POWER KINGDOM

Sealed Lead Acid Battery

1 GENERAL FEATURES

1.1 Sealed Construction

Power Kingdom's unique construction and sealing technique ensure that no electrolyte leakage can occur from the terminals or case of any Power Kingdom battery. This feature insures safe, efficient operation of Power Kingdom batteries in any position. Power Kingdom batteries are classified as "Non-Spillable" and will meet all requirements of the International Air Transport Association.

1.2 Absorptive Glass Mat System (AGM System)

Power Kingdom batteries make use of fine mat separators (glass fiber) wherein suffient electrolyte is absorbed to provide the longest life and steady serive. This system prevents escapte of electrolyte from the separator which causes leakage.

1.3 Gas Recombination

Power Kingdom batteries incorporated unqiue design that effectively controls generation of gas and allows recombination of over 90% of gas generated during the normal use.

1.4 Mainenance-Free Operation

During the expected floating service life of Power Kingdom batteries, there is no need to check the specfic gravity of the electrolyte or add water, which means they require no maintenance serive.
In fact, there is no provision for these maintenance functions.

1.5 Position-Free and Leakage-Free

The combination of the sealed construction and the use of absorptive mat separators permits operaton of Power Kingdom batteries in any position without loss of capacity, electrolyte and service life. Power Kingdom batteries are made to operate in any position.

1.6 Stable Quality & High Reliability

The Power Kingdom SLA battery has stable and reliable performance. It can be easily maintained to permit proper operation of the equipment that it powers. The battery can withstand overcharge, overdischarge, vibration, and shock, and is capable of extended storage.

1.7 Long Service Life, Float or Cyclic

The Power Kingdom SLA battery has long life in float or cyclic service. The expected life of float service is shown on Figure10 and life of cyclic service figure 11.

1.8 Low Pressure Venting System

Power Kingdom batteries are equipped with a safe,low pressure venting system, which operates at 1psi to 6psi,designed to release excess gas and reseal automatically in the event that gas pressure rises to a level above the normal rate. Thus, there is no excessive build up of gas in the batteries.This low pressure venting system, coupled with the extraordinarily high recombination efficiency, make Power Kingdom batteries the safest sealed lead-acid batteries available.

1.9 Heavy-Duty Grids

The heavy-duty lead calcium-alloy grids in Power Kingdom batteries provide an extra margin of performance and service life in both float and cyclic applications, even in conditions of deep discharge.

1.10 Low Self Discharge

Because of the use of Lead Calcium grids alloy, Power Kingdom SLA battery can be stored long periods of time without recharge.

1.11 High Recovery Capability

Power Kingdom batteries have an excellent charge acceptance and recovery capablibty evenafter deep discharge.

1.12 U. L. Component Recognition

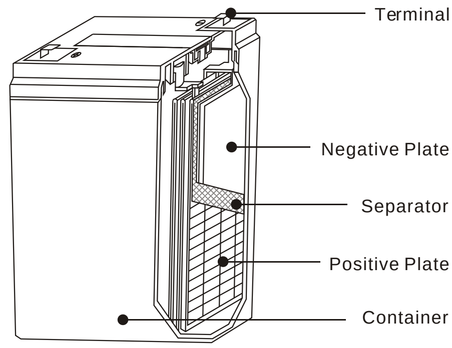
AII of our Power Kingdom SLA batteries have already passed UL test.

2 APPLICATIONS

A partial list of common applications includes, but is not limited to, standby or primary power for:

- Alarm Systems
- Cable Television
- Communications Equipment
- Control Equipment
- Computers
- Electronic Cash Registers
- Electronic Test Equipment
- Electric powered Bicycle and Wheelchairs
- Emergency Lighting Systems
- Fire & Security Systems
- Geophysical Equipment
- Marine Equipment
- Medical Equipment
- Micro Processor Based Office Machines
- Portable Cine & Video Lights
- Power Tools
- Solar Powered Systems
- Telecommunications Systems
- Television & Video Recorders
- Toys
- Uninterruptible Power Supplies
- Vending Machines

3 CONSTRUCTION



3.1 Positive plates

Positive plates are made from a Lead-Calcium system.

3.2 Negative Plates

Negative plates are made from a Lead-Calcium system.

3.3 Separators

The glass fiber separators in Power Kingdom SLA batteries have high resistance to acid. The high porosity of the separators retains adequate electrolyte for the reaction of active materials in the plates.

3.4 Safety Vents

The venting system, which operates at 1 psi to 6 psi (0.07-0.43kg/cm^2)is designed to release excess gas and keep the internal pressure within the optimum range of safety, while it protects the negative plates from contamination from oxygen in the air. Vents are 100% visually inspected during battery production.

3.5 Terminals

Depending on the battery model, the terminals may be T1,T2,T3,T4, etc. ("T" stands for "Terminal", it is always marked as "F"-Faston too).Excellent terminal sealing construction has been achieved by using long mechanical sealing paths and the selection of small shrinkage ratios for the sealing materials.

3.6 Case Materials

Standard case and cover are manufactured from ABS resin.

4 PRINCIPLE PROCESSES OF SEALED LEAD ACID BATTERY

Postive Plate.	$PbO_2+SO_4^{=}+4H^+ +2e^- = PbSO_4+2H_2O$
Negative Plate.	$Pb + SO_4^{=} = PbSO_4+2e^-$
Net.	$PbO_2+2SO_4^{=} + 4H^+ +Pb = 2PbSO_4+2H_2O$

The gassing and water loss reactions are as follows:

Positive Plate.	$H_2O = 2H^+ + \frac{1}{2}O_2+2e^-$
Negative Plate.	$2H^+ + 2e^- = H_2$
Net.	$H_2O = H_2+\frac{1}{2}O_2$ . . . . . . (1)

It is noted that the gassing reaction only generally occurs to any extent when the battery is almost totally charged. In the valve regulated battery it is obvious that water loss must be avoided. This is done by limiting the escape of hydrogen and oxygen from the battery. The design therefore accomplishes the recombination of the oxygen formed at the positive plate with the hydrogen formed at the negative plate. The reaction is as follows.

Negative a.	$Pb + \frac{1}{2}O_2 + H_2SO_4 = PbSO_4 + H_2O$
Negative b.	$PbSO_4 + 2H^+ + 2e^- = Pb + H_2SO_4$
Net Negative.	$\frac{1}{2}O_2+2H^++2e^- =H_2O$ . . . .(2)

Because the oxygen gas generated in the final stage of charging is absorbed by the negative, as shown by above equations, there is no increase in internal pressure, despite the sealed construction. When, however, the charging current exceeds the specified value, or when charging is conducted at less than the specified temperature, the amount of gas generated by reaction (1) cannot all be absorbed by reaction. (2) In the event, an increase in internal pressure develops, and, in the worst case, the safety vent opens.

The gases including Hydrogen are released from the safety vent.The Hydrogen is generated at the negative plate (along with oxygen) during the electrolysis that takes place during excessive overcharge. [Negative] $2H^{+}+2e \rightarrow H_2$ . . . . (3) [Hydrogen ions] [Electrons] [Hydrogen] It should be noted that when the safety vent functions, electrolyte is consumed and performance deteriorates. To prevent or reduce this, it is important that charging should be conducted under recommended conditions.

5 BATTERY STORAGE

It is recognized that Power Kingdom SLA batteries have excellent charge retention characteristics.That is, their self-discharge rate is low and is typically less than 3% per month at 25°C. Although the self discharge rate is low, specific precautions must be taken against the battery over discharging itself by self-discharge when in storage or not operating. It is necessary to understand what is meant by a fully discharged (flat)battery. A discharged battery may be determined by the voltage of that battery. The voltage of a battery that can be described as fully discharged varies with the discharge current.For example, the higher the discharge current for a battery, the quicker the battery reaches a fully discharged state and the lower the voltage will be for a battery to be described as fully discharged (flat). The self-discharge rate varies with ambient temperature. At all times a battery should be recharged immediately after discharge.

5.1 Final Acceptable Discharge Voltages

Discharge Current	Final Discharge Voltage,(vpc)
Up to 0.1 CA	1.75
0.11-0.17 CA	1.70
0.18-0.25 CA	1.67
0.26-0.6 CA	1.60
3CA	1.30
Above 3CA	Refer for advice.

The slowest practical rate of discharge for a lead acid battery is self-discharge. As the current is very low the fully discharged voltage is high, i.e. the battery is flat at 2.00-2.03 vpc. Therefore a program of stock control must be introduced to ensure that batteries are recharged well before that voltage is reached.

5.2 Supplementary Charge Advice

Storage Temperature	Charging Interval.
0°C (32°F) to 20°C (68°F)	Every 9 months.
21°C (70°F) to 30°C (86°F)	Every 6 months.
31°C (88°F) to 40°C (104°F)	Every 3 months.

In discharging a battery, lead sulphate (sulphation) is formed.If the battery is recharged as soon as discharging is completed, then the lead sulphate is converted to active material. However on self discharge the lead sulphate that is formed may become inactivation. That is it cannot be reconverted. The lower the voltage that a battery is allowed to fall to under self discharge, the more likely it is that the sulphate formation will not be able to be reversed and the battery damaged beyond recovery.

5.3 Precautions Against Over Self Discharge.

a. The batteries should be stored in a cool, dry place.
b. The storate time must be determined according to the new ambient temperature.
c. The batteries should not be stored in direct sunlight.
d. The batteries should not be subjected to an external heat source.
e. The voltage of batteries in stock should be regularly checked.

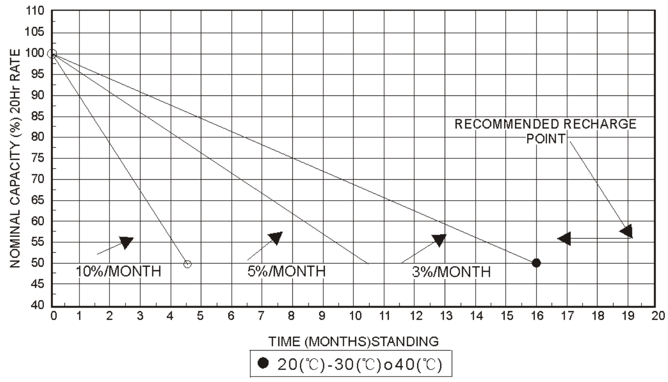
5.4 Precautions for Pre Installed Batteries

When batteries are installed in a product, the following precautions to avoid over discharge during storage must be taken:

a. Only new or freshly recharged batteries should be used.
b. Any load that is on the battery in the product must be FULLY DISCONNECTED. Any discharge on the battery other than self-discharge will quickly flatten the battery and cause the formation of lead sulphate which, if left in this state for too long, will irreversibly damage the battery.
c. The first operating instruction for equipment fitted and sold with a rechargeable lead acid battery must be "The battery must be fully charged before use".

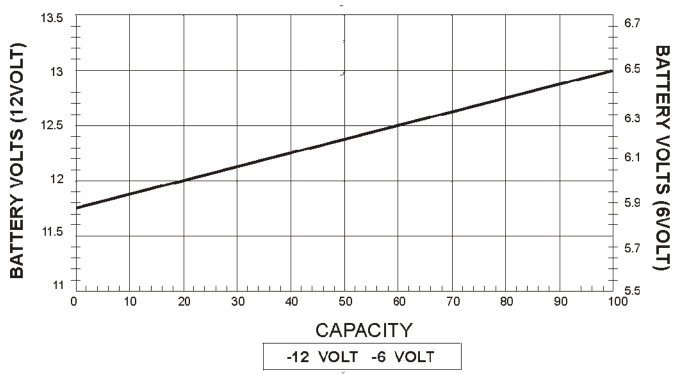
5.5 Self-Discharge Characteristics. (Figure 1)

SELF DISCHARGE OF CP BATTERIES (Figure 1)



5.6 Open Circuit Voltage and Remaining Capacity. (Figure 2)

OPEN CIRCUIT VOLTAGE (OCV) REDUCTION FROM SELF DISCHARGE V'S REMAINING CAPACITY
VALUES SHOWN AT 20°C FOR NORMAL ELECTROLYTE S. G. RANGE (Figure 2)



5.7 Recharging a Self Discharging Battery

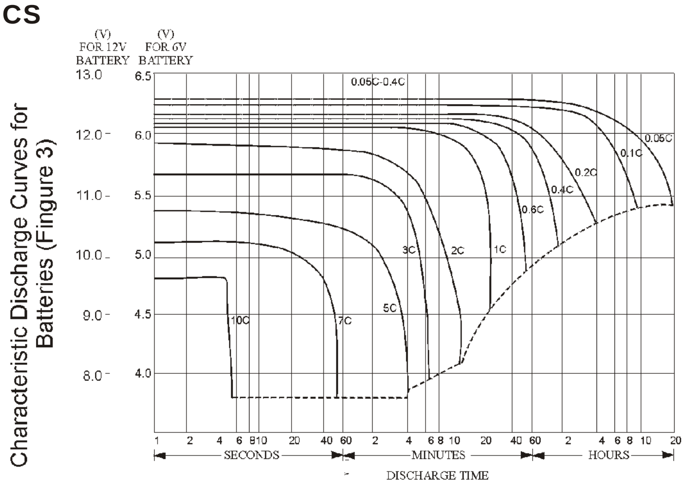
When it is necessary to give a self-discharged battery a "top up" charge the following procedures should be observed.

1. Ensure the OCV of the battery is greater than 2 vpc. If the voltage is lower than 2 vpc please refer the problem to Power Kingdom before attempting to recharge.
2. Constant voltage charging is recommended.

Storage Time	Top Up Charging Recommendation
Less than 6 months from manufacture or previous top up charge.	Maximum of 20 hours at a constant voltage of 2.4vpc.
Up to 12 months after manufacture or previous top up charge.	Maximum of 24 hours at a constant voltage of 2.4vpc.
Note: A faster recharge may be obtained by using the constant current method of charging. This requires a closer supervision of the charging procedures.	
Less than 6 months (As above)	Maximum of 6 hours at a constant current of 0.1C Amps.
Up to 12 months (As above)	Maximum of 10 hours at a constant current of 0.1C Amps.

6 BATTERY DISCHARGE CHARACTERISTICS

The discharge capacity of a lead acid battery varies and is dependant on the discharge current. Power Kingdom PS SLA batteries (small batteries) use a rate at the 20 hour rate. i.e.the capacity of the battery at 20 hours discharged to an end voltage of 1.75 vpc at a temperature of 25°C.



6.1 General Comments

The discharge curves (Figure 3) show the minimum design parameters for each fully charged Power KIngdom battery after installation. Full capacity is reached after some initial service.

- Float Service.
  One month after installation and recharging.
- Cycle Service.
  Within three to five cycles after initial charge and service entry.

6.2 Technical Terms

1. Battery capacity for small SLA batteries by accepted convention worldwide is described in "AMPERE HOUR" at the 20-hour rate C_{20} when discharged at 25°C. i.e. a PS7-12 is 7.0 Ah at C_{20} that is the battery will deliver 0.35 amps current for 20 hours to a cut off voltage of 1.75 volts per cell (10.5 volts per battery).

2. Battery load, by convention is described in terms of a multiple of C, in amps, where C is the capacity at 25°C, i.e. for a 7.0 Ah battery:

Multiple of C	Load(Amps)	Cut off Volts/Cell
3C	21	1.30
1C	7.0	1.30
0.5C	3.85	1.55
0.1C	0.7	1.75
0.05C	0.35	1.75

3. Battery cut-off voltage is the volts per cell to which a battery may be discharged safely to maximize battery life, this data is specified according to the actual discharge load and run time. As a rule of thumb high amp loads and short run times will tolerate a lower cut off voltage (eg. 3C at 1.3V/C), whereas a low amps long run time discharge will require a higher cut off voltage (eg 0.05C at 1.75V/C).

6.3 Battery Selection

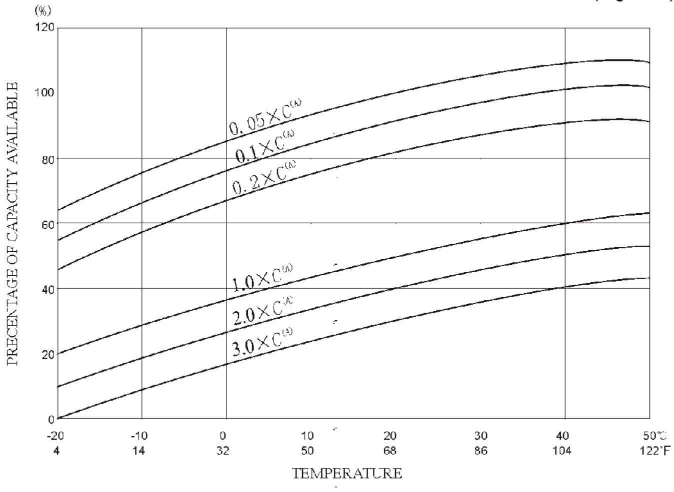
The battery discharge graph (Figure 3) may be utilized in battery selection. However it is suggested that a review is made of the data sheet for each battery type or the chart showing the actual ampere hour capacity of each battery type at various discharge times.

6.4 Effect of Temperature on Battery Capacity

As temperature rises, electrochemical activity in a battery increases and conversely decreases as temperature falls. Therefore, as the temperature rises, the charge voltage should be reduced to prevent overcharge and increased, as the temperature falls, to avoid undercharge. In general, in order to attain optimum service life, the use of a temperature compensated charger is recommended. The recommended compensation factor for the batteries is -3mV/°C/Cell (for floated/standby) and -4mV/°C/Cell (cyclic use). The standard center point for temperature compensation is 25°C.

The nominal battery capacity is based on the temperature of 25°C. Above this temperature the capacity increases marginally but it must be noted that the working battery should be kept within the temperature design limitations of the product. Below 25°C the capacity decreases. This decrease in capacity becomes large at temperatures below 0°C and in heavy discharge rates. The graph (Figure 4) illustrates the situation and the decrease in capacity with the decrease in operating temperature. Temperature must be taken into capacity design calculations in applications where the operating temperature of the system is below 20°C .

TEMPERATURE EFFECTS IN RELATION TO BATTERY CAPACITY(Figure 4)



7 BATTERY CHARGING

Correct battery charging ensures the maximum possible working life for the battery. There are four major methods of charging.

-Constant Voltage Charging.
-Constant Current Charging.
-Two-Step Constant Voltage Charging.
-Taper-Current Charging.

7.1 Constant Voltage Charging

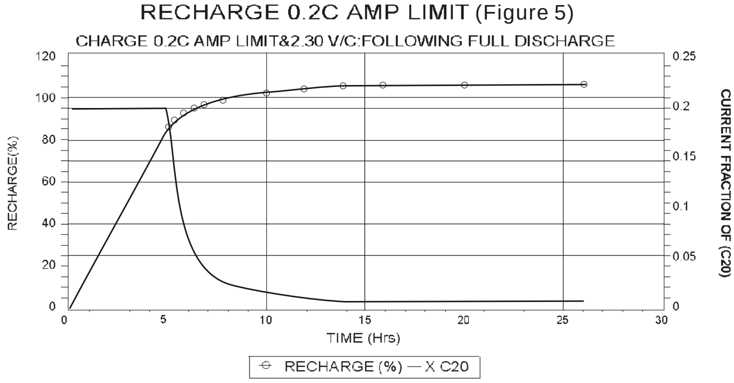
This is the recommended method of charging for SLA batteries, which is the most suitable and commonly used. It is necessary to closely control the actual voltage to ensure that it is within the limits advised.

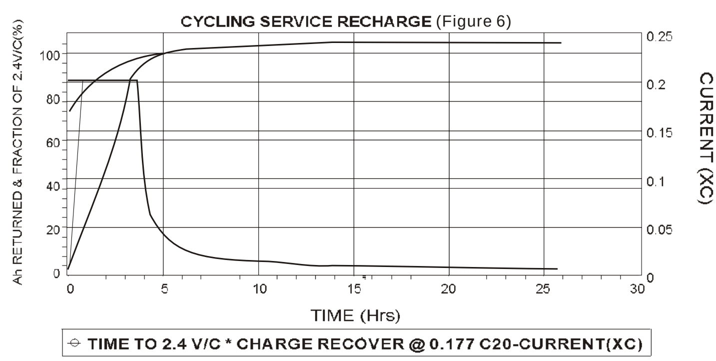
Float Service: 2.27-2.30 vpc at 25°C.

Cycle Service: 2.40-2.45 vpc at 25°C.

It is suggested that the initial current be set within 0.4 C Amps. The attached graph indicates the time taken to fully recharge the battery. It should be noted that the graph illustrated is for a fully discharged battery, i.e; a battery that has reached the minimum cell voltage recommended for its discharge time. It is also seen that it is necessary to charge a greater amount of energy into the battery than was taken out of the battery on discharge. The actual current indicating that the battery is fully charged is approx 5mA/Ah under charging voltage is 2.30 vpc.

RECHARGE 0.2C AMP LIMIT (Figure 5)





Note: It is necessary to ensure that the voltage is correctly set. A charging voltage set too high will increase the corrosion of the positive plates and shorten battery life. A charging voltage set too low will lead to sulphation of the plates causing loss of capacity and ultimately shortening the life of the battery.

7.2 Constant Current Charging

This charging method is not ofen adopted for SLA batteries, but is an effective method for charging a multiple number of batteries at one time and/or as an equalizing charge to correct the variance of capacitities among batteries in a group. It is necessary to understand that if the batteries are not removed from the charger as soon as possible after reaching a state of full charge, considerable damage will occur to the batteries due to overcharging.

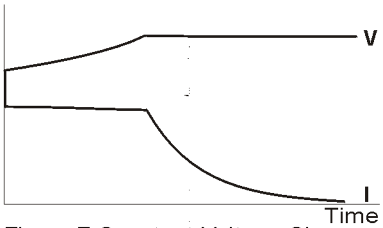


Figure 7:Constant-Voltage Charge With Current Limited

7.3 Two Stages Constant Voltage Charging

This method should not be used where the battery and load are connected in parallel. If this method is to be used it is suggested that the Power Kingdom technical department is contacted.

7.4 Taper Current Charging

This method is not recommended for SLA batteries as it often reduces serive life, however, if this method is to be used it is suggested that the Power Kingdom technical department is contacted.

7.5 Intial Charge Current Limit

A discharge battery will accept current at the initial stage of charging. High charging current can cause abnormal internal heating which may damage the battery. Therefore, when applying a suitable voltage to recharge a battery that is being used in cyclic application, it is necessary to limit the charing current to a value of 0.25C Amps.

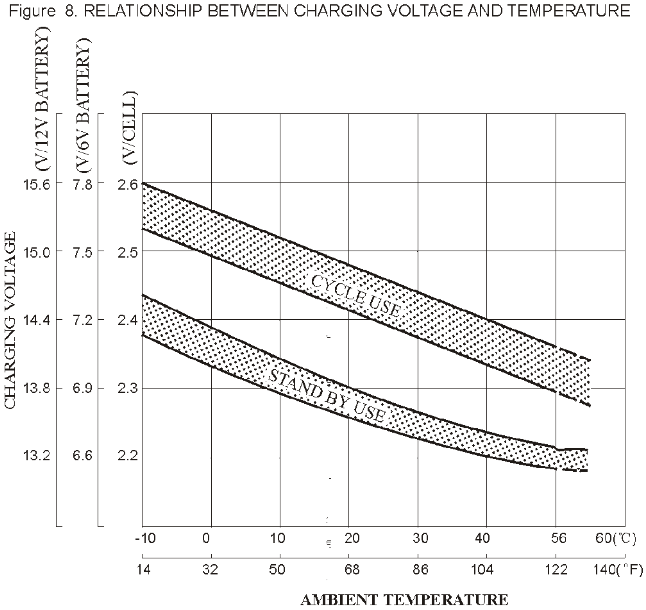
7.6 Recovery Charge After Deep Discharge

When a battery has been subjected to deep discharge (commonly referred ti as iver discarge), the amount of electrical energy which has been dishcarged can be 1.5 to 2.0 times greater than the rated capacity of the battery. Consequently, a battery which has been over dishcarged requires a longer charging period than normal.

7.7 Effect of Temperature on Charging Voltage

As temperature rises, electrochemical activity in a battery increases. Similarly, as temperature falls, electrochemical activity decreases. Therefore, conversely, as temperature rises, charging voltage should be reduced to prevent overcharge,and increased as temperature falls to avoid undercharge. In general, to assure optimum service life, use of a temperature compensated charger is recommended. The recommended compensation factor for PS batteries is -3mV/°C/Cell (stand by) and -4mV/°C/Cell (cyclic use). The standard center point for temperature compensation is 20°C. Figure 8 shows the relationship between temperatures and charging voltages in both cyclic and standby applications.

Figure 8. RELATIONSHIP BETWEEN CHARGING VOLTAGE AND TEMPERATURE



7.8 Effect of Voltage on Battery Gassing

Although the batteries are of the recombination type and the amount of gassing at normal operating voltages and temperature is negligible, if the charging voltage is increased, gassing will occur despite the recombination design of the product. Gassing does not normally occur while the battery is operating under float conditions and normal constant voltage recharge of 2.27-2.30 vpc at 25°C .Very little gassing occurs when the battery is recharged under normal cycling recharge procedures. However it can be seen on the accompanying graph the higher voltages that this especially under conditions of constant current charging will substantially increase the volume of gas.

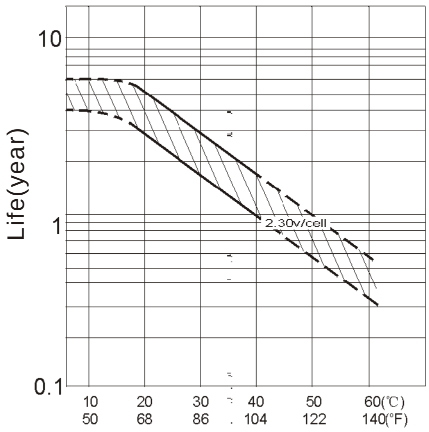
8 BATTERY LIFE

Battery life depends on a number of key factors. These include: .

- Operating temperature of the battery;
- Method of charging utilized;
- Actual use of the product i.e.: float or cycle service; etc.

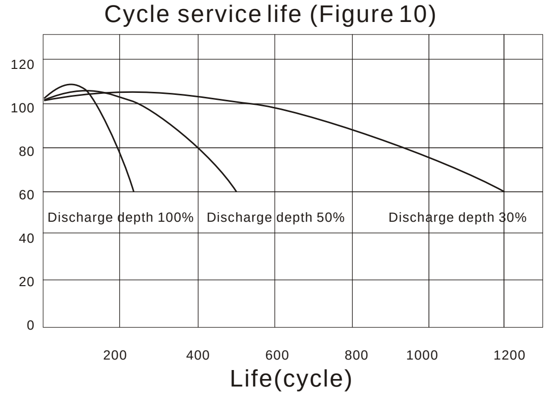
8.1 Float Service

The estimated design life under float service. PS series: 3-5 years; PK series: 8-10 years; PL series:15-20 years. The float service is effected by the factors listed above and the number and depth of discharges the battery suffers during its life time. Basically the more discharges suffered and the deeper the discharges, the shorter the battery life.



Effect of Temperature on Long Term Float Life (Figure 9)

Cycle service life (Figure 10)

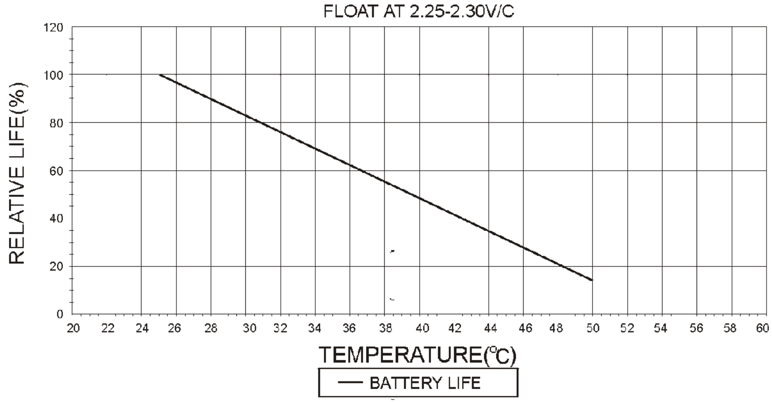


8.2 Cycle Service

Giving due consideration to the above factors, the actual life of a battery in cycle service is dependant on the depth of discharge of each cycle. The greater the depth of discharge of each cycle, the lesser the number of cycles available from the battery.

RELATIVE BATTERY LIFE V'S TEMPERATURE (Figure 11)

FLOAT AT 2.25-2.30V/C



9 PROLONGING BATTERY LIFE

Charging instructions

1. Always recharge the battery immediately after use.
2. Constant voltage charging is recommended. At 25°C, 2.27-2.30vpc for float use and 2.40-2.45vpc for cycle use.
3. The maximum initial charging current should be 0.4CA.
4. If batteries are used in series or parallel, the correct size cabling should be used.
5. Don't charge the battery in upside-down position.
6. The battery requires approx. 110% of the total discharging energy to fully recharge.

Supplementary charge advice

Storage Temp.	Charging Interval.
20°C or Less	Every 9 months.
20-30°C	Every 6 months.
30-40°C	Every 3 months.

Discharging instructions

1. Never leave a battery in a discharging condition.
2. Never allow a battery to fall below 2 vpc in storage. The full capacity may not be able to be reached and actual service life decreased.

3. Maximum continuous discharge current is 5CA. For greater continuous discharge currents please consult our technical staff.
4. Avoid over discharging the battery.
5. Stored batteries should receive a supplementary charge at intervals suggested.

Other considerations

Ensure the operating temperature is below 40°C.

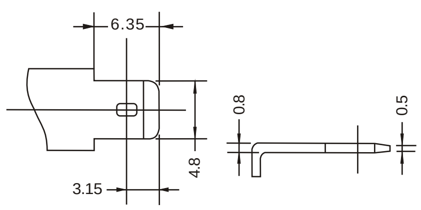
10 STORAGE

(1) When storing the batteries, be sure to remove them from the equipment, or disconnect them from the charger and load. Keep them in a place where the air is dry and the temperature is sufficiently low.
(2) Charge the batteries, at least once, every six months during storage.
(3) The batteries gradually deteriorate even during storage.

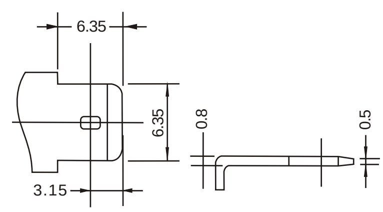
11 OTHER CAUTIONS

(1) When cleaning the batteries, use soft cloth only. Use of organic solvents such as gasoline or thinner, and application or adherence of oil to the batteries must be avoided. Do not clean the batteries using dirty or oily cloth. Also contact with soft polyvinyl chloride or the like must be avoided.
(2) Batteries may generate inflammable gas in some cases. Do not expose them to flame or excess heat. Do not short batteries.
(3) Do not attempt to disassemble the batteries. Avoid contact with sulfuric acid leaking from broken batteries. If contact is made with skin or clothes, rinse the area generously with water. If eyes contact, wash eyes with clean water, and consult a physician immediately.
(4) Batteries may explode if put into the fire. Never dispose of batteries in fire.
(5) Mixed usage of batteries differing in capacity, type, manufacturer or history of use (charge/discharge operation) may damage the batteries and the equipment due to the difference in characteristic values. This must not be attempted anyhow.
(6) While our batteries are exceptionally dependable, we do not recommend use in life support medical applications unless there is an alternate battery or back-up power supply.
(7) When the batteries come to their end of life, discharge duration time becomes short remarkably. And finally, batteries lose their available capacity by internal short-circuit and/or dry out of electrolyte. Therefore, please consider the design of the charger for the battery some care regarding above battery damage modes, such as short-circuit protection for out put.

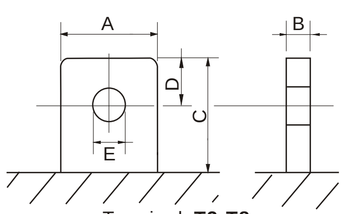
Power Kingdom Battery Terminals(Figure 12)



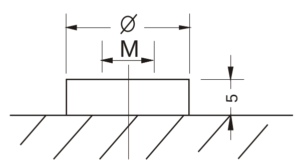
T1



T2



Terminal: **T3-T8**



Terminal: **T9-T12**

Type	A	B	C	D	E
T3	12	2.0	12	5.0	5.5
T4	20	3.0	19	6.0	6.0
T5	20	3.0	18	7.7	8.0
T6	17	9.0	18	8.0	6.0
T7	17	6.0	16	7.0	8.0
T8	25	3.0	18	8.0	8.0

Type	M	Φ
T9	5	12
T10	6	15
T11	8	21
T12	5	21

12 BATTERY INDEX

Battery Type	Nominal Voltage	20h Rated Capacity (AH)	Length		Width		Height		Total Height		Weight(Approx)		Terminal Type
			mm	in	mm	in	mm	in	mm	in	Kg	Pound	
PS4.5-4	4	4.5	48	1.89	48	1.89	102	4.02	108	4.25	0.62	1.37	T1
PS10-4	4	10	102	4.02	44	1.73	95	3.74	101	3.98	1.15	2.53	T1
PS1.2-6	6	1.2	97	3.82	24	0.94	52	2.05	58	2.28	0.31	0.68	T1
PS1.5-6	6	1.5	97	3.82	24	0.94	57	2.24	64	2.51	0.40	0.88	T1
PS2.3-6	6	2.3	43	1.69	37	1.46	76	2.99	76	2.99	0.34	0.75	T1
PS2.5-6	6	2.5	66	2.60	33	1.30	97	3.82	104	4.09	0.61	1.34	T1
PS3.2-6	6	3.2	134	5.28	35	1.38	61	2.40	67	2.64	0.71	1.56	T1
PS4-6	6	4	70	2.76	47	1.85	101	3.98	107	4.21	0.85	1.87	T1
PS4-6S	6	4	70	2.76	47	1.85	101	3.98	101	3.98	0.78	1.72	
PS4.5-6	6	4.5	70	2.76	47	1.85	101	3.98	107	4.21	0.85	1.87	T1
PS5-6	6	5	70	2.76	47	1.85	101	3.98	107	4.21	0.92	2.03	T1
PS6-6	6	6	85	3.35	48	1.89	101	3.98	105	4.13	1.08	2.38	T1
PS7-6	6	7	151	5.94	34	1.34	94	3.70	100	3.94	1.36	3.00	T1/T2
PS8-6	6	8	151	5.94	50	1.97	94	3.70	100	3.94	1.85	4.07	T2
PS10-6	6	10	151	5.94	50	1.97	94	3.70	100	3.94	1.85	4.07	T2
PS12-6	6	12	151	5.94	50	1.97	94	3.70	100	3.94	2.10	4.63	T2
PS14-6	6	14	108	4.25	71	2.80	140	5.51	140	5.51	2.37	5.22	
PS14-6T	6	14	108	4.25	71	2.80	140	5.51	140	5.51	2.37	5.22	
PS0.7-12	12	0.7	96	3.78	25	0.98	62	2.44	62	2.44	0.34	0.75	
PS1.2-12	12	1.2	97	3.82	43	1.69	52	2.05	58	2.28	0.61	1.34	T1
PS1.9-12	12	1.9	178	7.01	35	1.38	61	2.40	67	2.64	0.99	2.18	T1
PS2-12	12	2	150	5.90	20	0.79	90	3.54	90	3.54	0.68	1.50	T1
PS2.3-12	12	2.3	178	7.01	35	1.38	61	2.40	67	2.64	0.99	2.18	T1
PS2.5-12	12	2.5	103	4.06	46	1.81	70	2.76	70	2.76	0.98	2.16	T1
PS3.2-12	12	3.2	134	5.28	67	2.64	61	2.40	67	2.64	1.40	3.08	T1
PS4.5-12	12	4.5	90	3.54	70	2.76	101	3.98	107	4.21	1.72	3.79	T1
PS5-12	12	5	90	3.54	70	2.76	101	3.98	107	4.21	1.80	3.96	T1
PS7-12	12	7	151	5.94	65	2.56	93	3.66	99	3.90	2.66	5.86	T1/T2
PS7.2-12	12	7.2	151	5.94	65	2.56	93	3.66	99	3.90	2.66	5.86	T1/T2
PS10-12S	12	10	151	5.94	65	2.56	111	4.37	117	4.61	3.25	7.16	T2
PS10-12	12	10	151	5.94	98	3.86	95	3.74	101	3.98	3.70	8.15	T2
PS12-12	12	12	151	5.94	98	3.86	95	3.74	101	3.98	4.20	9.25	T2
PS12-12D	12	12	151	5.94	98	3.86	95	3.74	101	3.98	4.40	9.69	T2
PS17-12	12	17	181	7.13	77	3.03	167	6.57	167	6.57	5.70	12.56	T3
PS17-12D	12	17	181	7.13	77	3.03	167	6.57	167	6.57	5.70	12.56	T3
PS20-12	12	20	181	7.13	77	3.03	167	6.57	167	6.57	5.90	13.00	T3
PS24-12	12	24	165	6.50	125	4.92	175	6.89	182	7.17	8.50	18.72	T6
PS25-12	12	25	166	6.54	175	6.89	125	4.92	125	4.92	8.60	18.94	T3/T9
PS28-12	12	28	175	6.89	166	6.54	125	4.92	125	4.92	8.60	18.94	T3/T9
PK200-6	6	200	350	13.78	170	6.69	212	8.35	212	8.35	32.0	70.5	T5/T10
PK33-12	12	33	195	7.68	130	5.12	159	6.26	180	7.09	10.2	22.5	T7/T9
PK40-12	12	40	197	7.76	165	6.50	170	6.69	170	6.69	13.5	29.7	T4/T9
PK55-12	12	55	229	9.02	138	5.43	208	8.19	227	8.94	18.0	39.6	T5/T10
PK60-12	12	60	258	10.16	166	6.54	206	8.11	235	9.25	24.0	52.9	T7/T10
PK65-12	12	65	355	13.98	167	6.57	179	7.05	183	7.20	22.2	48.9	T5/T10
PK80-12	12	80	355	13.98	167	6.57	179	7.05	183	7.20	24.2	53.3	T5/T10
PK100-12	12	100	330	13.00	171	6.73	220	8.66	227	8.66	32.0	70.5	T8/T10
PK100-12S	12	100	506	19.92	110	4.33	238	9.37	238	9.37	32.5	71.5	T12
PK120-12	12	120	410	16.14	175	6.89	227	8.94	227	8.94	38.0	83.7	T8/T10
PK150-12	12	150	485	19.09	172	6.77	240	9.45	240	9.45	47.0	103.5	T8/T10
PK200-12	12	200	522	20.55	238	9.37	218	8.58	236	9.29	65.0	143.0	T8/T10
PL100-2	12	100	169	6.65	71	2.80	206	8.11	206	8.11	8.0	17.62	T11
PL150-2	2	150	169	6.65	100	3.94	206	8.11	206	8.11	12.0	26.43	T11
PL200-2	2	200	171	6.73	106	4.17	330	12.99	367	14.45	15.0	33.04	T11
PL300-2	2	300	171	6.73	151	5.94	330	12.99	367	14.45	21.0	46.26	T11
PL400-2	2	400	210	8.27	173	6.81	330	12.99	367	14.45	28.0	61.67	T11
PL500-2	2	500	241	9.49	171	6.73	330	12.99	367	14.45	33.0	72.69	T11
PL600-2	2	600	302	11.89	175	6.89	330	12.99	367	14.45	42.0	92.51	T11
PL800-2	2	800	410	16.14	175	6.89	330	12.99	367	14.45	57.0	125.6	T11
PL1000-2	2	1000	482	18.98	175	6.89	330	12.99	367	14.45	66.5	146.5	T11
PL1500-2	2	1500	400	15.75	350	13.78	345	13.58	382	15.04	100	220.3	T11
PL2000-2	2	2000	490	19.29	350	13.78	345	13.58	382	15.04	132	290.8	T11
PL3000-2	2	3000	710	27.95	350	13.78	345	13.58	382	15.04	204	449.3	T11