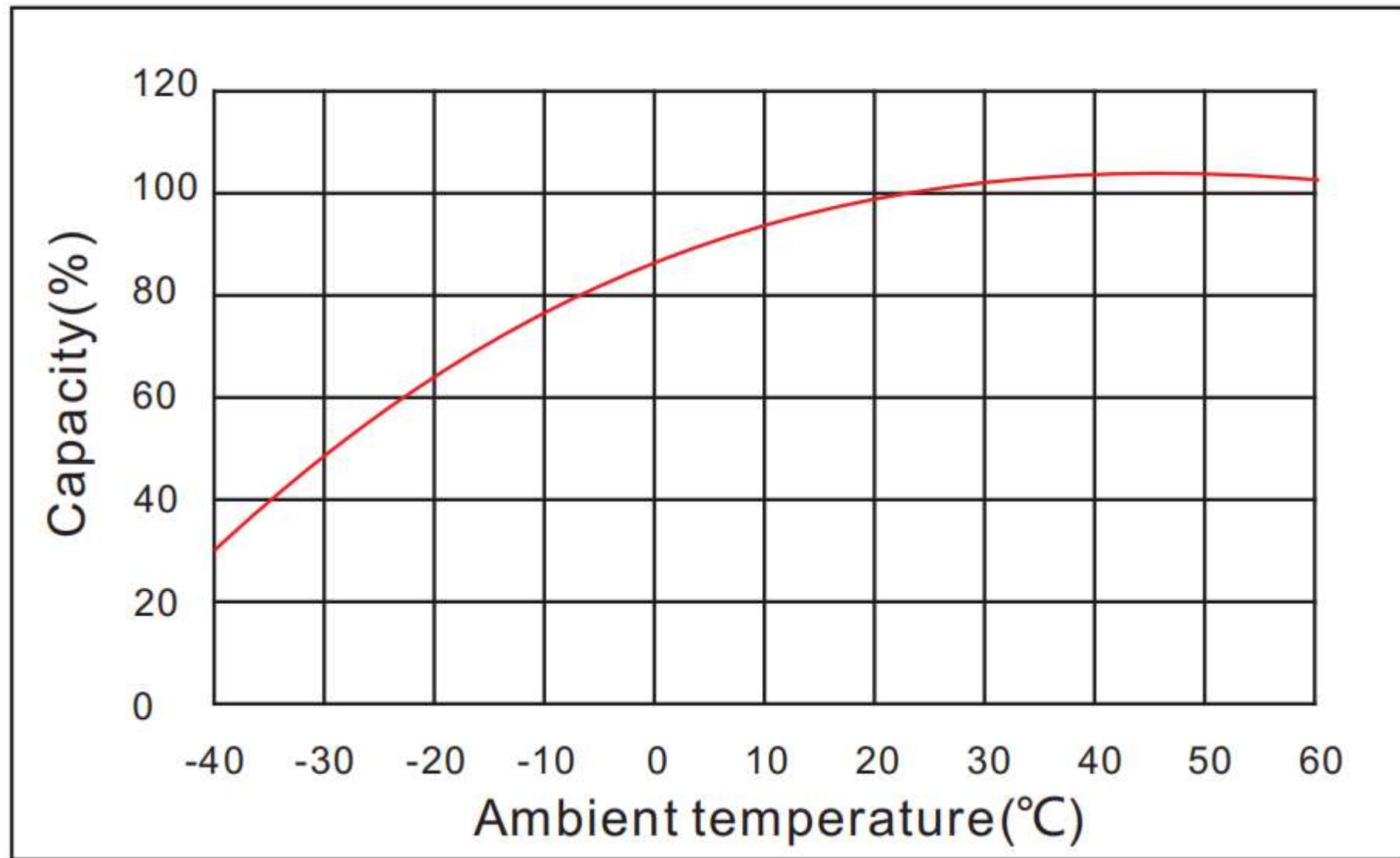


# Charging Characteristic

Hyper Lead Acid Batteries are high-end products that work best with good quality battery chargers that have a compatible charge profile (or ability to adjust custom charge settings). Below settings for automated battery chargers are recommended to fully utilize the benefits of Hyper Lead Acid Batteries.

- Cyclic charging: the battery is frequently charged and discharged like a daily routine. The battery is boosted to a higher voltage (absorb / equalization) phase then automatically followed by the float phase when and if the battery is (close to) full. You don't want to exceed 14.1v for the boost / absorb / equalize charging phase.
- Standby charging: the battery is only discharged once per week (or less).
- Float charging: the battery is in a constant charged state and rarely discharged. The Float Phase will also set in on standby charging when the battery is full (fully automated).

# The effect of temperature on capacity





# Influence of Temperature on Capacity

The discharge characteristics and temperature of batteries are closely related. When the temperature is low, the discharge capacity of the battery will be reduced. For example, when the temperature is dropped from 25°C to 5°C, the capacity of the battery will drop to about 70% of its rated capacity.

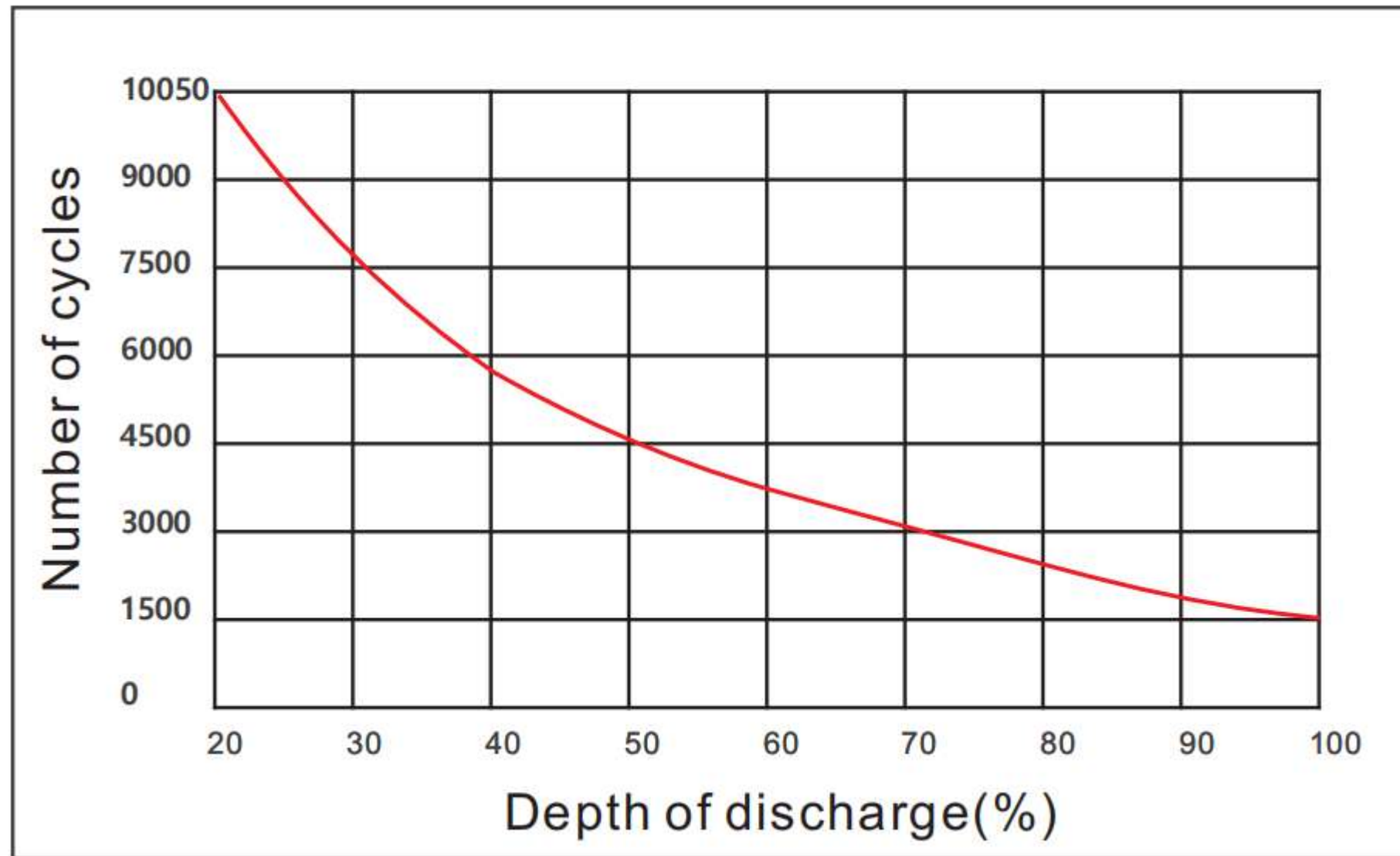
As the ambient temperature rises, the battery capacity will increase within a certain range, for example, the battery capacity will rise to about 105% of the rated capacity when the temperature rises from 25°C to 40°C, however if the temperature continues to rise, the capacity increase will slow down, and ultimately not increase further.

## Discharge Voltage

The termination voltage refers to the battery voltage dropping during discharge to the minimum working voltage required for operation. The termination voltage and the discharge current are closely related. Generally during high current discharge the termination voltage of the battery should be set lower.

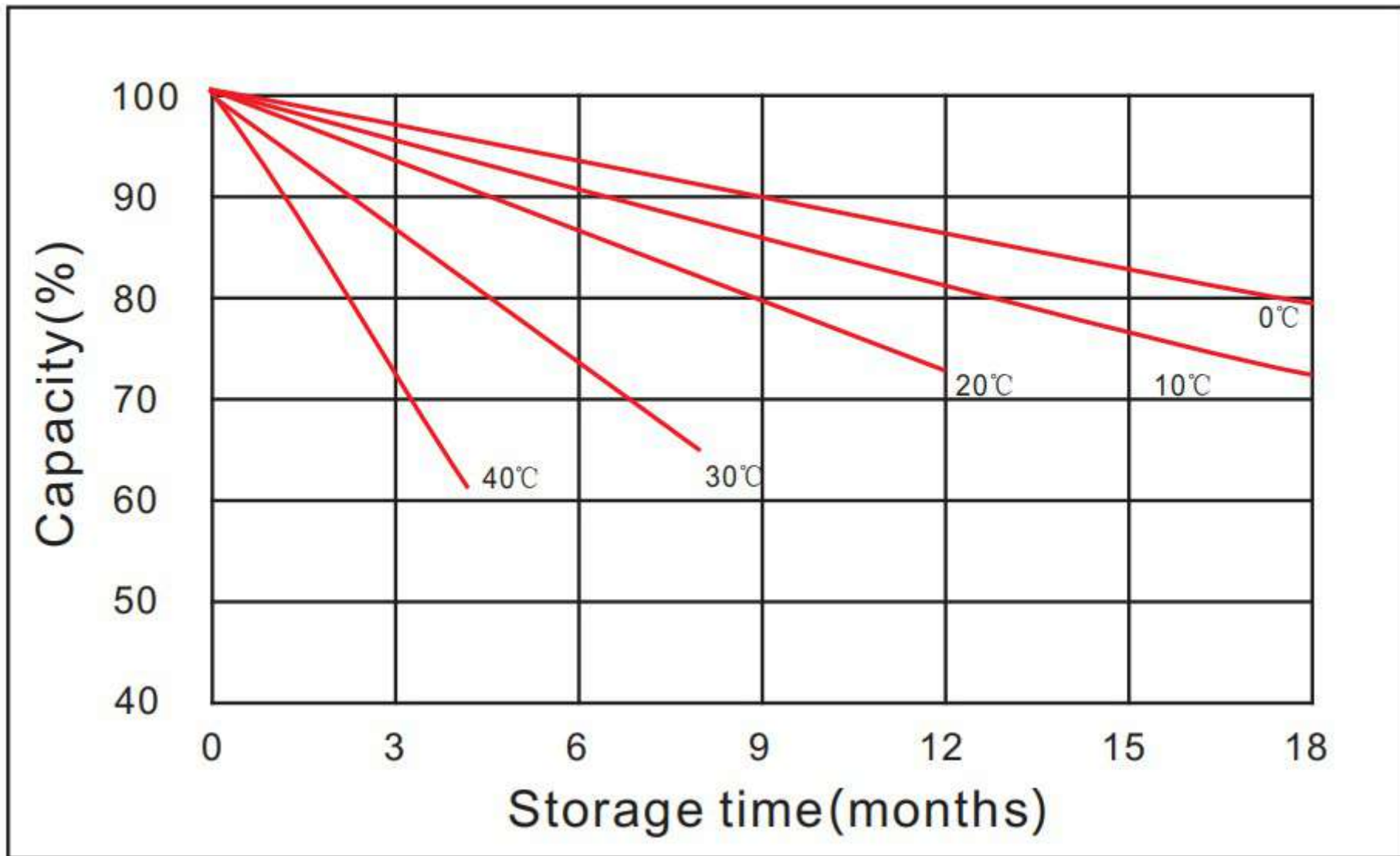
Over discharging below the termination voltage should be avoided since the over discharging could only gain a small amount of additional capacity, but drastically reduce the battery's service life.

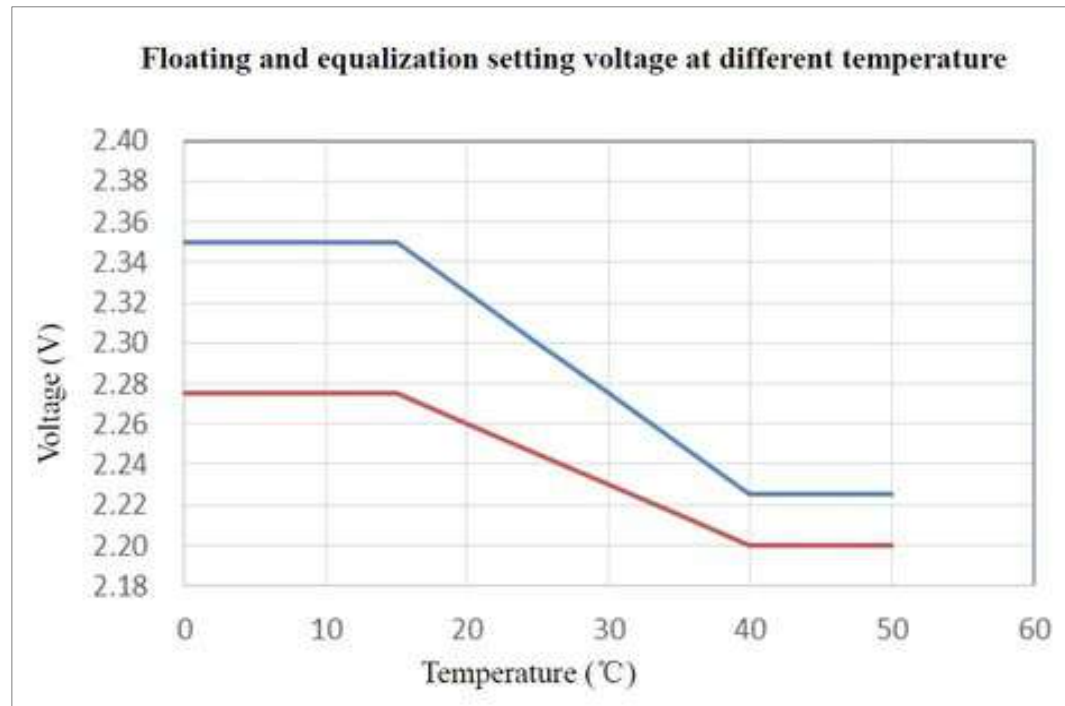
# The effect of discharge depth on cycle life





# Curves of self-discharge



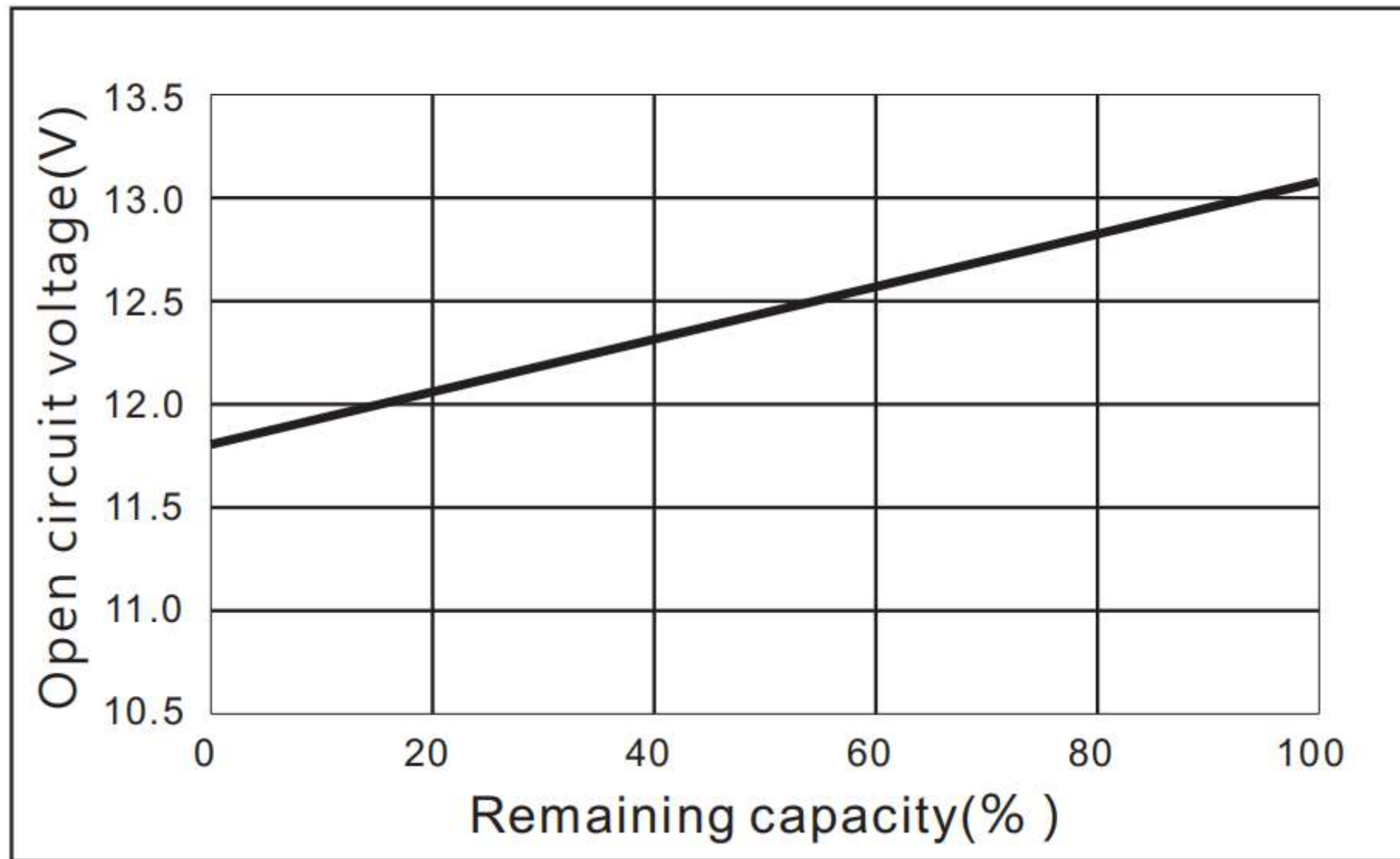


## Self-Discharge

The self-discharge characteristics of a battery changes with environmental temperatures, the higher the temperature the higher the self-discharge, so the batteries should not be stored in an environment that is subjected to extremely high temperature conditions for long durations of time.

Due to the use of our unique Nano-Tech plate technology, the self-discharge consumption of Hyper Lead Acid Batteries is efficiently reduced. At a constant 25°C environmental temperature Hyper Lead Acid Batteries can be kept on a shelf for up to 1.5 years without constant top up charging. The batteries will maintain over 60% of their rated capacity after 12 months.

# Curves of open circuit voltage vs. capacity

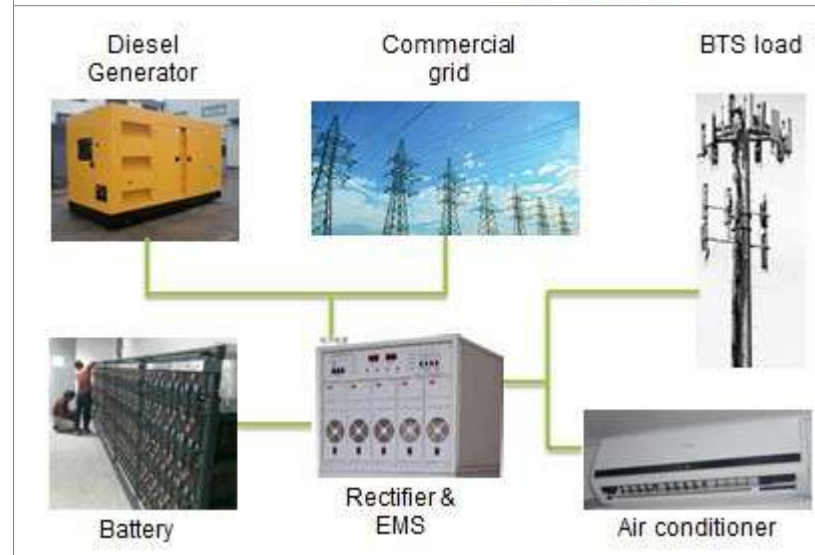
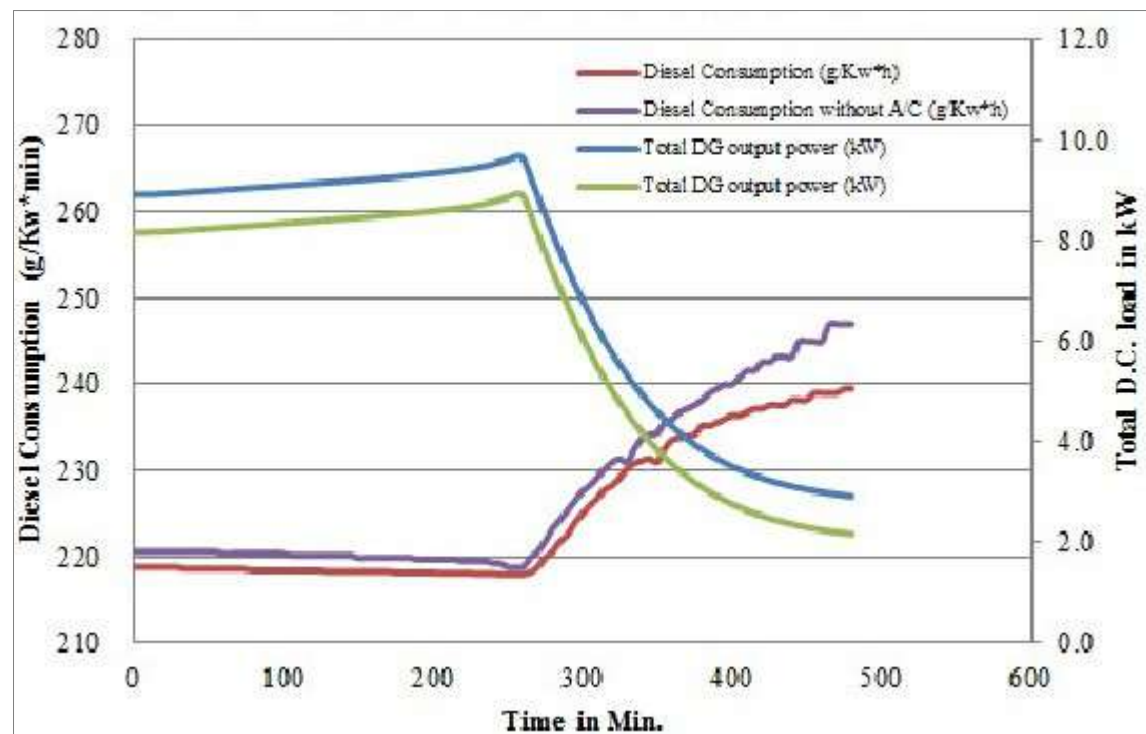
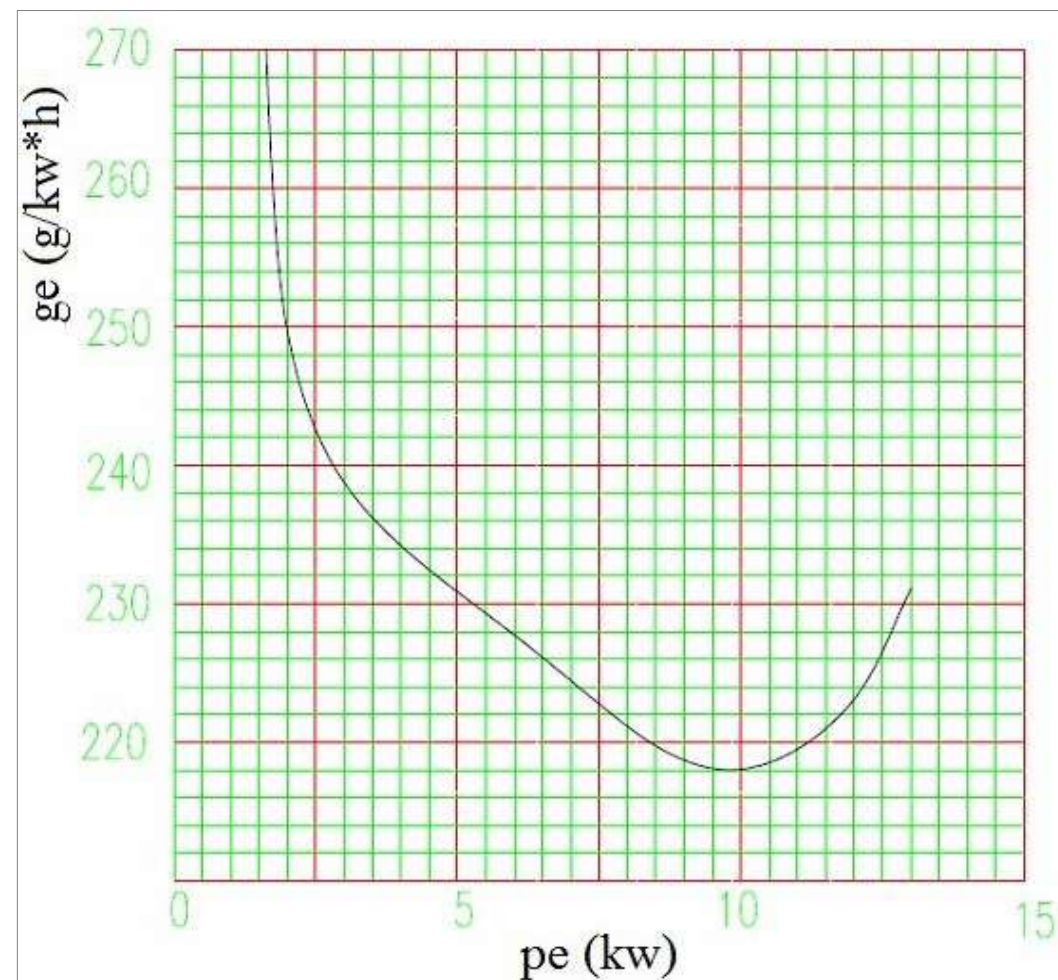


# Hyper Lead Acid vs AGM / GEL vs Lithium-Ion Comparison

Below is the table showing how Hyper lead acid batteries compare against AGM / GEL and Lithium battery options.

		HYPER LEAD ACID		AGM / GEL		LITHIUM ION
Max / Design Life	✓	20 Years		3-6 Years		5-10 Years
Cycle Life 30% DOD	✓	6000		1300-1400		5000
Cycle Life 50% DOD	✓	3500		600-900		3500
Cycle Life 80% DOD	✓	2400		200-300	✓	2400-3000
Max DOD %	✓	100%		50%		80%
Partial State of Charge	✓	Hardly Affected		Sulphation Issues	✓	Hardly Affected
Dendrite Growth Issues	✓	No	✓	No		Yes
Risk of Fire / Explosion	✓	Low / None		Low / None		High / Yes
Maintenance		Maintenance Free		Maintenance Free		Maintenance Free
Warranty	✓	3-5 Years		1-2 Years		Varies
Years in the market		5+	✓	30+		< 4
Current upfront cost price		\$\$\$	✓	\$\$		\$\$\$\$\$\$
Cost of ownership over 10 yrs		\$		\$\$\$		\$\$\$\$
Cost per kWh of Usable Storage	✓	\$		\$\$		\$\$\$\$\$\$
Retro-Fit onto existing systems	✓	EASILY		EASILY		DIFFICULT / CAN'T
On-Grid + Off-Grid Application	✓	Yes, easy for both	✓	Yes, easy for both		On-Grid Only mostly
Charge vs Discharge Efficiency %	✓	90-92%		50-55%	✓	90-92%





DEF-CON 5

**NS-cell**  
HYPER BATTERY

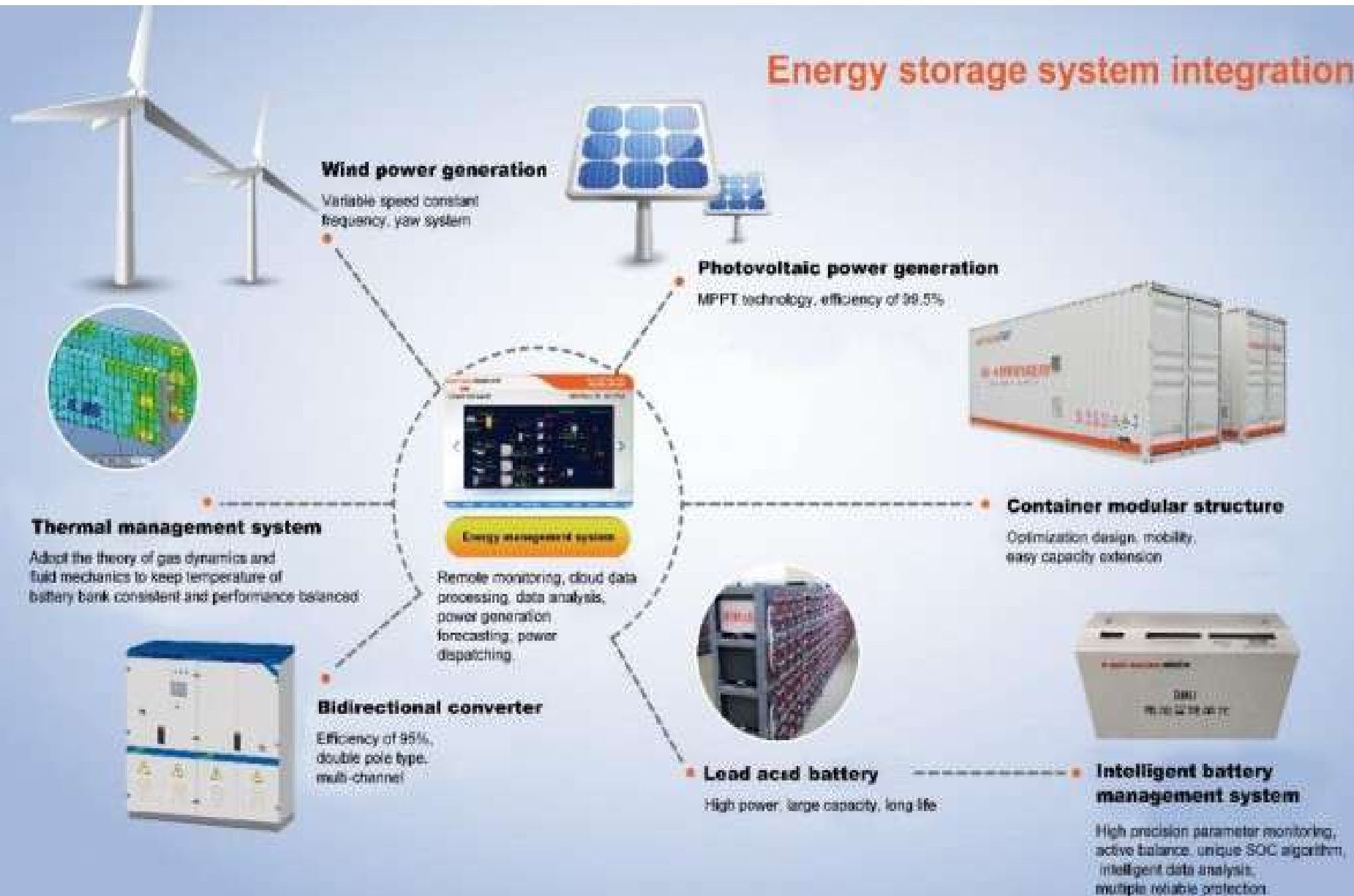


DEF-CON 5

**NS-cell**  
HYPER BATTERY



## Energy storage system integration



DEF-CON 5

**NS-cell**  
HYPER-BATTERY



## About NS-Cell & Def-Con 5

NS-Cell in collaboration with DC5 is a global green technology company headquartered in Malaysia. We design, manufacture, sell and provides innovative electrical energy storages, power quality systems, and services.

Scalable and modular power electronics, intelligent software technologies, and electrical engineering expertise are the base of our business. Our innovative Hyper System™ technology enables the use of our products and services in a wide range of different application needs.

### Our mission

Our Energy Storage and Power Quality solutions enable renewable energy growth, increase industry productivity, and create winning businesses for our global customers.

### Our Vision

To be a major smart ESS solution manufacturer in ASEAN and recognized as a preferred supplier in the global battery energy storage and power quality markets

### Our Values

Customer first - Easy to deal with - Power quality and LEAN excellence  
Open and trustworthy - Universal satisfaction