SUNCYCLE ®

Advanced Technology

Flooded Lead Acid Batteries

Installation & Operating Instructions

Battery Energy Power Solutions Pty Ltd

96 Fairfield Street, Fairfield NSW 2165 Australia

ABN 83 003 325 139

April 2002
Revision 2

This Manual should remain with the battery and be referred to for periodic and scheduled maintenance.

Information recorded by the installer in this document will be required should there be a system failure.

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READ THIS FIRST

Important Instructions
For Remote Area Power Systems

To obtain maximum battery life and be eligible for any future warranty claims you must carry out these mandatory tasks.

1. SYSTEM DESIGN
    a. The system must be designed by a suitably qualified person and operated within that design criterion. i.e. Repeated over-charge or over-discharge will shorten the life of your batteries and your warranty.
    b. You should make an allowance to expand the system as requirements increase with the introduction of new technologies and as families grow.

2. OPERATING TEMPERATURE
    a. The batteries are designed and rated to operate at an average temperature of 25°C. Operation outside of these parameters will affect your warranty coverage. For every 10°C increase of operation over 25°C the battery life will be halved and the covering warranty reduced by the same amount. (Arrhenius Effect)
    b. Good ventilation and temperature control will maximize the life of your batteries.

3. EQUALISATION CHARGE
    a. An equalisation charge should be performed approx every two months or as required.
    b. Charger settings for equalisation charge are 2.45 volts per cell for 6 hours.

4. LOW VOLTAGE DISCONNECT SETTINGS
    a. Low voltage disconnect should be set at 1.92vpc for optimum battery life.
    This is equivalent to 20% depth of discharge at the Aust Standard C120hr rate for RAPS systems.

5. ROUTINE MAINTENANCE
    a. Routine maintenance is essential for system safety and appropriate battery life. A small amount of time spent maintaining your system correctly can make a big difference to your battery life.

6. RECORD KEEPING
    a. The installer of the system must fill out the “installation and commissioning” sheet at the front of this manual. This must be left in the manual and produced upon request from Battery Energy if a warranty claim is requested.
    b. At the rear of this instruction manual are data sheets for recording a snapshot of the system on a regular basis. Battery Energy will require this if a warranty claim is made.

7. WARRANTY REPORTING
    a. All warranty claims must have supporting documentation including the data sheets from the rear of this instruction manual completed, signed and dated.
    b. A copy of the “installation and commissioning” sheet must accompany any warranty claim.
    c. Proof of purchase must be supplied.
    d. Photographs are also useful to assist with diagnosis of some problems.

What Damages Your RAPS Battery?

Most of the circumstances that damage Remote Area Power Supply batteries are avoidable and preventable.

Some of the causes of failure are listed below.

1. **Stratification/Sulphation**
    a. Inactivity of battery or insufficient charging capacity.
    b. No Equalisation Charge being given.
2. **Over-discharge/Undercharge (Incorrect Sizing)**
    a. Using more power from the system than it was specifically designed for.
    b. System undersize causes depth of discharge to be excessive.
    c. Results in shortened battery life.
3. **Overcharge (Unregulated charging)**
    a. Causes shedding of active material from plates.
    b. Causes excessive heat in battery.
4. **Lack of Equalisation Charge**
    a. Can lead to internal shorts and sulphation of the plates.
5. **Corrosion**
    a. Can cause premature failure from continuous overcharging.
    b. This is the usual failure mode for a battery at the end of its service life.

A. INTRODUCTION	These instructions have been written to cover installation and maintenance of Battery Energy 'Suncycle' batteries, with particular reference to safety and good work practice. Although, reasonably comprehensive, there will be matters not covered in this publication. For further information either contact Battery Energy direct or your local supplier.
B. SAFETY	The safety precautions outlined herein should be followed during battery installation and maintenance. To perform installation, repairs, or maintenance on battery systems you should ensure that you are properly trained, use the correct tools and adhere to all safety requirements under law.
Major areas for caution are: -	**1. Sulphuric Acid** Lead Acid Battery electrolyte is a dilute mixture of Sulphuric Acid and water. This is corrosive and can cause burns if contacted with skin or eyes and should be respected accordingly. ❑ If acid is splashed into eyes, rinse immediately with copious quantities of clean water and seek medical attention. ❑ If electrolyte comes into contact with skin, immediately drench affected area with copious quantities of water and remove any acid contaminated clothing. In the event of a rash or allergy related reaction, seek medical attention. ❑ If electrolyte is ingested, do NOT induce vomiting, drink as much fresh clean water as possible and seek medical attention. (a) Safety glasses should be worn when working with flooded batteries. (b) Ensure a supply of fresh clean water is on hand. ❑ If a large spillage of electrolyte occurs, then it should be neutralised with soda ash or bicarbonate of soda that should be disposed of through a registered waste merchant.
	2. Arc or naked flame in vicinity of batteries Lead Acid Batteries generate hydrogen gas as a normal part of their operation. Hydrogen gas in sufficient concentration with air (4%) is potentially combustible when presented with a source of ignition (spark or flame). It is, therefore, necessary to adhere to the following: - ❑ Install batteries in a well ventilated area - this will prevent a concentrated build up of hydrogen gas occurring during charging. ❑ Limit access to battery enclosure to responsible persons only. ❑ Ensure that no naked flames or sparks are permitted in the vicinity of the batteries - no smoking, electric hand tools, etc. ❑ Use only tools with insulated handles - to avoid the possibility of accidentally short-circuiting across opposing terminals and creating an arc. It is also good policy to remove metallic bracelets, rings, etc. that can cause severe burns if a short circuit is made. Ensure that all connections are made firmly.
	3. Handling Heavy Objects When handling Lead Acid Batteries you should be aware of safe lifting practices especially when repeatedly lifting weights exceeding 15kg. Manual handling equipment such as, hoists, trolleys, etc. should be used wherever necessary. The weight and dimensions of your batteries are set out in Table 1.
	4. SAFETY SIGNS A safety sign is supplied with each 12-cell, to 24-cell system and should be on display in the battery room in accordance with Australian Standards.
C. QUALITY SYSTEMS	Battery Energy cells are made to the highest quality with every care taken during manufacture to ensure that the best performance criteria are met. Battery Energy product design is conservative in terms of grid thickness, active material, loading, separation, etc. Products may exceed published specifications. Battery Energy has attained quality accreditation to Quality Standard ISO 9002 since 1991. Batch traceability of individual items carried out in accordance with ISO 9002. The cell numbers are stamped on the covers for reference purposes. All cells are cycled, rated and tested to Australian Standard 4086 Part 1.

D. BATTERY HANDLING	**1. Unpacking** The batteries will be delivered in either wooden crates and/or polystyrene/cardboard sleeves. To remove the battery from the wooden crate, remove the top and one side panel from the cradle. The cardboard sleeve may be slid up over the top of the cell **Do not manoeuvre battery by the terminals** Included in the accessories supplied with the battery are the following: - • Stainless 316 bolts, nuts & washers: M8 • Plastic shrouds to insulate terminals. • Explosion proof vents. The batteries are supplied with transit vents that are to be removed before installation. • Dust caps to protect the cell from incursion of extraneous materials If any damage - e.g. cracked or broken containers - is evident on unpacking, Battery Energy or its agent should be informed immediately. **2. Storage** Suncycle batteries are designed for low self-discharge and can be stored in the charged state for significant periods of time. The maximum recommended storage period at 25ºC. is 3 to 5 months, after which an equalisation or refresher charge is required. At elevated temperatures, more frequent charging is recommended; for instance, an equalisation over extended periods of time at 35ºC average will encourage irreversible sulphation and loss of capacity. Batteries should not be left in this state for more than 24 hours. **3. Parallel Strings** Suncycle cells can be operated in parallel strings if it is desired to increase the capacity of the system. This is normally not recommended for capacities under 1100Ah (120H rate) where it is effective and cost efficient to select the capacity required from one cell. Should an increase in capacity be required due to the system increasing in size; the addition of another bank of equal size may be necessary to increase the capacity Up to four strings can be operated in parallel without compromising the integrity of the system. Factors to be considered in an increase in capacity are: - 1. All banks must be in a similar environment in terms of temperature, lighting, etc. 2. The voltage drop through the interbank connections must be similar such that each bank is within 10mV under load conditions. Battery Energy can supply these links if requested and given the design criteria for the system. Different size cells should not be mixed in a string. Different sized strings should not be set up in parallel strings.

E. ASSEMBLY	

E. ASSEMBLY

The batteries are designed to have bolted or lead burnt connections. If lead burnt connections method is preferred contact Battery Energy for further advice. Bolted connections are usually recommended for low rate applications.

1. Instructions.

a. Remove accessories from protective packaging.
b. Remove batteries from protective packaging.
c. Consider the following points

- Ensure the pad or stand on which batteries are to be installed is level and smooth without bumps or protrusions that may affect the bases of the batteries.
- Batteries should not be placed directly on concrete floors.
- Operating temperature of the cells must be considered. They must NOT be exposed to the open sunlight, leave in an enclosed shaded area, preferably with cooling ventilation.
- Uniformity of temperature between the different cells is also important in extending battery life.
- Ventilation is important for health and protection of sensitive electronic equipment as corrosive gasses are emitted during the charging process.
- Ensure that if a stand is to be used, that it is sufficiently robust to support the weight of the batteries without sagging.

d. Design cell layout such that positive and negative take-off terminals are positioned near to their respective power sources. This reduces voltage drop and increases energy efficiency.
e. Position first cell with the help of the sling.

Batteries are NOT to be moved by lifting the lugs.

f. Position the second cell with terminal faces mating with the opposite polarity terminals of the first. This creates a series string of cells providing a nominal voltage equivalent to: 2V x No. of cells in string. If parallel connections are required consult Battery Energy or its agent.
g. Repeat step f. with remaining cells until all are positioned
h. Remove transit vents by unscrewing from the cell.
i. Screw ceramic safety vents firmly into all cells in the battery bank. This forms an airtight seal on the rubber washer fitted to the vent.
j. Fit dust caps into vents – they are a press in fit.
k. Bolt terminals of adjacent cells together utilising the stainless steel bolts and links provided.
Ensure that one flat washer is between the head of the bolt and the terminal.
A light film of protective grease can be applied if available.
Tighten the bolts to ensure a solid connection (torque to 10 - 12NM).

DO NOT place a stainless steel washer between the cable lugs and the battery terminal!

l. Check that all electrolyte levels and indicator marks are aligned with each other and level.
m. Ensure supply/load is isolated from battery connection cables
n. Connect positive and negative cables from supply/load isolator to respective battery take off terminals at the end of the bank. Ensure that the conducting face of the cable terminal is bolted up against the lead battery terminal.
o. Fit supplied insulating safety shrouds to all exposed metal surfaces.

This battery installation is now complete and ready to energise.

2. Electrolyte Levels

It is essential that electrolyte levels are high enough to cover the plates. Exposure to air will lead to drying-out of the plates and will cause loss of capacity and irreversible damage to the battery.
Cells should be topped up to just below the high mark at six monthly intervals.
Apart from regular daily discharges up to the C/10 current rate, these batteries are

designed to do infrequent, slow discharges at the 100H rate. They should not be taken below a cell voltage of 1.85V/cell at this rate.

F. MAINTENANCE CHECKS

	Monthly	Quarterly	Bi-annually	Annually
Check Battery Bank Voltage	*	*	*	*
Check all levels for Variance	*	*	*	*
Check Pilot Cell Temperature		*	*	*
Check Pilot Cell Density		*	*	*
Equalisation/Equalise Charge		*	*	*
Top-up with Distilled Water			*	*
Record Voltage, Specific Density, & Temperature of all Cells Θ			*	*
Clean and Dry top of Battery Cells			*	*
Check Connections & re-torque if Needed				*

ΘRecording of these records are a condition of your warranty and will be requested by Battery Energy if you need to make a claim.

4. Annually

Tightness of the bolted connections should be checked and re-torque if required.

5. Topping up and Safety Vents

Care must be taken not to overfill the cell such that the safety vent gets wet. This causes the fine filter to clog with the net result that electrolyte is pumped out of the cell to the bottom level of the vent.

Electrolyte level will vary with state of charge so to avoid overfilling top up should be done during the two-monthly equalisation charge. This also has the desired effect of mixing the electrolyte. If this is not done, the electrolyte should only be topped up to approximately 10mm below the high mark. The vents do not need to be removed during the topping up operation. The dust cap should be taken off and the water added with the aid of a small filter funnel.

7. Battery Water

Distilled or battery quality deionised water must be used.

Tap water, tank water or rainwater collected off a galvanised iron roof will damage your battery and void your warranty. The use of even mildly contaminated containers e.g. with detergent, sugar or alcohol, will ruin the battery. Do not add acid or any other additive to the battery. Contaminating your electrolyte with additives voids your warranty. Additional water can be purchased direct from Battery Energy or its agents.

10 hr rate capacity

Specific Gravity	% Charged	Open Circuit Voltages (per Cell)
1240	100	2.086
1220	80	2.067
1200	60	2.048
1180	40	2.031
1160	20	2.013
1140	0	1.996

- Gravity reading must be taken after a rest period of 24 hours to get an accurate correlation. Temperature is assumed at 25ºC. At other temperatures, a correction must be made. The measured gravity decreases by 7 points for every 10ºC rise in temperature. Therefore if a measurement of 1240 is done at 35ºC. the true density at 25ºC is 1247. Pro rata factors can be used to calculate densities at other temperatures.

8. Specific Gravity Readings

One advantage of vented cells is the state of charge can often be determined from the specific gravity (S.G.) of the electrolyte. Care needs to be exercised as erroneous readings can result for the following reasons: -

a) Stratification can occur. Differences, particularly in the tall cells, can reach 30 to 40 points e.g. 1240 at the bottom of the cell1200 at the top.

b) During charging, the S.G. of the electrolyte in the plates may be very different from that of the electrolyte not in direct contact with the plates.
The S.G. recorded during charge may remain low until vigorous gassing has commenced at the end of charge.
Because of the above two conditions the relationship between S.G. and the state of charge at different temperatures is given in the State of Charge Estimation Chart. See Page 18?
The correct state of charge can only be established after specific gravity and temperature correction is taken into consideration.

G. CHARGING

1. Float Charge

When cells are operated with no load or light loads (less than 5% daily depth of discharge) the best method of charge is constant voltage float charge. The levels that the regulator float voltage should be set to are dependent upon average temperature and are shown below.

At this temperature	Voltage Setting Should Be
15ºC	**2.24V**
20ºC	**2.23V**
25ºC	**2.22V**
30ºC	**2.21V**
35ºC	**2.20V**

Consult with Battery Energy for temperatures outside this range. If the average electrolyte specific gravity is slowly falling, then the float voltage should be revised upwards under advice from your installer or Battery Energy.

2. Recharge Following Discharge and equalisation or refresher charge

To bring the battery up to the full 100% charged state following a deep discharge either a constant current or a constant voltage charge can be given. Batteries are not 100% efficient and therefore they require approximately 15% more energy to be put back in the battery than was taken out on discharge. When giving an equalisation charge, this needs to be increased to 30-40% to allow for cell differences and possible stratification of the electrolyte.

3. Constant Current

If charging at constant current is employed, then the maximum rate at the start of charge is about the C/10 (where C is the 10H rate capacity). Once the gassing point is reached, this should be reduced to C/14. Gassing at high currents will cause the cell to heat up. Extended charging at temperatures above 50ºC is not recommended and either a lower charge rate should be employed, or the charger switched off to allow the battery to cool.

4. Constant Voltage

Charging at constant voltage is the normally adopted method.
To fully recharge a battery following a 100% discharge, the following times are required:

Voltage Settings for Constant Voltage Charging	
2.35 Volts	27 Hours
2.40 Volts	21 Hours
2.45 Volts	17 Hours
2.50 Volts	13 Hours
(Charge assumed to be C/10 maximum)	

Check the recharge level by testing the specific gravity and compare this with details on Fig ?.

Equalisation charge times can be calculated by taking the allowance for this recharge to gassing point (approximately 10H) from the above figures and increasing by two hours to allow for cell differences.
The Specific Gravity only rises when gassing (2.35V per cell) has been reached and enough time elapsed (half to one hour) for the electrolyte to have mixed. If the battery is floated at 2.25V/cell it can take weeks for the gravities to come up to the specified 1240 level.
Regulators often switch off when a set voltage is reached (e.g. 2.4V or more) usually 2.5V/cell. This is equivalent to 14.4 to 15v for a 12v system or 28.8 to 30v for a 24v system. This may not be sufficient time for the electrolyte to mix and the gravity can be

G. CHARGING	showing 1180, indicating a discharged battery, while the battery can be virtually fully charged in the plates, but not in the bulk of the electrolyte. If there is any doubt, then the battery should be left at a point above gassing for several hours and the gravity re-checked. Normally batteries will accept high rates of charge from a discharged state. If the system has an electrical problem leading to the batteries not being charged and the battery has been completely flattened at very low rate over a long period of time the charger voltage can rising sharply to the gassing point (2.35V/cell and above). If the specific gravities reading are not below 1100 the battery can be recovered by the application of a small charging current (trickle charge at approx C50), so that the voltage reading of each cell does not exceed 2.35 volts per cell. The alternative is to limit the voltage (2.35V/cell and above) accordingly until the battery has reached a state of charge when it can accept more current. **THIS CAN LEAD TO DESTRUCTION OF THE CELL IF LEFT FOR A PROLONGED PERIOD UNDER THESE CONDITIONS.** **5. Comments on Equalisation Charging** Equalisation charging is employed to achieve several things: a) To return the batteries to a 100% state of charge. b) To even out differences between the cells that accentuate over a period of time where minimum recharge is used. c) To counter the problem of stratification. a) Stratification is where the electrolyte, particularly in tall cells with large volumes of excess electrolyte develops varying densities from the top to the bottom of the cell. b) If it is left unchecked, it can result in sulphation and corrosion at the bottom of the cell, with subsequent permanent loss of capacity. Equalisation charging must be carried out at least quarterly and more frequently if the system is being run down and exhibiting low specific gravity readings. Specific gravity readings of all the cells at top of charge should be above 1230. **6. Setting of Regulators** Most regulators are set to rise to a certain voltage/cell and then cut out. The batteries benefit from having an absorption time when the voltage cut-out point is reached. The most efficient setting for Suncycle batteries is between 2.45-2.5V/cell. There needs to be an allowance for temperature compensation. An increase of 5mV/DegC should also be allowed for, i.e. at 35ºC, the setting/cell is 50mV lower than at 25ºC. If regulators are set at much lower values, e.g. 2.35V/cell or 14.1V for a 12V system then the capacities and gravities in the bank will slowly fall. Within the 2.45-2.5V range, the regulator setting should be adjusted according to the average amount of energy used on a daily basis, i.e. if 30% of the 10H rate is used then a regulator setting of 2.5v is set, if 10% is used a value of 2.45v is set
H. FAULT FINDING	**1. Sulphation** Sulphation will occur if the battery is left in a discharged state for extended periods of time. Its electrical symptoms are loss of capacity, reluctance to accept charge (often coupled with high electrolyte temperature) and high charge voltage readings. The only solution to sulphation is a slow extended charge over a period of days or weeks. If the battery has a significant degree of sulphation, this might not be successful. The alloys used by Battery Energy will resist sulphation and loss of capacity and give good capability, but they are still sensitive to serious abuse. **2. Shedding of Active Material** During the course of the normal battery life cycle, active material will be lost from the positive plates and settle down into the sludge trap at the base of the battery. Battery Energy products are designed to minimise this, by the use of double wrap fibreglass around the positive plates. The sludge trap on the bottom of the container will gradually fill, eventually build up and coming in contact with the bottom of plates thereby shorting the cell, causing end of life

H. FAULT FINDING

failure.
This build up normally takes many years and is inherent in the aging of the battery and is not due to faulty manufacture.
Some information as to the state of the battery can also be gleaned from the colour of the sediment. Brown is indicative of overcharge of the battery, grey is indicative of undercharge.

3. Internal Short Circuit
Trees or growths of conductive material between the positive and negative plates cause internal short circuit within the battery. They usually occur at the bottoms or tops of the plates, rarely through the separators or around the side edge. They can be caused by a manufacturing fault, such as misalignment or burning of separators.
The usual criteria for a short are:
1. Much lower capacity than other cells.
2. Lower gravity than other cells (20 points plus, e.g. cells reading 1230, cell with short 1205).
3. Lower voltage readings on charge.
Shorts will cause deterioration of the cell over a period and the difference between cells will increase. As the cells do not gas, the consumption of water will also be less.
Plate growth is fairly common in older batteries and is a symptom of severe overcharge. The plates grow in a horizontal and vertical direction.

In extreme cases, this can lead to either the container cracking due to internal pressure, the lid cracking, or positive plates shorting on the negative busbar. A rod is placed underneath the negative busbar in Battery Energy cells to prevent this happening. If the plates can be seen reaching the container, then again the battery should be changed.

5. Reversed Polarity
If a battery or an individual cell reaches a state of being reverse charged - as for instance in the bank being completely discharged, one cell is lower in capacity than the others, its voltage goes into reversal, i.e. the opposite sign to other cells in the group. On recovery, depending upon the length of time in reversal, this cell will give much lower capacity than before and, possibly, a lower charge voltage (if irreversible sulphation has not occurred).

Under most circumstances, the cell will have to be replaced.

6. Corrosion
Corrosion is the predominant failure mode of lead acid batteries. This is a natural occurrence with aging of batteries. This is the destruction of the positive grid by electrochemical processes. It is exacerbated by high temperature, overcharge, high specific gravity, etc. Battery Energy products are built with particularly thick grids (7.3 to 8mm) and thick members, as well as special alloys to resist this for as long as possible so that the design life of 12 years plus can be achieved.
Destruction of the grid will result in shedding of the active material and can be observed by a build-up of sludge in the bottom of the container. It is accompanied by a significant loss of capacity. As much as 50% of the rated capacity, once the grid has disintegrated, the battery cannot be recovered and will need to be replaced.

7. Batteries not Performing/Perceived Capacity Loss

When a Remote Area Power System is not performing well or giving full capacity the first component to be singled out is the battery bank. Our experience tells us that 9 times out of 10 that this loss of capacity is due to other reasons than faulty batteries. This is a system failure so a complete analysis of your system needs to be done.
At this stage you should call the reseller or installer who installed and commissioned the system for you.

There are many reasons for this failure mode some of which are listed below.

a) *<u>System Sizing</u>*
The system is undersized or does not have enough energy input. If more capacity is

H. FAULT FINDING

taken out of the system than put back in each day, the batteries will run down and less energy will be available. This can also arise from the addition of new appliances to the system or ancillary equipment such as solar panels, wind generators, etc. not operating to their full specification. The battery sizing should be based on a maximum daily average requirement of 33% of the 10H rate or 20% of the 100H rate. If the average is likely to grow, then this must be taken into account when sizing the system.

b) <u>The Low Voltage Cut Out</u>

The low voltage cut out is set too high. The voltage of the system is dependent on a number of factors.

<u>The Current</u>

The voltages at different currents can be seen from Figure ?.
The state of charge. This can also be seen from Figure ?

<u>The Temperature</u>

Significantly less capacity will be obtained at lower temperatures to the same voltages. The factor to be used when calculating this is 1% per degree (i.e. around 10% less capacity at 15 Deg C to 25 Deg C.). This is usually seen as moving the whole discharge curve downwards, so it will also be accompanied by a drop in voltage of between30 and 50mV/cell compared to the readings at 25DegC.
The 10 hour (C/10) capacity = AS650 = 340Ah C/10 = 34A
The factor is accelerated at higher currents.
For the optimum battery life a voltage cut out of around 1.92vpc is recommended.
Refer to figure below.

Low Voltage Cut-out Settings

Per 2 Volt Cell	1.92 Volts per cell
12 Volt System	11.5 Volts
24 Volt System	23.0 Volts
48 Volt System	46.0 Volts

This is for 25ºC average operation. Settings will need to be adjusted for other operating temperatures.

I. MAINTENANCE KIT DESCRIPTION (Optional Extra)

1. Digital Multimeter (3-1/2 digit)
This is used for checking system and cell voltages. Voltmeter has an accuracy class of 0.5 or better and a resistance of at least 10KΩ/v, in accordance with AS1042.

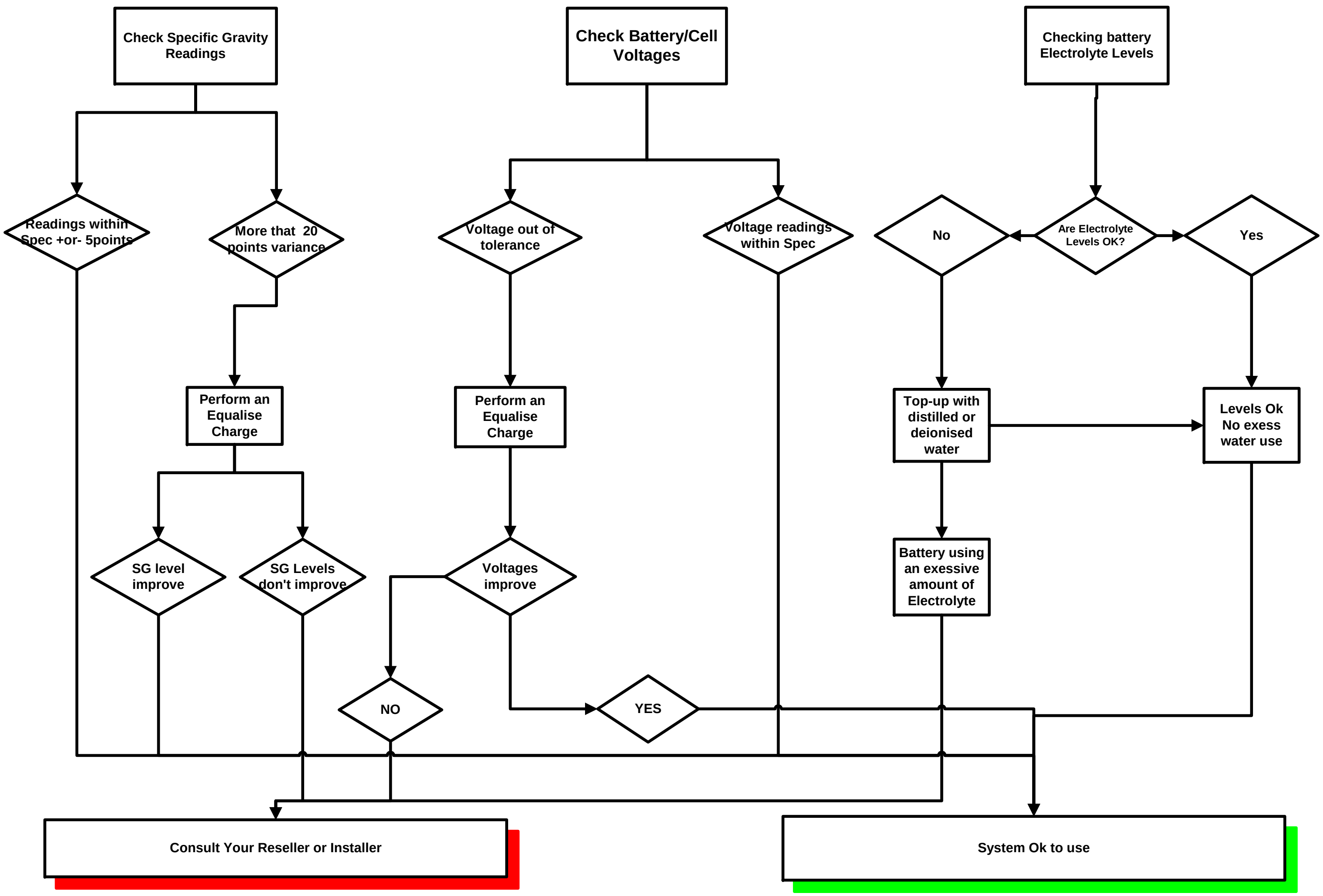
2. Thermometer
An alcohol thermometer is also supplied ranging from 10ºC to 100ºC.
This can be placed through the vent of the pilot cell and left in the cell permanently to record temperature.

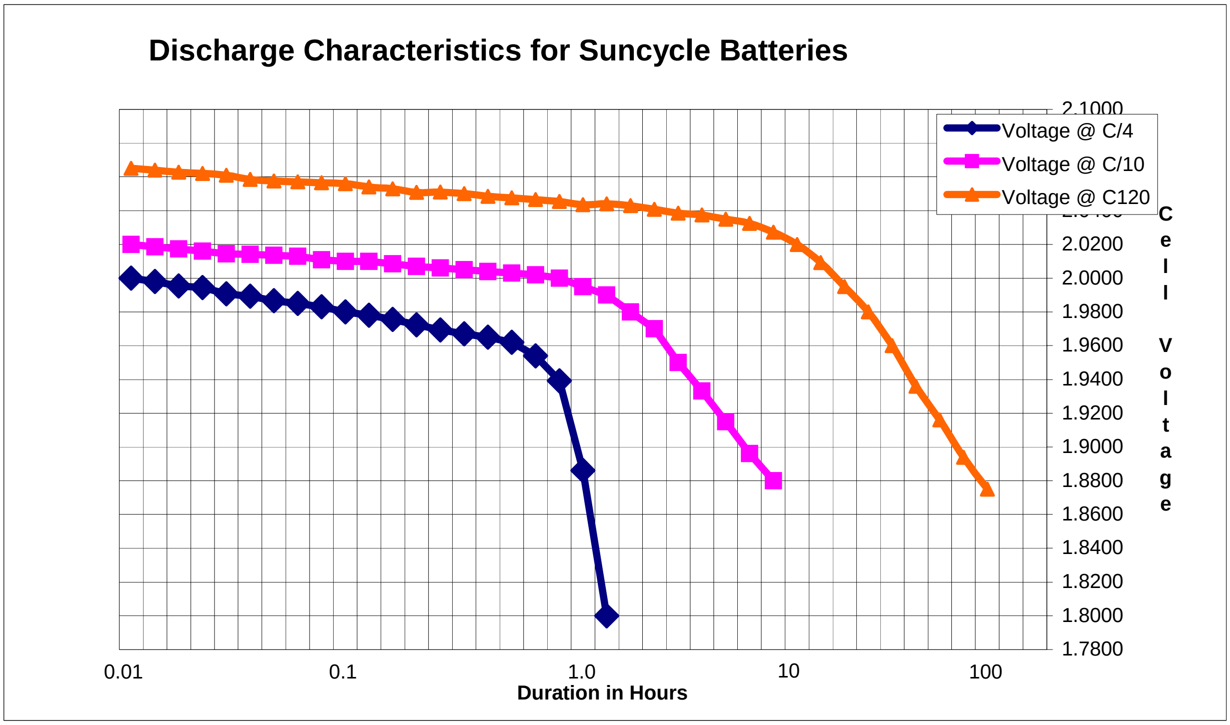
3. Hydrometer
A high quality hydrometer is also included. Automotive or other hydrometers are either not accurate or have the wrong tube for transport reasons. The length of the tube is gauged to fit down through the explosion proof vent, without the need for removal.

4. Spanner
An insulated spanner is provided for all M8 connections within the batteries.

5. Funnel
A funnel is provided for addition of water through the vent. It is important to keep the top of the cells free of dust or moisture so that 'tracking' - an electrical circuit between the terminals on the top part of the cell - does not occur.

Spare nuts, bolts, and vents are available upon request.


Check Specific Gravity Readings
Check Battery/Cell Voltages
Checking battery Electrolyte Levels
Readings within Spec +or- 5points
More that 20 points variance
Voltage out of tolerance
Voltage readings within Spec
No
Are Electrolyte Levels OK?
Yes
Perform an Equalise Charge
Perform an Equalise Charge
Top-up with distilled or deionised water
Levels Ok No exess water use
SG level improve
SG Levels don't improve
Voltages improve
Battery using an exessive amount of Electrolyte
NO
YES
Consult Your Reseller or Installer
System Ok to use


Discharge Characteristics for Suncycle Batteries
Voltage @ C/4
Voltage @ C/10
Voltage @ C120
2.1000
2.0200
2.0000
1.9800
1.9600
1.9400
1.9200
1.9000
1.8800
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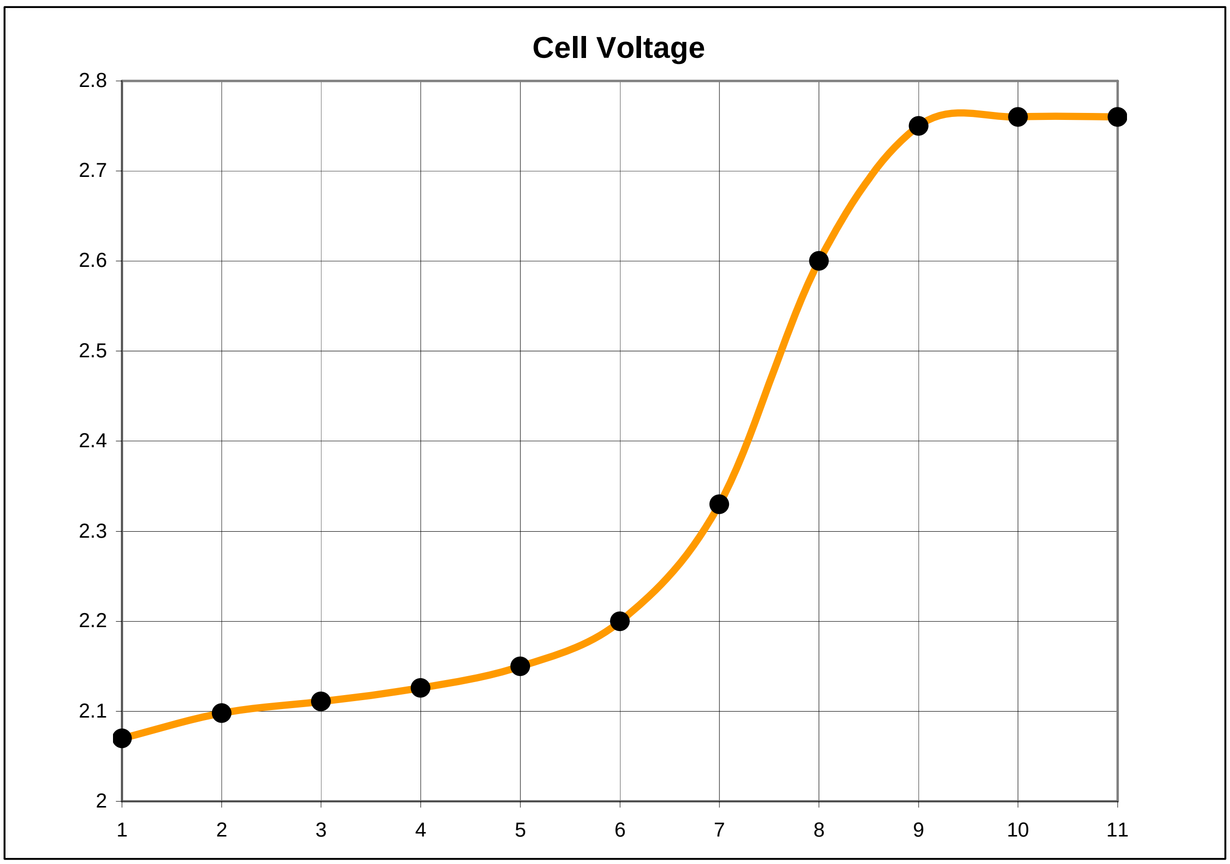
Duration in Hours


Cell Voltage
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2.6
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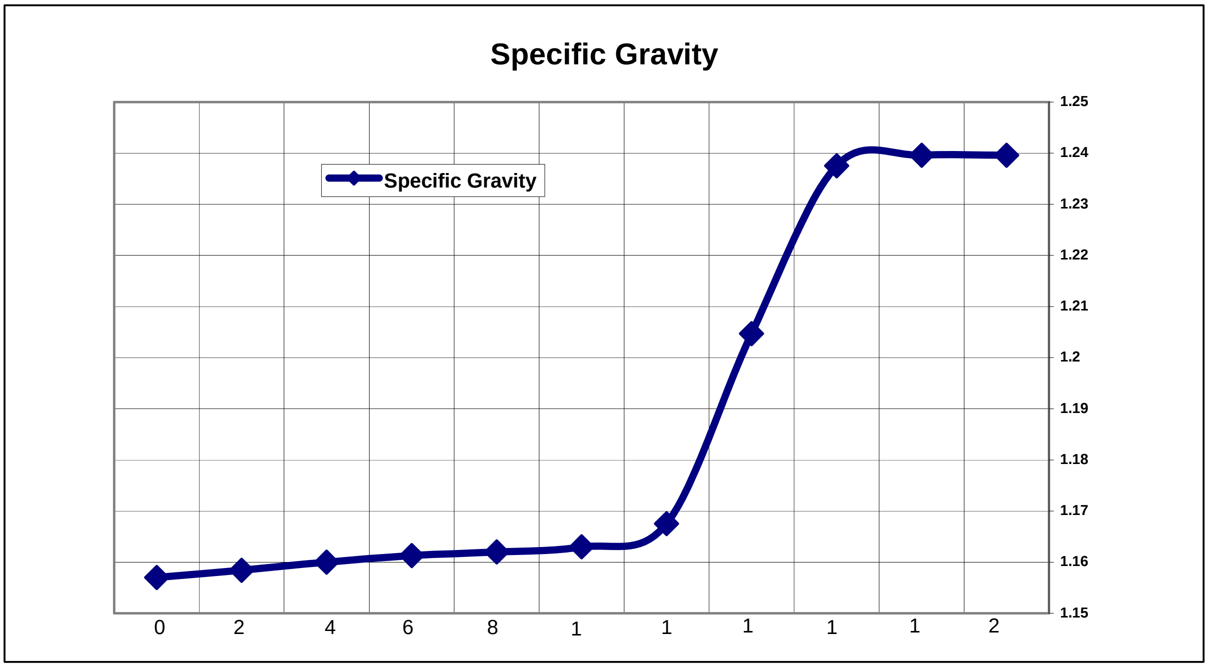
Specific Gravity
Specific Gravity
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1.24
1.23
1.22
1.21
1.2
1.19
1.18
1.17
1.16
1.15
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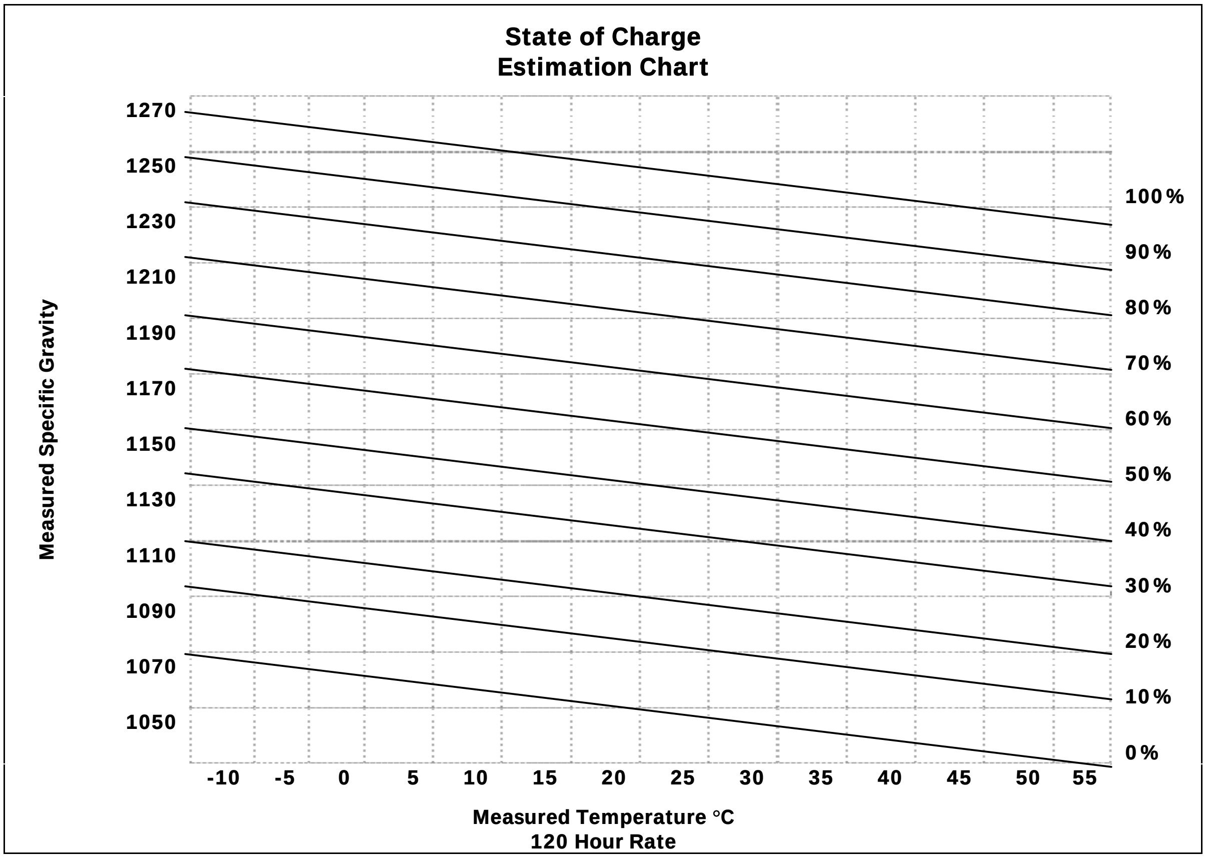
State of Charge
Estimation Chart
Measured Specific Gravity
1270
1250
1230
1210
1190
1170
1150
1130
1110
1090
1070
1050
100%
90%
80%
70%
60%
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50
55
Measured Temperature °C
120 Hour Rate

System Installation & Commissioning Records Sheet

(TO BE FILLED OUT BY INSTALLER AND KEPT WITH MANUAL FOR FUTURE REFERENCE)

Customer Name;		**Telephone Number/s;**	
Address;		**Charging Equipment;**	
Date of Purchase;		**Regulator Type & Model;**	
Purchased from;		**Charging/Float Voltage;**	
Location of Site		**PV Arrays, Type & Number;**	
Installed By;		**Charging Current;**	
Proof of Purchase i.e. Invoice #;		**Equalisation/Equalisation Voltage;**	
SEIA Accreditation #;		**System Design Load Kw;**	
Installers Signature;		**Current System Load Kw;**	
Critical Nature of Installation;	Emergency Services ☐ Industrial/Commercial ☐ Domestic ☐ School ☐	**Application Type;**	Solar ☐ RAPS ☐ Backup ☐ Diesel Start ☐

Special Comments Relating to System;

Table 1 Technical Specifications Suncycle										
			Nominal Ah Cap. @ 25° C				Overall Dimensions			
Cell/ Battery Type	Electrolyte Reservoir Per cell Lt.	Nominal Voltage	3 hr	10 hr	24 hr	120 hr	Length mm	Width mm	Height mm	Weight Kgs
6AS190	0.7	6	75	106	129	195	286	184	184	30
2AS450	1.6	2	169	236	288	450	190	197	197	21
2AS620	2.2	2	245	342	417	620	190	276	276	32
2AS770	4.0	2	279	420	525	840	190	292	482	51
2AS940	4.0	2	345	515	644	1000	190	292	482	55
2AS1100	4.0	2	449	640	787	1100	190	292	482	59

Contact Information

Battery Energy Head Office

96 Fairfield St
Fairfield NSW 2165
Phone 029 681 3633
Toll free number 1800 819 829.
Fax 029 632 4622
E-mail sales@batteryenergy.com.au

Queensland/NT

54 Jephson street

Toowong Qld 4066

(07) 3371 1622
E-mail ian.watson@batteryenergy.com.au

Victoria/TAS/SA

21 Aristoc Road

Glen Waverley Vic 3150

Tel: (03) 9550 1893

Fax: (03) 8707 1655
E-mail adrian.edgar@batteryenergy.com.au

W.A. Phone/Fax 089 491 6577

Periodic Maintenance Records

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Customer: ______________________
Location: ______________________
Telephone No: ______________________

Battery Type: ______________________
Capacity: ______________________
No. Of Cells: ______________________

Pilot Cell No: ______________________
Date Installed: ______________________
Purchased From: ______________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

<u>Annual Checks:</u>

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Two

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

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Customer: ____________________ Battery Type: ____________________ Pilot Cell No: ____________________
Location: ____________________ Capacity: ____________________ Date Installed: ____________________
Telephone No: ____________________ No. Of Cells: ____________________ Purchased From: ____________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

<u>Annual Checks:</u>

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Two

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

Customer: ____________________
Location: ____________________
Telephone No: ____________________

Battery Type: ____________________
Capacity: ____________________
No. Of Cells: ____________________

Pilot Cell No: ____________________
Date Installed: ____________________
Purchased From: ____________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

<u>Annual Checks:</u>

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Three

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

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Customer: ____________________
Location: ____________________
Telephone No: ____________________

Battery Type: ____________________
Capacity: ____________________
No. Of Cells: ____________________

Pilot Cell No: ____________________
Date Installed: ____________________
Purchased From: ____________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

<u>Annual Checks:</u>

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Four

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

Customer: ____________________
Location: ____________________
Telephone No: ____________________

Battery Type: ____________________
Capacity: ____________________
No. Of Cells: ____________________

Pilot Cell No: ____________________
Date Installed: ____________________
Purchased From: ____________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Annual Checks:

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Five

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

Customer: ______________________________
Location: ______________________________
Telephone No: ______________________________

Battery Type: ______________________________
Capacity: ______________________________
No. Of Cells: ______________________________

Pilot Cell No: ______________________________
Date Installed: ______________________________
Purchased From: ______________________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Annual Checks:

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Six

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

Customer: ____________________
Location: ____________________
Telephone No: ____________________

Battery Type: ____________________
Capacity: ____________________
No. Of Cells: ____________________

Pilot Cell No: ____________________
Date Installed: ____________________
Purchased From: ____________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

<u>Annual Checks:</u>

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Seven

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added

Periodic Maintenance Records

Customer: ______________________________
Location: ______________________________
Telephone No: ______________________________

Battery Type: ______________________________
Capacity: ______________________________
No. Of Cells: ______________________________

Pilot Cell No: ______________________________
Date Installed: ______________________________
Purchased From: ______________________________

Monthly

Month	Date & Initial of reader	Charger Volts	Acid Level	Pilot Cell		
				Hyd ro-meter reading	Volts	Temp °C
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Annual Checks:

Clean Surface of Batteries

Re-torque battery connector bolts.

Year Eight

Date				
Cell No.	Volts	Hydrometer Reading	C°	Water Added

Six Monthly

Date			
Volts	Hydrometer Reading	C°	Water Added