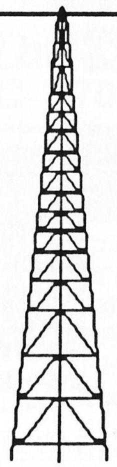
PAARA

GRAPHS



June 86

THE OFFICIAL NEWSLETTER OF THE PALO ALTO AMATEUR RADIO ASSOCIATION

AND

THE MENLO PARK C.D. AMATEUR RADIO CLUB

1986 CLUB OFFICERS

President	Alan Larson	WA6AZP	326-6430
Vice-President	Andy Korsak	VE3FZK	366-5228
Secretary	Bill King	N6CHI	595-0258
Treasurer	Jack McEnnerney	W6LII	591-8526
Trustee, W6OTX	Fred Canham	K6YT	948-9238
Property	Ed Fairbanks	W6AIN	322-0319
Co-Property/Badge	Fred Canham	K6YT	948-9238
Refreshments	Frank Chandler	WB6QPY	322-7678
ARES Officer	Steve Stuntz	K6FS	322-4952
Club Historian	Jerry Zobel	W6ARA	322-0063

BOARD OF DIRECTORS

Tom Scherf	K6JBR	365-4068	85-86
Ron Panton	W6VG	854-4814	85-86
Gerry Wagstaffe	W6NIR	325-4814	85-86
John Buonocore	KD6ZL	366-1658	86-87
Micheal Bach	WB6FFC	592-2710	86-87
Perry Yelton	KD6ID	366-9481	86-87

PaaraGraphs Staff

Editor	Rob Taylor	KA6NAN	658-9138
Co-Editor	Ken Dueker	KB6BPM	322-6984
Advertising	Swede Swenson	N6CHL	368-9808
Mailing	Bill McElhinney	KA6LZI	325-9808
Author	(Mystery Writers)	?6???	???-????

PAARA POLICIES

Membership in PAARA is $6.00 per calender year which includes a subscription to Paaragraphs.
Make payment to: PAARA, P.O. Box 911, Menlo Park, Ca. 94026

<u>Club Net 147.45 MHZ Monday @ 8:30 PM</u>

Misc info: Wayne Green, now owner of 73' magazine, is very interested in having ham projects, kits, ideas submitted now

(submitted by Paul, WA6BRM)

April 9th board of directors meeting

President	Allen Larson	Present
Secretary	Bill King	Present
Members	Tom Scherf	Absent
	Ron Patton	Absent
	Gerry Wagstaffe	Present
	John Bonocore	Present
	Mike Bach	Absent
	Perry Yelton	Absent
Visitor	Fred Canham	Present

The following equipment has been donated to PARRA from the estate of Norm Mac Intyre, W6LLV.

Hallicrafters HT 32 Transmitter $75

One new SK 510 socket, SK 516 Chimney, and 8164/3-1000Z Make offer

Cushcraft A28-4 28 MHZ 4 element beam, new condition $40

These items are offered to PAARA members through PaaraGraphs. They will be on display at the Foothill Flea Markets unitl sold. Contact Fred Canham, K6YT, phone (415) 948-9238.

PROGRAM FOR FRI. JUNE 6, 1986 MENLO PARK REC. CENTER

K6 GZK GEORGE, ON "THE LINK"

GEORGE OPERATES THE 145.6 MHZ END OF A VHF/UHF LINKUP SPANNING MOST OF CALIFORNIA AND BEYOND -- WE'LL HEAR AT THE TALK JUST HOW FAR IT GOES. LICENSED IN 1951, WORKED AT RADIO KXRX MID 50'S, COUNTY COM. LATE 50'S, HAD TV BUISNESS 20 YEARS, HAM RADIO BUISNESS 10 YEARS. HIS FIRST 220 REPEATER WENT UP IN 1977.

NEXT TIME: (JULY 11 NOT 4) W6QIT MIKE VILLARD, OF SRI AND STANFORD PROF., & COLLEAGUE(?) WILL ALSO DO AUG. MTG.

PPRS (Pacific Packet Radio Society)
every 1st Tuesday of the month
7:30 PM @ Ampex Cafeteria, Redwood City
(Take 101 to Woodside Rd,
go south on Bay Rd to Ampex)

The Care and Feeding of the Sealed Gelled-Electrolyte Lead-Acid Rechargeable Battery

Bob Leichner WO6W May 23, 1986

This note was prompted by a group discussion in which it became clear that the information might be usefull to others as well. I am not an authority on the application of these cells and will welcome any additional comments.

Special thanks to Fran Hoffart of National Semiconductor for his design suggestions and several discussions. Materials included were provided courtesy of Power Sonic Corporation and National Semiconductor.

The sealed gelled-electrolyte lead-acid rechargeable battery is a relativly low-cost source of power for portable and emergency use. This note gives a brief overview of the most important characteristics and representative charging information for these cells. Please remember that a particular manufacturer's cell may differ in some ways from the information presented here, and that the manufacturer's specifications should be consulted with special attention given to peak charge voltage and current limits. I've tried to give representative values for commonly available cells.

RATINGS:

Ratings for this type of battery are specified for room temperature and a 20 hour discharge rate. As an example, a 2.6 amp hour battery will put out .13 amps for 20 hours at room temperature (20 hours x .13 amps = 2.6 amp hours). A new 2.6 A.H. battery will not put out 2.6 amps for 1 hour... it will give only 1.7 amps for a 1 hour period before reaching its discharge voltage. As the rate of discharge increases, the available capacity decreases and the voltage at 100% discharge drops (see fig. 1). As temperature increases capacity increases as well, but at the cost of decreased useful service life. (fig. 2: discharge rate vs. time vs. AH rating, fig. 4: capacity vs. discharge rate vs. temperature)

Cells have an open circuit voltage of about 2.12 volts. Batteries of higher voltages are made up of series connections of 2.12 volt cells. While the cell voltage will be higher than 2.12V immediately after charging, it will return to this value after some time off of the charger (minutes for my 55AH battery). As the cell is discharged, the voltage will drop, slowly at first, to a fully discharged value that depends of the rate of discharge. Cells may be damaged if over-discharged.

The charge capacity of a cell will drop over the service life. Cells are typically designed for 4 to 6 years float use or 300 to 500 normal discharge-charge cycles. At the end of this service a cell may still retain 40% to 60% of its original capacity. The number of discharge-charge cycles will depend upon depth of discharge: more cycles for shallow discharge (fig. 6).

CHARGING:

All that is required for charging is that the peak charger voltage be higher than the voltage of the discharged battery. Under these conditions a current will flow in the battery which reverses the chemical reaction by which the battery provides electrical power. There are several charging conditions to avoid:

OVERCHARGING: If the charging voltage is excessive and high current flows after the battery is fully charged, electrolyte water is decomposed and the cell ages prematurely.

UNDERCHARGING: Under low voltage conditions, charging current stops before the battery is fully charged. The chemical cycle that provides electrical power is not completely reversed and the battery's capacity is not fully restored. In time, the available capacity of the battery can be reduced.

A similar effect can occur if the battery is left fully discharged for a long time.

SELF-DISCHARGE: Cells exhibit a low rate of self-discharge. At room temperature a cell may lose only 2-3% of charge per month. Below 50% charge, the self-discharge rate will increase and in time the capacity of the battery will be reduced. For this reason it is advisable to recharge a stored battery every six to nine months. The self-discharge rate will also increase with temperature so that a battery stored at higher temperature (a car trunk?) will need more frequent recharging.

PREFERRED CHARGING METHODS: Several manufacturers recommend constant voltage-limited current charging for maximum service life and capacity along with reasonable charging times. While there are many other methods for charging these cells, the following are representative.

The peak voltage applied for charging differs in float and rapid charge applications. For float applications where the battery is left on the charger after full recharge (emergency/standby or unattended charging), the PEAK charging voltage should be 2.25 to 2.3 volts per cell. The initial float charge current should be limited to between 3 and 5 times the 20 hour battery rate. As an example, a 12V 3 A.H. battery (six cells) would be charged with between 13.5 and 13.8 volts limited to .45 to .75 amps. End-of-charge current, depending upon cell type, will be between 1.5 and 30 ma.

For portable applications where a rapid charge is desired, use 2.45 volts per cell. Again, limit initial charge current to 3 to 5 times the 20 hour rate of the battery. End-of-charge current, depending upon cell type, will be about 0.01 x cell current rating. When the battery is fully charged (indicated by final voltage and end-of-charge current), remove the charger or revert to float charge conditions. One manufacturer comments that 2.45V/cell charge rates should not be left on for more than a few days after full charge is reached.

Fig. 8 shows the voltage and current curves for a 6V/8 A.H.

battery being charged at 7.4 volts (2.45V/cell) with current limited to 2A. (5 x 20 hour current rating). Note that the battery is fully charged once both the final voltage and current values are reached.

Fig. 8 is typical for a battery being charged a reasonable period after discharge. If a battery is left discharged for a long time it may initially appear to be an open circuit and will not accept much current. Leaving the charger connected for an extended time will usually reverse this condition.

CHARGING TIME: Current acceptance by a cell will depend on the rate of preceeding discharge, time since discharge, depth of discharge and temperature. As an extreme case, cells discharged at the 1 to 5 hour rate have been recharged in 2 to 3 hours using unlimited current. These high charge rates shorten battery life for many manufacturer's batteries. Charging at the 3 to 5 times 20 hour rated current limit is a good compromise between performance and battery life. Fig. 8 shows estimated capacity return vs. charging time for the 2.45 volts/cell voltage limits. Note that about 80% of the battery charge is returned in the first half of the time required for a 100% charge.

CONSTANT CURRENT CHARGING: Cells may be charged using a constant current supply at a trickle rate of 0.5 to 2.0 ma. per rated A.H. of battery capacity. This rate will fully charge a cell but will also take a long time! Rapid rate constant current charging is also possible but batteries may be easilly damaged if left on the charger after reaching full charge.

PRECAUTIONS:

Dry cells give off hydrogen gas as a normal by-product of their operation. Manufacturers caution against the use of closed containers and advise provisions to prevent accumulation of hydrogen gas, potential ignition and over-pressure.

One manufacturer strongly cautions that the cells act much as capacitors and will accept charge to the peak output voltage of the charging supply. If the supply has high ripple peaks, overcharging may result. They recommend using a scope to measure the peak ripple voltage or, alternativly, an accurate meter and a 500mfd capacitor and 1000 ohm resistor in parallel across the output of the charger.

CIRCUITS: (Schematics and details are attached)

TAPER CHARGER: This circuit is very inexpensive if you already have a 13.8VDC supply with sufficient current capacity. A drawback is that the taper charge characteristic of this design results in longer charge times than the constant voltage / current limited method recommended above.

SINGLE RATE CHARGER: This design provides constant voltage / current limited charging. The integrated circuit regulator choosen is suitable for charging at currents up to about 2A which is adequate for batteries rated up to about 10 amp-hours. This charger can be adjusted for float or fast charge voltage. With the fast charge voltage it is important to remove the charger once the battery is fully charged to avoid overcharging.

DUAL RATE CHARGER: This charger has just about every feature one might want at the cost of greater complexity and expense. The current limiter (Q1, R1) from the single rate charger can be added to provide adjustable peak charging current. This charger automatically switches from fast to float charge rate so that it may be left connected to the battery without danger of overcharging. Note that R4 and R6 should be adjusted for 2.45V/cell rather than the 2.5V specified by the author for a different type of cell.

OTHER BATTERIES:

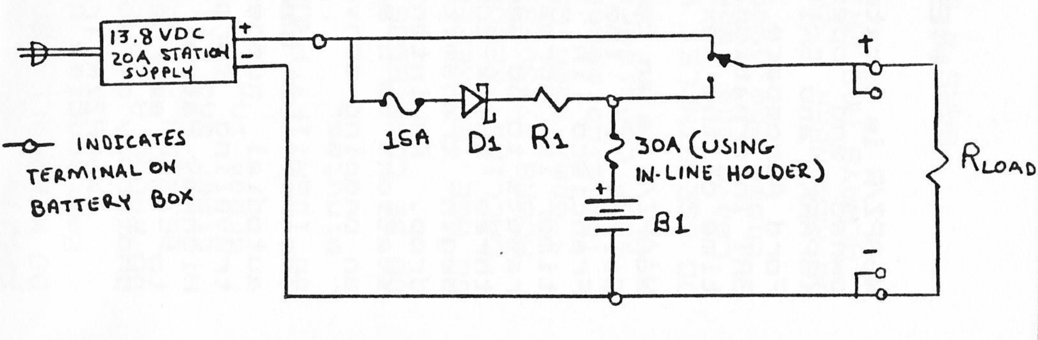
The immobilized electrolyte lead-acid battery is very similar to the gelled electrolyte batteries discussed above. They take somewhat longer to charge and require a slightly higher voltage and peak charge current than most gelled electrolyte batteries. The following values are typical:

% of discharge	volts per cell	charge current	hours to charge
float service	2.28-2.32V	10-20% of rating	continuous
5-50%	2.45-2.55V	10-40% of rating	10-18
50-100%	2.50-2.55V	20-50% of rating	12-20

As an example, A 12V 2.6AH battery in deep cycle use (50-100% discharge) would be charged at between 15.0V and 15.3V with current limited between .52A and 1.3A. Cautions about over and under-charging still apply.

I have been told by several people that automobile batteries are designed for high discharge rates followed by immediate rapid recharging. These batteries are not designed for and do not perform well in low drain, long period discharge service as demanded by emergency and portable operation. Marine deep-discharge cells seem to be better suited to these applications. I know very lttle about the marine cells but suspect they are worth looking into.

TAPER CHARGER: This circuit delivers high charge current to fully discharged batteries and tapers to float charge current for charged units. Charge times are longer than for constant voltage / current limit designs as peak current is delivered for a short time only. The design takes advantage of a supply running at 13.8 VDC, a constant voltage one Schottky diode drop above the minimum float charge voltage of the battery. Charger components are mounted on a plastic marine battery box that houses the battery with several 1/4" x 2" bolts used as terminals for the connection of supplies and loads. With this design, battery voltage may be monitored to indicate charge condition.



WELCOME TO W6APZ/R 145.23

W6APZ/R is located in the Palo Alto foothills behind Stanford University. It is owned and operated cooperatively by the South Peninsula Amateur Radio Klub (SPARK) and SRI Amateur Radio Society (SARS). SPARK members are employees of Ford Aerospace and Communications Corporation. SARS members are employees of SRI International. Check in on 144.63 input, 145.23 output for the date and time of the next meetings of our clubs.

W6APZ/R is an open repeater that serves the Greater San Francisco Bay area from Gilroy in the South, and the Livermore Valley in the East, through San Francisco in the North. The repeater operates 24 hours a day. The blab timer is normally set to **one and a half minutes.** During commute hours it resets to 30 **seconds.** The timer resets each time the carrier is dropped when three quick tones are heard. The tones are the cue to the next station to begin transmitting. There is no need to wait for the repeater carrier to drop. An intentional pause between the carrier drop and the tones allows for stations to break in. This facilitates emergency traffic and permits joining an ongoing conversation.

The repeater has an emergency autodial capability. SPARK and SARS have made ten autodial numbers available to all licensed hams living in or regularly traveling through the Greater Bay Area. These numbers include the three Highway Patrol districts, AAA, and several local police departments. Access to the emergency autodial is available at no cost by sending an SASE and a photocopy of your license to:

W6APZ/R Trustee, 840 Talisman Dr., Palo Alto, Ca. 94303.

REPEATER TIPS

DOs

DO KEEP ALL TRANSMISSIONS SHORT
Emergencies don't wait.

DO PAUSE A COUPLE OF SECONDS BETWEEN EXCHANGES to reset the timer and allow someone to break in.

DO IDENTIFY PROPERLY every ten minutes.

DO BE COURTEOUS AND FRIENDLY.

DO USE THE REPEATER ONLY AS A CALLING FREQUENCY DURING COMMUTE HOURS (7:30-8:30am, 11:30-1pm, 4-6pm) then QSY for your QSO. The club members will appreciate your consideration.

DO USE SIMPLEX WHENEVER POSSIBLE. Leave the repeater available for those who need it.

DO REMEMBER - EMERGENCY TRAFFIC ALWAYS HAS PRIORITY.

DON'Ts

DON'T MONOPOLIZE THE REPEATER.

DON'T ABUSE AUTOPATCH PRIVILEGES. Business traffic is not permitted. The repeater is a community resource, like a party line.

DON'T NEGLECT PUBLIC SERVICE such as accident reporting, emergency preparedness, etc.

DON'T BREAK INTO A CONTACT unless you have something to add.

DON'T ACKNOWLEDGE JAMMERS. That's how they get their kicks. If you can read your contact through the interference, continue your QSO. If not, QSY or QRT.

DON'T FORGET - WHAT YOU SAY OVER THE REPEATER CAN BE HEARD OVER THOUSANDS OF SQUARE MILES.

DON'T DISCUSS AUTODIAL CODES ON THE AIR.

SARS & SPARK HOPE YOU WILL ENJOY THE PALO ALTO 523 REPEATER

B1: 12V/55AH sealed gelled-electrolyte lead-acid rechargeable battery

D1: 30A. 45V. Schottky: This diode prevents the battery from discharging into the supply when it is turned off (possibly preventing damage to the supply!). The low Schottky diode voltage drop of .3V enables the float charge voltage to the battery to stay above the minimum required 13.5V (6 cells x 2.25 V/cell). An alternative is to raise the station supply voltage and use a conventional diode... as long as all your equipment is happy with the higher supply voltage!

R1: .25 ohm 80W (four 1 ohm / 20W resistors in parallel) results in a maximum charge current of 12A. Calculations for choosing R1 follow.

1) float charge voltage = 6 cells x 2.25V/cell = 13.5V
   = 13.8V supply - .3V drop across D1
2) battery discharged voltage (assume discharge at 20 hour rate)
   6 cells x 1.75V/cell = 10.5V for the battery.
3) Charge current normally limited between 3 and 4 times the 20 hour rate of the battery. I allow a higher peak for a short time
   55 A.H. battery rating / 20 hours = 2.75A 20 hour rate.
   3 x 2.75A = 8.25A, 4 x 2.75A = 11A.
4) drop across R1 = float charge voltage - battery discharged voltage
   13.5V - 10.5V = 3.0V
5) reasonable R1 = drop across R1 / reasonable charge current.
   3.0V / 12A = .25 Ohm
6) R1 power loss = drop across R1 x reasonable charge current
   3V x 12A = 36W

This charger design may be used for batteries with different ratings if the value of R1 is adjusted. A 12V/3AH battery should have charge current limited between .45A and .6A resulting in R1 = 5 Ohm.

CONSTANT VOLTAGE / LIMITED CURRENT CHARGER: This circuit is a constant voltage supply with current limiting. The voltage of the supply may be set for float or rapid charge rates.

Operation: U1 is an adjustable voltage regulator which operates by holding its output 1.25V above the adjust pin level. R2, R3 and R4 are used to set the voltage output prior to current limiting. Q1 and R1 limit the current provided by the regulator. As the voltage drop across R1 exceeds 600 mV, Q1 begins to turn on pulling the regulator adjust pin closer to ground. This reduces the voltage output of the regulator which in turn reduces the current passing through the load. Q1 and R1 may be omitted if the current limiting feature is not required. D1 and D2 protect the regulator from various fault conditions and should not be omitted. Larger current capacity regulators may be used if needed.

Continued Next Month

POWER PS SONIC

POWER-SONIC BATTERIES: ECONOMICAL, RECHARGEABLE POWER COMBINED WITH THE HANDLING EASE OF DRY BATTERIES

FEATURES

Sealed/Maintenance-Free
The sealed construction of the POWER-SONIC battery allows trouble-free, safe operation in any position. There is no need to add electrolyte as gases generated during overcharge are recombined in a unique "Oxygen Cycle."

Easy Handling
No special handling precautions or shipping containers — surface or air — are required due to the leak-proof construction.

Economical
The high watt-hour per dollar value is made possible by the materials used in a sealed lead-acid battery; they are readily available and low in cost.

Long Service Life
Under normal operating conditions four to five years of dependable service life can be expected in standby applications or between 200 and 1000 charge/discharge cycles depending upon depth of discharge.

Design Flexibility
Batteries may be used in series and/or parallel to give you choice of voltage and capacity. Due to recent design breakthroughs, the same battery may be used in either cyclic or standby applications without sacrificing life or performance. Furthermore, POWER-SONIC offers over 30 basic model sizes.

Rugged Construction
The high-impact resistant battery case is made of non-conductive polystyrene with superior resistance to shock, vibration, chemicals, and heat.

Compact
POWER-SONIC batteries utilize state of the art design, highest grade materials, and a carefully controlled plate-making process to provide excellent output per cell. This high energy density results in superior power/volume and power/weight ratios.

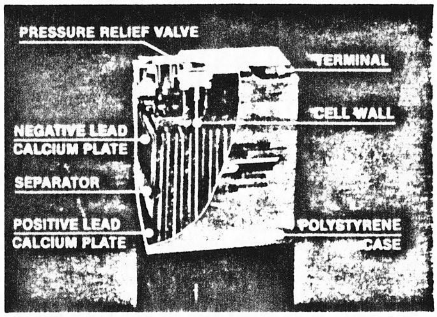
High Discharge Rate
Low internal resistance allows discharge currents of over ten times the rated capacity of the battery. Therefore, a relatively smaller battery may be specified in applications requiring high peak currents.

Long Shelf Life
A low self-discharge rate permits storage of fully charged batteries for up to a year at room temperature before charging is required. Lower storage temperatures enhance shelf life characteristics even further.

Wide Operating Temperature Range
POWER-SONIC batteries may be used over a temperature range of —76°F to +140°F (—60°C to +60°C).

Deep Discharge Recovery
Special separators, advanced plate composition, and a carefully balanced electrolyte system have greatly improved the capability of recovering from deep discharge.

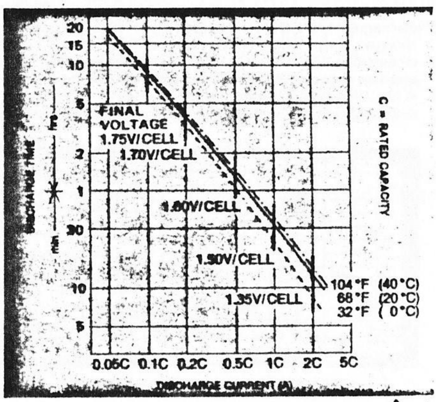
CONSTRUCTION



CAPACITY

The capacity of a battery, expressed in ampere-hours (AH), is the total amount of electrical energy available from a fully charged cell. Its value depends on the discharge current, the temperature during discharge, the final cutoff voltage, and the general history of the battery. POWER-SONIC batteries are rated at 20 hours of constant current discharge @ 68°F (20°C) to a cutoff voltage of 1.72V/cell. As an example, Model PS-610, with a rated capacity of 1AH will deliver 50 milliamps (1/20 of 1AH or 0.05C) for 20 hours before the voltage drops to 5.16V.

When a battery discharges current at a constant rate, its capacity changes according to the amperage load. Capacity increases when the discharge current is less than the 20-hour rate and decreases when the current is higher. The graph below shows capacity curves for POWER-SONIC batteries. Amperage is on the horizontal scale and the time elapsed is on the vertical scale; the product of these values is the capacity.

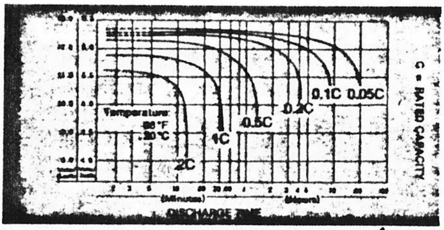


DISCHARGE TIME vs. DISCHARGE CURRENT fig.1

PERFORMANCE CHARACTERISTICS

DISCHARGE

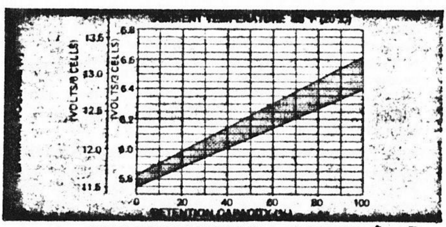
During discharge the voltage will decrease. The graph below illustrates this for different discharge rates. "C" is the rated capacity of a battery. An important feature of POWER-SONIC batteries is shown in the discharge curves; namely, the voltage tends to remain high and almost constant for a relatively long period before starting to decline.



DISCHARGE CURVES: VOLTAGE vs TIME fig. 2

OPEN-CIRCUIT VOLTAGE

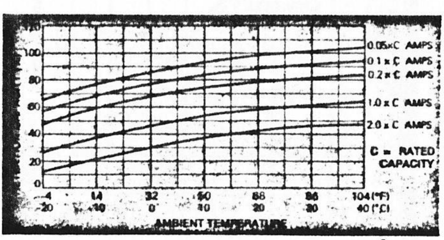
Open-circuit voltage varies according to ambient temperature and remaining capacity. Generally, it is determined by the specific gravity of the electrolyte. Discharge lowers the specific gravity; consequently, it is possible to determine the approximate remaining capacity of the battery from the open circuit voltage. The open-circuit voltage of a POWER-SONIC battery is 2.15V/cell when fully charged and 1.94V/cell when completely discharged.



OPEN CIRCUIT VOLTAGE vs CAPACITY fig. 3

TEMPERATURE

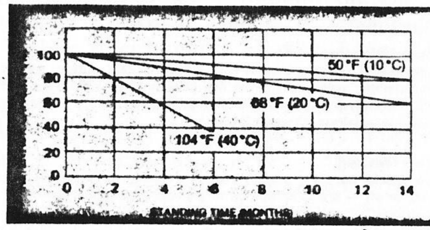
Capacity is a function of ambient temperature and rate of discharge. At 68 °F (20 °C) rated capacity is 100%. The capacity increases above this temperature and decreases as the temperature falls. The higher the rate of discharge, the lower the available capacity. POWER-SONIC batteries may be discharged at temperatures ranging from -76 °F to + 140 °F (-60 °C to + 60 °C) and charged at temperatures from -4 °F to 122 °F (-20 °C to 50 °C).



EFFECT OF TEMPERATURE ON CAPACITY fig. 4

SHELF LIFE AND STORAGE

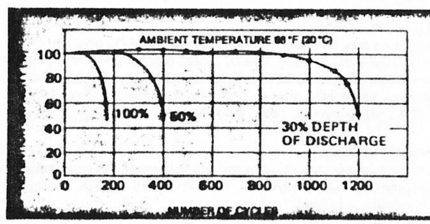
Air-tight vents and special alloys in the plates assure a low self discharge rate, and consequently, a long shelf life. At room temperature about 60-70% of the rated capacity remains after one year of storage. One recharge every six to nine months is sufficient to maintain the original capacity of a battery not in use. The rate of self discharge varies with the ambient temperature.



SHELF LIFE CHARACTERISTICS fig. 5

LIFE - CYCLIC USE

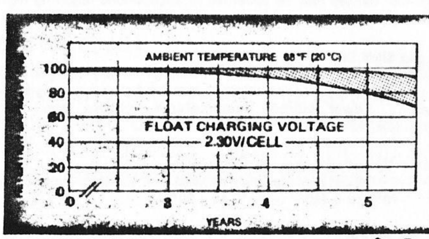
The number of charge/discharge cycles depends on the capacity taken from the battery (a function of discharge rate and depth of discharge), operating temperature, and the charging method. The following graph shows the relationship between depth of discharge and number of cycles.



CHARGE/DISCHARGE CYCLE LIFE fig. 6

LIFE - STANDBY USE

The float service life, or life expectancy under continuous charge, depends on the frequency and depth of discharge, the charge voltage, and the ambient temperature. At a float voltage of 2.25V - 2.30V/cell and an ambient temperature of 68° (20°C) POWER-SONIC batteries should last six to seven years before the capacity drops to 60% of its original rating.



LIFE IN FLOAT SERVICE fig. 7

CHARGING

GENERAL

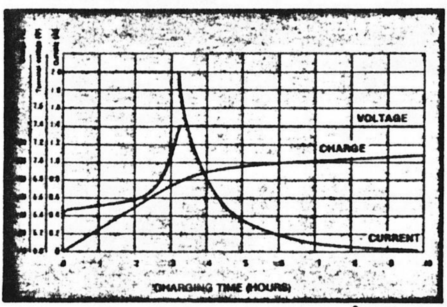
Dependable performance and satisfactory service life of POWER-SONIC batteries depend upon correct charging. Faulty charging procedures or inadequate charging equipment result in decreased battery life and/or unsatisfactory performance. The selection of suitable charging circuits and methods is as important as choosing the right battery for the application. To charge a POWER-SONIC battery, a DC voltage higher than the open-circuit voltage of 2.15V/cell is applied to the terminals of the battery. POWER-SONIC batteries can be charged using any of the conventional charging techniques. To obtain maximum service life and capacity along with acceptable recharge times and economy, constant voltage current limited charging is recommended.

Overcharging: As a result of too high a charge voltage, excessive current will flow after reaching full charge causing decomposition of water in the electrolyte and, hence, premature aging.

Undercharging: If too low a charge voltage is applied, the charger current output will essentially stop before the battery is fully charged. This allows some of the lead sulfate to remain on the plates which will eventually reduce capacity.

CHARGING CHARACTERISTICS

As the terminal voltage of the discharged battery rises, its current acceptance decreases. The battery is fully charged once the current stabilizes at a low level for a few hours. You will notice that there are two criteria for determining when a battery is fully charged — the final current level and the peak charging voltage while this current flows.



CHARGING CHARACTERISTICS fig. 8

CHARGING METHODS

Taper Charging

This is the simplest, most inexpensive charging method. Either quasi-constant voltage or quasi-constant current characteristics can be built into the charger through combination of transformer, diode, and resistance. Of the two, constant potential charging is preferable.

Constant Current Charging

Constant current charging is suited for applications where discharged ampere-hours of the preceding discharge cycle are known. Monitoring of charge voltage or limiting of charge time is necessary, however, to avoid excessive overcharge.

This method is effective for charging a battery that has been stored for an extended period of time or for occasional overcharging to equalize cell capacities.

Constant Voltage Charging

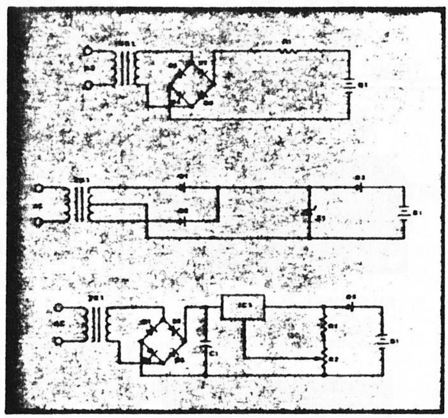
Constant voltage charging is the preferred method to charge POWER-SONIC batteries. Depending on the application, batteries may be charged either on a continuous or non-continuous basis.

Cycle Applications:

Limit initial current to 0.25C (C is the rated AH capacity of the battery). Charge until battery voltage (under charge) reaches 2.45 volts per cell at 68°F (20°C). Hold at 2.45 volts per cell until current drops to approximately 0.01C ampere. Battery is fully charged under these conditions, and charger should either be disconnected or switched to "float" voltage.

"Float" or "Standby Service":

Hold constant voltage source of 2.25 to 2.30 volts per cell continuously across the battery. At this voltage, the battery will seek its own current level and maintain itself in a fully charged condition.



EXAMPLES OF CONSTANT VOLTAGE CHARGERS fig. 9

APPLICATION NOTES:

- Continuous over or undercharging is the single worst enemy of a lead acid battery. Caution should be exercised to insure that the charger is disconnected after cycle charging, or that the float voltage is set correctly.
- Because there is a chance of off-gassing hydrogen and oxygen if the battery is overcharged, it is important to provide adequate air circulation.
- Batteries should not be stored in a discharged state (or at high temperature). If a battery has been discharged for some time it may not readily take a charge. To overcome this, leave the charger connected and the battery should eventually begin to accept charge.
- Due to the self discharge characteristics of this type of battery, it should be charged after six to nine months of storage, otherwise permanent loss of capacity might occur as a result of sulfation. To prolong shelf life without charging, store batteries at 50°F (10°C) or less.


WE HAVE THE MOST COMPLETE STOCK OF ELECTRONIC EQUIPMENT IN ALL OF NORTHERN CALIFORNIA
QUEMENT
QUEMENT ELECTRONICS
1000 SO. BASCOM, SAN JOSE • 998-5900 • Open Mon.-Sat. 9-6
1986 CALLBOOKS
Cellular Telephones
Quement Offers
PANASONIC
AUDIOVOX
GTE Mobilnet
Plus A Complete Group Of
LARSEN ANTENNAS
YAESU
FRG 8800
General Coverage Receiver
All-band, all-mode
AM/SSB/CW/FM, 150kHz-30MHz
FRG 9600
Scanning Receiver for 60-905 MHz
FM/AM/SSB, 100 memories
FT 757GX
ICOM LATEST EDITION
IC-3200A
DUAL BANDER
Covers Both
2 Meters
& 70 cm
ICOM
HAND-HELDS
VHF/UHF
IC-02AT
IC-04AT
IC-2AT
IC-4AT
IC-3AT
ICOM
SIMPLEX-REPEATER-SATELLITE
IC-271H
2 Meters
100 Watts
All mode
IC-471H
430-450MHz
74 Watts
All mode
ICOM IC-R71A
Superior Grade General Coverage Receiver
ICOM
IC-R7000
25 MHz-1300 MHz
EASY WHEELCHAIR ACCESS
VISA
MasterCard
QUEMENT
QUEMENT ELECTRONICS
• ANTENNAS • HAM GEAR • CITIZEN'S BAND • COMMERCIAL AND INDUSTRIAL PARTS SUPPLY • SERVICE DEPARTMENT • ACOUSTIC SOUND DEMONSTRATION ROOM • COMPLETE STEREO HI/FI DEPARTMENT

WORLDWIDE DISTRIBUTION
HAM RADIO OUTLET
NEW OAKLAND LOCATION
6 STORE BUYING POWER
ICOM IC-R71A
Superior Grade General Coverage Receiver
~~$799~~
SALE! CALL FOR PRICE
ICOM IC-R7000
25 MHz-1300 MHz
IN STOCK FOR IMMEDIATE DELIVERY!
ICOM IC-1271A
NEW
1.2 GHz Transceiver: The First Full-featured 1240-1300 MHz Transceiver
AT GREAT LOW, LOW PRICES
ICOM IC-37A
IC-27A (25W,2M,FM)
IC-27H (45W,2M,FM)
IC-37A (25W,220MHz,FM)
IC-47A (25W,70cm,FM)
CALL FOR LOW, LOW PRICE
ICOM HAND-HELDS
VHF/UHF
IC-02AT
IC-04AT
IC-2AT
IC-4AT
IC-3AT
CALL FOR LOW, LOW PRICE
ICOM LATEST EDITION
IC-3200A DUAL BANDER
Covers Both 2 Meters & 70 cm
AT GREAT LOW, LOW PRICES
ICOM IC-735
The Latest in ICOM's Long Line of HF Transceivers
CALL FOR LOW, LOW PRICE
All Major Brands in Stock Now!
Bob Ferrero W6RJ
President
Jim Rafferty N6RJ
VP So. Calif Div.
Anaheim Mgr.
ANAHEIM, CA 92801
2620 W. La Palma
(714) 761-3033, (213) 860-2040
Between Disneyland & Knotts Berry Farm
BURLINGAME, CA 94010
999 Howard Ave.,
(415) 342-5757 George, Mgr. WB6DSV
5 miles south on 101 from SFO
NEW OAKLAND, CA 94606
2210 Livingston St.,
(415) 534-5757 Don, Mgr. N6IPE
Hwy 17 to 23rd Ave Exit
SAN DIEGO, CA 92123
5375 Kearny Villa Rd.
(619) 560-4900 Glenn, Mgr. K6NA
Hwy. 163 & Claremont Mesa Blvd
PHOENIX, AZ 85015
1702 W. Camelback Rd
(602) 242-3515 Bob, K7RDH
East of Hwy 17
VAN NUYS, CA 91401
6265 Sepulveda Blvd.
(818) 988-2212 Al, Mgr. K6YRA
San Diego Fwy at Victory Blvd
FREE SHIPMENT
Most items UPS surface
CALL TOLL FREE (800) 854-6046
MasterCard
Toll free including Alaska & Hawaii. Phone Hrs: 9:30 a.m. to 5:30 p.m. Pacific Time. California and Arizona customers call or visit nearest store. California and Arizona residents please add sales tax. Prices, specifications, descriptions subject to change without notice.
VISA

PAARA
P.O. BOX 911
Menlo Park,
Ca. 94026

SAN FRANCISCO, CA
PM
JUN 3
1986
941

First Class

Andy Korsak VE3FZK 86/01
504 Lakemead Way
Redwood City CA 94062