

Now Available on our Web Site

- ✓ Current Bulletin Board items.
- ✓ Freehold weather forecast.
- ✓ 2003 Duty Pilot Schedule: Please check to see if you are scheduled. Arrange for a substitute if you can't serve.

For these features and MUCH more point your browser to:

<http://nutmegsoaring.org>

CALENDAR

Flying at Mifflin County Airport, PA. Oct 4-12.

LOST & FOUND

Found at Freehold - One digital camera. Please identify. Contact Lisabeth Boyce. 203-393-1225 or boycemail@earthlink.net.



FREEHOLD AIRPORT PHONE NUMBERS

Field Phone: 518-634-7346 - have this with you when you fly!!

Office Phone (Clem's Office): 518-634-7626

Nutmeg News is the official publication of the Nutmeg Soaring Association, Inc. Edited by Jim Sidway, 211 Lum Lot Road, Southbury, CT 06488-1960 203.264.6170 jsidway@earthlink.net

Nutmeg News
% Jim Sidway
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Nutmeg News

Volume 44, Number 7

September 2003

Editor: Jim Sidway

GENE CARAPETYAN

Friend, Father, Water Skier, Power Pilot, Flight Instructor,
Sailor, Sailplane Pilot . . .

Lover of Life!

Memorial Service and Celebration of Gene's Life

Time: **Saturday, October 11, 2003, beginning at 1:30 p.m.**

Location: **Candlewood Isle Clubhouse, Lake Drive North,
Candlewood Isle, New Fairfield, CT 06812**

This will be a time to reflect on Gene's life, to share stories and relive the fun and excitement Gene brought to so many of us. Light refreshments will be served.

Directions:

From New Fairfield, CT:

- Take Highway 39 north towards Squantz Pond State Park.
- Turn east (right) on Candlewood Isle Road. (There is a stop light.)
- At the entrance to Candlewood Isle, stop at the guard house.
- Turn left onto Lake Drive North.
- Proceed approximately one fourth of a mile to the Candlewood Isle Clubhouse.

There is limited parking at the Clubhouse. Additional parking is available adjacent to the guard house, next to the tennis courts.

SEAT BELTS

Submitted by Robin Mcnamara

As you know new safety belts were installed in the two 2-33s last month. Robin Mcnamara was responsible for procuring the new belts. She came across a good article at the DG Sailplane website on the correct construction, installation and use of safety belts in gliders that would benefit all Nutmeggers. The URL for the article is: <http://www.dg-flugzeugbau.de/anschnallen-e.html>

FREEHOLD LAND OUT OPTIONS

Submitted by Lincoln Stoller

Van Etten Field

From I15: heading of 71°, 13.0 miles

Map: USGS, Pittsfield

42°-27.039 N , 73°-51.221 W

160°/340°: 2700' x 100' grass, alt. 335' msl

4 miles W of Ravena

Owner Robert Van Etten, 1412 Saw Mill Rd., Ravena, NY 12143 -
(518) 756-3517

Follow Rt. 143 about 3 miles W of Ravena to Left (West) on Marshall Rd. Follow Marshall Rd about 1/4 mile to its end. Turn L (S) onto Van Der Zee Rd. Follow for about 3/4 mile to break in the trees on the right. See the field stretching to the SE, orange windsock 3/4 of the way to the N end. A dirt road takes off Van Der Zee to the right and tracks W along the trees at the N end of the field. This road provides direct access to the field. There are no fences around this field. This large, flat and level field is kept mowed across its full width. It is usable most of the year, though the snow is not cleared in winter. The field is located in a low, shallow valley that rises on W, S, and E sides. The surrounding hill are tree covered. This field about 0.5 miles S of the Rutkiewicz field. Robert Van Etten says we're welcome to use the field. He was also interested in our operation at Freehold.

Rutkiewicz Field

From I15: heading of 70°, 13.5 miles

Map: USGS, Pittsfield

42°-22.634 N , 73°-51.165 W

20°/200°: 1700' x 50' grass, alt. 325' msl

Owned by Red and Judy Rutkiewicz

40 Rutkiewicz Rd., Ravena, NY 12143, (518) 756-8504

3 miles W of Ravena

Follow Rt. 143 about 3 miles W of Ravena to L (W) on Marshall Rd.

Follow Marshall Rd about 1,000' to Left (South) on

Rutkiewicz Rd. Follow for about 500' to first right on paved driveway into the woods. Follow to end at Rutkiewicz farm.

Hangar is on left, taxi way to airfield is through two barbed wire gates on right.

Red Rutkiewicz was an Albany Air Traffic Controller until 1981 when Ronald Reagan fired him, and a lot of other ATC's, to break a union strike. Red retired. He flies about once each week and said we are welcome there.

Field is actively maintained and has an orange wind sock at N end. Field is flat and southern section is 500' wide. Regularly mowed grass landing strip is narrow, 50 to 60', as required for power plane wing span. Grass to either side of the landing strip might be high. Barbed wire fence runs along W edge 30' from the edge of the runway. Far northern section, near wind sock, narrows to 100' between fences. Area at the extreme north end can get wet. Cows sometimes graze in the field, although this is unlikely during the spring or summer.

Note that there are larger farmed fields 1/2 mile to the North, but in at least one spot there is a power line that cuts across the field from W to E, not following the road. Beware of wires in this area.

Raber Airstrip

From I15: heading of 17°, 18 miles

Map: marked on USGS, Amsterdam. Located on the Jimapco Albany county map, but not marked.

42° 38.051N x 74° 2.657W

90°/180°: 1800' x 60' grass, altitude 1371' msl

Owner: Robert Raber, Jr., 1297 Thacker Park Rd. (Route 157), E. Berne, (518) 872-1049

Directions: 0.5 mile E of the corner of Thacher Park Rd (Route 157) and Saw Mill Rd. Turn R at the next unmarked driveway just to the E of Raber's house located at 1297. The airstrip abuts Mr. Raber's residence. No indication of the airstrip can be seen from Route 157. The field is 2 miles N-NE as the crow flies from the Heldeberg airstrip.

The field is flat but not level. It loses 50' of altitude as it slopes eastward from taxi way and orange wind sock on W end of airstrip down to the marshy area at the E end, where it opens on to the farmed fields in the small valley containing Elm Drive. The taxi way cuts perpendicularly N through the trees and leads to a hanger.

The field is no narrower than 60' and no wider than 75' for its whole length and is immediately bounded on both sides by trees of medium height. The field would be hard to see until you were nearly on top of it. The wind sock is buried in the trees on the N side of the field's W end. Any wind would cause some turbulence below the height of the trees in this narrow key-slot of a field. It is so narrow that it may not be of use to glider pilots.

Mr. Raber keeps a Cessna in his hangar and says that he has had other planes come in for emergency landings. He keeps the field mowed with a bush hog. This is a generally hilly and wooded area. The farmed fields to the E are irregular and rolling.

NAVIGATING WITH A HANDHELD GPS

Submitted by Lincoln Stoller

I want to alert Nutmeg members to some good information on using a GPS that I've found on the Internet. John Bell has just written and self published a concise and well appreciated book on using a GPS for cockpit navigation. His focus is on the smaller, handheld units, and his book can be downloaded in PDF format from his web site at <http://www.cockpitgps.com/>. He sells the book as "honor ware" for \$10.

AUGUST 2003 BOD MEETING

Board of Directors Meeting: August 22, 2003 at Freehold, NY

Present: Bill Kenyon, Michael Ampela, Peter Krebs

Convened: 7:40 P.M. **Adjourned:** 10:00 PM

Financial situation: Krebs reported that between lower income (assessments and weather related fewer tows) and somewhat lower expenses (different categories) the year might close with \$ 11,000 lower than budgeted operating income. He explained that the different reserve funds can pick up that shortfall. Nevertheless it is recommended to keep further non-safety related expenses to a minimum. It is suggested that no new radio be purchased (Draganovic repaired old one), no new interior for 2-33s be bought and the need for Pawnee engine probes be further studied. It seems that the recovering of the Pawnee's wings can wait. But it looks as if the somewhat expensive 3000 hour Grob overhaul is coming up this winter (to be funded from reserve fund).

The airport usage agreement has finally been signed by all users except by Hoovler.

Blanik damage: Stoller took it for repairs to Ontario where the shop is waiting for some parts (early September). Krebs will notify Stoller about his deductible payment in writing.

Insurance claim Burns: Kenyon reported that a claim adjuster will study the situation but that it looks as if we are (as all other airports) not insured for noise related incidents. It appears anyway that the whole claim might be of no merit.

Commercial glider rides: Kenyon and others are further exploring the FAA requirements for offering such service.

Operations: Grob: The spoiler box had water which could not drain and was repaired. Pilots should pay attention during preflight that drain holes are open. **954:** Had static line problems - since repaired - indicating wrong speeds. Attention is needed when nearing stall speeds i.e. not rely totally on indicator. Ampela set up a visit to **ALB ATC** to meet with the controllers, telling them about our operations and make for safer flights. Those who are interested to participate, please contact Ampela.

NYS-DOT : Today Ampela and Kenyon met with state representatives and showed / explained our airport and ideas for its improvement (our recent letter to obtain financial help). Apparently the impression was positive and the DOT people will make runway measurements in the week of 8/25. Kenyon will follow up.

Search Committee: Kenyon explained that the current slate of officers had agreed to serve until the end of 2003. Although some might be willing to serve longer it is deemed prudent to have a committee in place to look for alternatives. During tomorrow's General Meeting members will be sought for this committee.

FrAA moved their Cub to Greenville and there are indications that this move might be definitive. Reasons seem to be the arbitrary rules not known ahead of time. Stein is working in proposing and coordinating with Hoovler such rules. These rules were presented verbally at the meeting. After discussing them with Hoovler, it will be appropriate to discuss them with the FrAA. It would be desirable to have the FrAA (and others) at Freehold as "good neighbors" although the income from their presence is not large while Nutmeg's liability exposure is.

Hangars: Under study by Ramsdell (zoning issues) and others.

Miscellaneous: Mifflin County: Ridge soaring is planned for the week 10/4 - 10/12 and it is hoped that the Grob can be taken there. Interested parties (flying and trailering) should let the directors/officers know their intentions. There seems to be no **fly-in** planned in fall now that FrAA seems to be gone to Greenville. The farmer promised to treat the **weeds** on the runway. The idea of a possible **multi-club contest** at Freehold has been shelved for the moment.

AUGUST 2003 MEMBERSHIP MEETING

General Membership Meeting: August 23, 2003 @ Freehold Airport

Directors/Officers present: Kenyon, Stein, M. Opitz, Ampela, Krebs

Number of members present: Approx. 23 full and associate members

Called to order: 7:00 p.m. **Adjourned:** 8:15 p.m.

The **minutes** of the last membership meeting (07/05/2003) were approved as published in the August Nutmeg News.

Financial situation: Krebs reported that between lower income (assessments and weather related fewer tows) and somewhat lower expenses (different categories) the year might close with \$ 11,000 lower than budgeted operating income. Explained that the different reserve funds likely can pick up that shortfall. Nevertheless it is recommended to keep further non-safety related expenses to a minimum. It is suggested that no new radio be purchased (Draganovic repaired old one), no new interior for 2-33s be bought and the need for Pawnee engine probes be further studied. It seems that the recovering of the Pawnee's wings can wait. But it looks as if the expensive 3000 hour Grob overhaul is coming up this winter.

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Search Committee: Kenyon explained that the current slate of officers had agreed to serve until the end of 2003. Although some might be willing to serve longer it is deemed prudent to have a committee in place to look for alternatives. Draganovic

and Smith form this committee and will report their findings at an appropriate time.

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Mifflin County: Ridge soaring is planned for the week 10/4 - 10/12 and it is hoped that the Grob can be taken there. Interested parties (flying and trailering) should let the directors/officers know their intentions.

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Miscellaneous: Kenyon repeated the safety request that **golf carts** are moved only on the extreme left or right of the runways. **Webb** had heart surgery and is recovering well, our best wishes go to him. **Laitinen** donated a large number of sturdy chairs ideally suited for meetings: Thanks Doug! A big thank you went to the members and their relatives who arranged for a great **dinner buffet** at this meeting.

PAWNEE TOW HOOK

The tow rope on the Pawnee has been released on roll out after landing several times recently. For some reason the tow hook will work its way open as the tail wheel bounces down the runway without a load, i.e. a glider, on the tow rope. This is a known phenomenon that has existed for years. The hook begins to work its way open with each successive landing until it finally releases the rope. Prevention is simple: check and adjust the hook before every launch. When taxiing in to position for towing the Pawnee tow pilot should pause for the glider ground handler to examine and close the hook if necessary. This should be done before every tow. See the article entitled 'I Overheard a Conversation' by Esteban Draganovic in the May 2001 edition of the Nutmeg News (available at <http://nutmegsoaring.org>) for details and photos on proper tow hook use.

CONGRATULATIONS

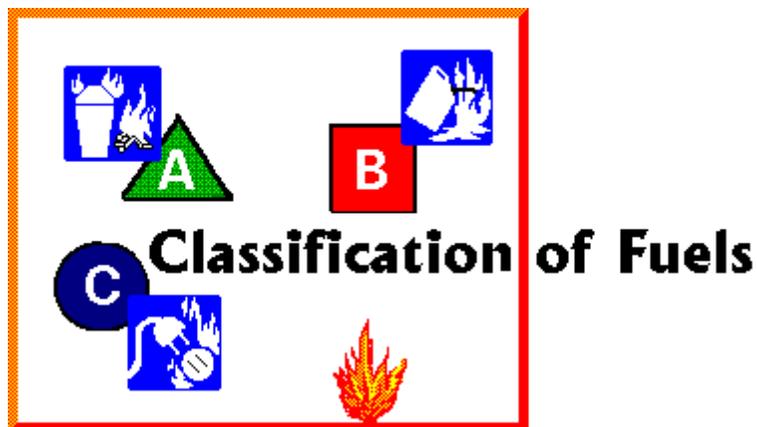
Congratulations to **Mike Monoski** and **Matt Neal** for recently obtaining their Private Pilot Glider ratings! Congratulations to **Mike Ampela** for recently qualifying as a tow pilot!

BANQUET 2004

Mark your calendars: The 2004 Annual Banquet will be held at the Southbury Connecticut Hilton on Saturday, February 21, 2004 (snow date Sunday, February 22). Full details in future editions of the Nutmeg News.

On Fire Extinguishers

Nutmeg Soaring is striving to operate within the highest standards of safety possible. Along those lines during our safety meetings this year the operations committee informed us that there will be fire extinguishers installed in the golf-carts to be properly equipped should there be an emergency due to an accident, or during engine starting of our tow-planes. Many members have received training in the use and application of fire-extinguishers in their professional lives, and from that experience we understand that there are some considerations, that if ignored, they greatly reduce the usefulness and effectiveness of the fire extinguishers. A notable example is the application of the fire extinguisher in bursts or intermittently, especially if the fire is fueled by combustible liquids, resulting in flare-ups of the fire. The flow of extinguishing agent should be maintained constant and aimed at the base of the fire until the fire is completely controlled, thus avoiding the re-start of the fire. For those not familiar with the use and application fire extinguishers the following basic concepts could be a useful guide:



Class A - Wood, paper, cloth, trash, plastics

Solid combustible materials that are not metals.



Class B - Flammable liquids: gasoline, oil, grease, acetone

Any non-metal in a liquid state, on fire. This classification also includes flammable gases.



Class C - Electrical: energized electrical equipment

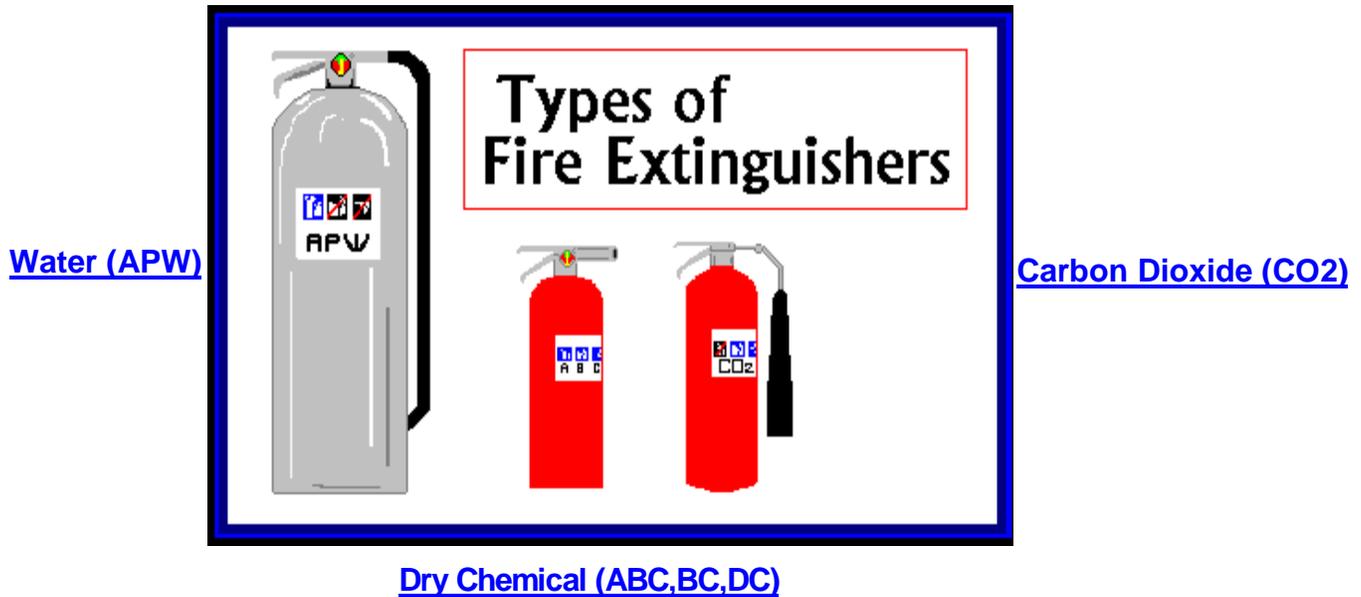
As long as it's "plugged in," it would be considered a class C fire.



Class D - Metals: potassium, sodium, aluminum, magnesium

Unless you work in a laboratory or in an industry that uses these materials, it is unlikely you'll have to deal with a Class D fire. It takes special extinguishing agents (Metal-X, foam) to fight such a fire.

It is very important to understand the fire class to apply the correct type of extinguisher to the fire.



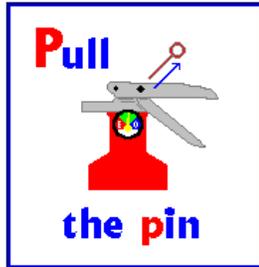
Different types of fire extinguishers are designed to fight different classes of fire.



Most fire extinguishers will have a pictograph label telling you which classifications of fire the extinguisher is designed to fight. For example, a simple water extinguisher might have a label like the one on left, indicating that it should only be used on Class A fires.



It's easy to remember how to use a fire extinguisher if you can remember the acronym **PASS**, which stands for **P**ull, **A**im, **S**queeze, and **S**weep.



Pull the pin.
This will allow you to discharge the extinguisher.



Aim at the base of the fire.
If you aim at the flames (which is frequently the temptation), the extinguishing agent will fly right through and do no good. You want to hit the fuel.



Squeeze the top handle or lever.
This depresses a button that releases the pressurized extinguishing agent in the extinguisher.



Sweep from side to side
until the fire is completely out. Start using the extinguisher from a safe distance away, then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.

This basic guide to the use of fire extinguishers, originally prepared in the form of a presentation for safety meetings can be found printed at the end of the "Accident handling procedures" booklet available at the operations trailer.

ABOUT BATTERIES

This writing presents some concepts intended to help us better understand and handle batteries, so present in our club activities. With the advent of electric Golf Carts some basic knowledge on batteries becomes even more important to keep the equipment running reliably, and to insure the longevity of the battery units.

The commercial use of the lead acid battery is over 100 years old. Today, the same chemical principles are being used to create energy that our Great, Great, Grandparents may have used. The Lead acid battery is made up of plates, lead, and lead oxide (various other elements are used to change density, hardness, porosity, etc.) with a 35% sulfuric acid and 65% water solution. This solution is called electrolyte which causes a chemical reaction that produce electrons. When you test a battery with a hydrometer you are measuring the amount of sulfuric acid in the electrolyte. If your reading is low, that means the chemistry that makes electrons is lacking. So where did the sulfur go? It has been absorbed into the battery plates and when you recharge the battery the sulfur returns to the electrolyte.

Words of caution: Lead-acid batteries contain a sulfuric acid electrolyte, which is a highly corrosive poison and will produce gas when recharged and explode if ignited. This will hurt you-- **BAD!** When working with batteries, you need to have plenty of ventilation, remove your jewelry, wear protective eyewear (safety glasses) and clothing, and exercise caution. Do **not** allow battery electrolyte to mix with salt water. Even small quantities of this combination will produce chlorine gas that can **KILL** you! Whenever possible, please follow the manufacturer's instructions for testing, installing, charging and equalizing batteries.



Battery Types: Basically there are **two types of batteries**; starting (cranking), and deep cycle (marine/golf cart). The **starting battery** is designed to deliver quick bursts of energy (such as starting engines) and have a greater plate count. The plates will also be thinner and have somewhat different material composition. The **deep cycle battery** has less instant energy but greater long-term energy delivery. Deep cycle batteries have thicker plates and can survive a number of discharge cycles. Starting batteries should not be used for deep cycle applications. The so-called **Dual Purpose Battery** is only a compromise between the 2 types of batteries. **Wet Cell** (flooded), **Gel Cell**, and **Absorbed Glass Mat (AGM)** are various versions of the lead acid battery. The **wet cell** comes in 2 styles; serviceable, and maintenance free. Both are filled with electrolyte. In general it is more advantageous to use the one that water can be added, and the specific gravity of the electrolyte can be checked with a hydrometer. The **Gel-Cell** and the **AGM** batteries are specialty batteries. They store very well and do not tend to sulfate or degrade as easily as wet cell. There is little chance of a hydrogen gas explosion or corrosion using these batteries, these are the safest lead acid batteries you can use. Gel-Cell and some AGM batteries may require a special charging rate.

CCA, CA, AH and RC: These are the standards that most battery companies use to rate the output and capacity of a battery.

Cold cranking amps (**CCA**) is a measurement of the number of amps a battery can deliver at 0 degrees F for 30 seconds and not drop below 7.2 volts. So a high CCA battery rating is good especially in cold weather for starting a car.

CA is cranking amps measured at 32 degrees F. This rating is also called marine cranking amps (**MCA**). Hot cranking amps (**HCA**) is seldom used any longer but is measured at 80 degrees F.

Reserve Capacity (**RC**) is a very important rating. This is the number of minutes a fully charged battery at 80 degrees F will discharge 25 amps until the battery drops below 10.5 volts.

Amp hours (**AH**) is a rating usually found on deep cycle batteries. If a battery is rated at 100 amp hours it should deliver 5 amps for 20 hours, 20 amps for 5 hours, etc.

Battery Maintenance is an important issue. The battery should be cleaned using a baking soda and water mix. Cable connection needs to be clean and tightened. Many battery problems are caused by dirty and loose connections. A serviceable battery needs to have the fluid level checked. Use only mineral free water. Distilled water is best. Don't overfill battery cells especially in warmer weather. The natural fluid expansion in hot weather will push excess electrolytes from the battery. To **prevent corrosion** of cables on top post batteries use a small bead of silicon sealer at the base of the post and place a felt battery washer over it. Coat the washer with high temperature grease or petroleum jelly (Vaseline), then place cable on the post and tighten. Coat the exposed cable end with the grease. Most folks don't know that just the gases from the battery condensing on metal parts causes most corrosion.

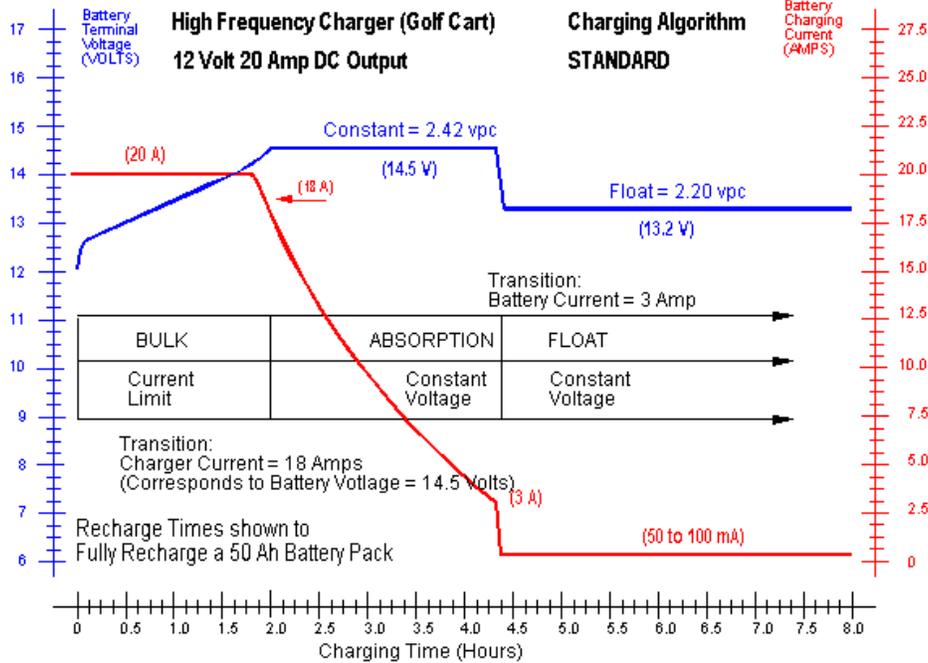
Battery Charging: The charging process can be divided in four phases, described below.

The **bulk** stage is where the charger current is constant and the battery voltage increases. You can give the battery whatever current it will accept as long as it does not to exceed 20% of the ampere-hour rating and that it will not cause over heating.

The **absorption** phase is the phase where the charger voltage is constant and current decreases until the battery is fully charged. This normally occurs when the charging current drops off to 1% or less of the ampere-hour capacity of the battery. For example, end current for a 50 ampere-hour battery is approximately 0.5 amps (500 milliamps) or less. If the battery will not "hold" a charge or current does not drop after the estimated recharge time and the battery is hot, then the battery maybe sulfated.

The optional **float** phase is where the charge voltage is reduced, then held constant and is used to indefinitely maintain a fully charged battery.

The optional **equalizing** phase is a controlled 5% overcharge to equalize and balance the voltage and specific gravity in each cell by increasing the charge voltage. Equalizing reverses the build-up of the chemical effects like stratification where acid concentration is greater in the bottom of the battery. It also helps remove sulfate crystals that might have built up on the plates. The frequency recommendation varies by manufacturer from once a month to once a year or is based on a specific gravity test where the difference between cells is .030 (or 30 "points"). To equalize, fully recharge the battery. At this point, increase the charging voltage to the manufacturer's recommendations, or if not available, **add 5%**. Heavy gassing should start occurring. Take specific gravity readings in each cell once per hour. Equalization has occurred once the specific gravity values no longer rise during the gassing stage. **Only equalize if the battery manufacturer recommends it.**



A typical charging profile for Lead-Acid Battery

It is **extremely** important to use the battery manufacturer's charging recommendations whenever possible for optimum capacity, maintenance and service life. A good rule-of-thumb is not to use a cycling charger (or charging setting) that is greater than 25% of the amp hour capacity (using the 20 hour rate) of the battery or batteries being charged. For float applications, (like in many trailer homes) size the charger at least 125% of the worst case electrical load.

Additional Words of Caution About Charging:

Before recharging check the electrolyte level and insure it covers the plates at all times and that it is not frozen.

After recharging, recheck the electrolyte levels after the battery has cooled and top off with distilled water as required, but do not over fill.

Insure the vent caps are clean. Reinstall the vent caps **before** recharging, recharge **ONLY** in well-ventilated areas, and **wear glasses** Do **not** smoke or cause sparks or flames while the battery is being recharged because produces explosive gasses.

If your battery is sealed, avoid recharging with current **above** 20% of the RC (or 50% of the ampere hour) rating. For example, 24 amps maximum for a 120 minute RC (48 ampere hour) rated battery.

You should turn the charger **OFF** before connecting or disconnecting cables to a battery. Do not wiggle the cable clamps while the battery is recharging, because a spark could occur and this might cause an explosion. Good ventilation or a fan is recommended to disperse the gasses created by the recharging process.

If a battery becomes hot, over 110° F (43.3° C), or violent gassing or spewing of electrolyte occurs, turn the charger off temporarily or reduce the charging rate.

If you are recharging Gel Cell batteries, a manufacturer's charging voltages are very critical. You might need special recharging equipment. In most cases, standard deep cycle chargers used to recharge wet batteries cannot be used to recharge gel cell and AGM batteries because of their charging profiles; using them will shorten battery life or cause "thermal runaway". Match the charger (or charger's setting) for the battery type you are recharging or floating.

If a battery is overcharged and all the electrolyte is "boiled" out, some batteries can produce **deadly** CO (Carbon Monoxide) gas.

Routinely tighten cables connections.



Battery Testing: Battery testing can be done in more than one way. The most popular is measurement of specific gravity and battery voltage. To measure specific gravity buy a temperature compensating hydrometer at an auto parts store (If a temperature compensated hydrometer is not available, use the temperature compensation chart below). To measure voltage, use a digital D.C. Voltmeter.

You must first have the battery fully charged. The surface charge must be removed before testing. If the battery has been sitting at least several hours (Preferably at least 12 hours) you may begin testing. To remove surface charge the battery must experience a load of 20 amps for 3 plus minutes.

The state of charge of a typical Lead-Acid battery is described in the following table:

Digital Voltmeter Open Circuit Voltage at Rest	Approximate State-of-Charge at 80°F (26.7°C)	Hydrometer Average Cell Specific Gravity	Electrolyte Freeze Point
12.65	100%	1.265	-77°F (-67°C)
12.45	75%	1.225	-35°F (-37°C)
12.24	50%	1.190	-10°F (-23°C)
12.06	25%	1.155	15°F (-9°C)
11.89 or less (typically 10.5)	DISCHARGED	1.120 or less	20°F (-7°C)

STATE-OF-CHARGE

[Source: BCI]

Electrolyte Temperature Degrees Fahrenheit	Electrolyte Temperature Degrees Celsius	Add or Subtract to Hydrometer's SG Reading	Add or Subtract to Digital Voltmeter's Reading
160°	71.1°	+0.032	-.72
150°	65.6°	+0.028	-.63
140°	60.0°	+0.024	-.54
130°	54.4°	+0.020	-.45
120°	48.9°	+0.016	-.36
110°	43.3°	+0.012	-.27
100°	37.8°	+0.008	-.18
90°	32.2°	+0.004	-.09
80°	26.7°	0	0
70°	21.1°	-.004	+.09
60°	15.6°	-.008	+.18
50°	10°	-.012	+.27
40°	4.4°	-.016	+.36
30°	-1.1°	-.020	+.45
20°	-6.7°	-.024	+.54
10°	+12.2°	-.028	+.63
0°	-17.8°	-.032	+.72

TEMPERATURE COMPENSATION CHART

Sulfation of Batteries starts when specific gravity falls below 1.225 or voltage measures less than 12.4 (12v Battery) or 6.2 (6 volt battery). Sulfation hardens the battery plates reducing and eventually destroying the ability of the battery to generate Volts and Amps.

To Increase Battery Life: The typical overall life of a good quality, well maintained deep cycle battery is:

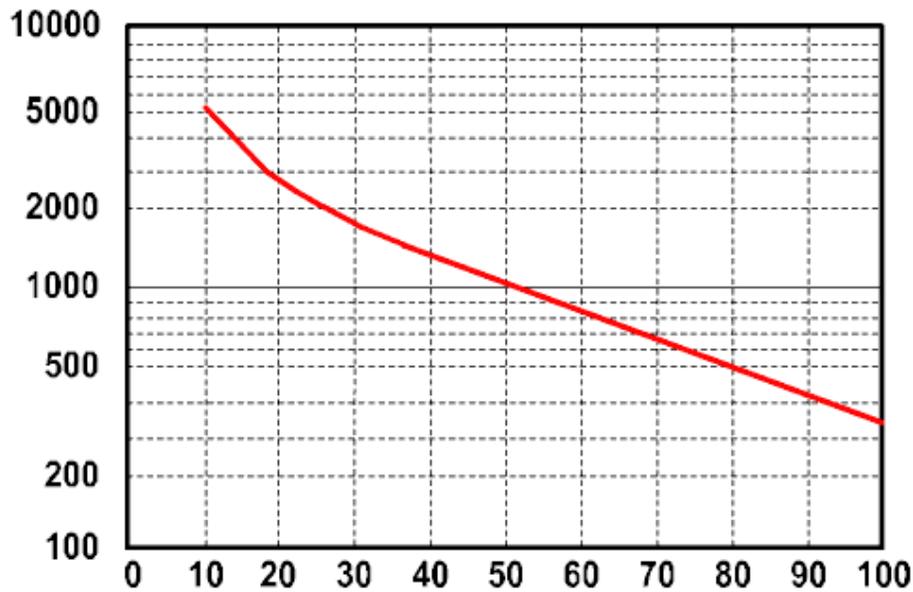
Starting (Used as a Deep Cycle)	0 to 12 months
Marine/RV	to 6 years
Golf Cart	to 6 years
Gelled VRLA	to 8 years
AGM VRLA	to 10 years
Ni-Cad	to 10 years
Telecommunications (Float)	to 10 years
Fork Lift	to 10 years
Industrial (Traction)	to 20 years
Industrial (Stationary)	to 20 years
Ni-Fe	to 20 years

Tips on extending the service life of a deep cycle battery:

Recharge a deep cycle battery as soon as possible after each use. When not in use, maintaining the battery's State-of-Charge at 100%. Continuous float charging is best way to prevent permanent lead sulfation. If continuous float charging is not possible, recharge **before** the State-

of-Charge drops below 80%. **Permanent sulfation kills approximately 85% of all deep cycle batteries.**

Reducing the average DoD (Depth-of-Discharge) by proper deep cycle battery sizing will significantly increase a deep cycle battery life. For example, a battery with an average of 50% DoD will last twice as long or more as an 80% DoD; a 20% DoD battery can last **five** times longer than one with a 50% DoD. Golf cart batteries will typically have an average 225 cycles at 80% DoD and 750 cycles at 50% DoD. Avoid DoDs that are greater than 80%, which is approximately 12.0 volts.



Cycles vs. Percent Depth-of-Discharge (DoD)

Never discharge below 10.5 volts. In the warmer climates and during the summer, "watering" is required more often. Check the electrolyte levels and add only distilled water or, in a emergency, rain water. The plates must be covered at all times, do not overfill, and keep the top of the battery clean. **Never** add electrolyte (battery acid) to a battery unless some electrolyte has spilled or removed. If the Specific Gravity levels are increased above the battery manufacturer's recommended level at 100% State-of-Charge, there will be a higher Ah capacity level, but more maintenance and a shorter service life. If the level is decreased, there will be a lower Ah capacity level, but less maintenance and a longer service life.

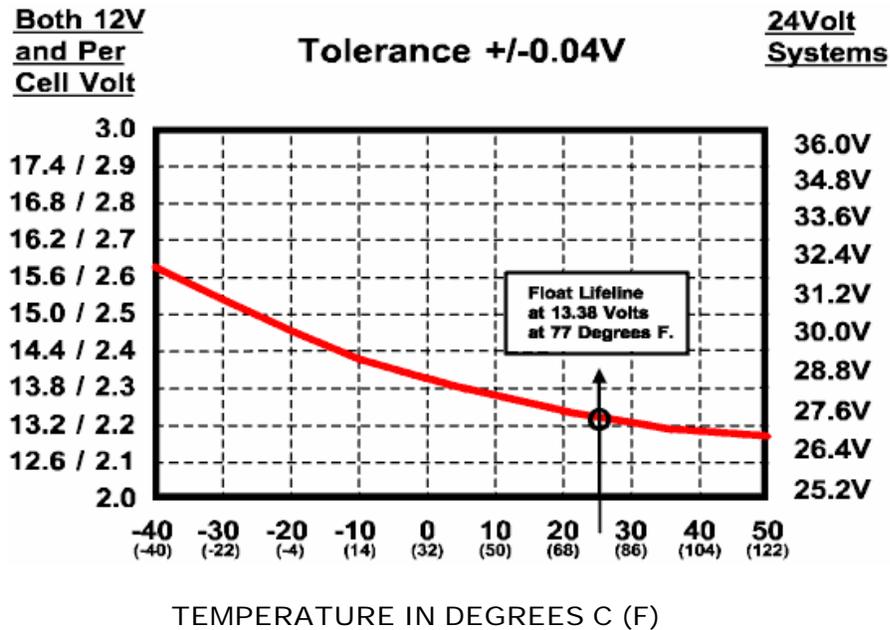
Maintaining the State-of-Charge over 80% (preferably 100%) and electrolyte levels; tightening loose hold-down clamps and cable connections; removing corrosion and periodic equalizing; if required, is normally the only preventive maintenance required for a deep cycle battery.

About Storing Batteries: Depending of the electrolyte temperature and battery type, batteries naturally self-discharge 1% to 25% per month while not in use, and lead sulfation will start occurring when the State-of-Charge drops **below 100%**. If left in a vehicle, disconnecting the **NEGATIVE (-)** battery cable will reduce the level of discharge by eliminating the parasitic load but has no effect on the self-discharge. **Cold** will slow the self-discharge process down and **heat** will increase it up. Use the following five simple steps when your batteries are not in use:

- Physically inspect for damaged cases, remove any corrosion, and clean and dry the tops of the batteries to remove discharge paths from dried battery electrolyte.
- Fully charge and equalize wet batteries, if required.

- Check the electrolyte levels and add distilled water as required, but avoid **overfilling**.
- Store in a **cold** dry place, but not so that it will freeze. The freezing point of a battery is determined by the State-of-Charge and the higher it is, the lower the freezing temperature.
- Based on the battery type you are using, connect a "smart" charger, or a voltage regulated "float" charger to continuously "float" charge your battery. Do **not** use a cheap, unregulated "trickle" charger or a manual two stage charger which was not designed for float charging or you will overcharge your battery.

The following graph demonstrates the effect of temperature on float voltage requirements.



There are trade-offs between the economics of continuous "float" charging, where self-discharge and resulting sulfation does not occur, and periodic charging and the increased potential for a shorter battery life due to permanent sulfation. If you decide to continue periodically recharging the batteries while not in use, increased recharging frequency and storage in colder temperatures will impede the self-discharge and reduce the possibility for permanent sulfation. When you remove the batteries from storage, equalize the battery, if required, using the manufacturers recommended procedure.

Most Common Causes of Premature Battery Failures:

- Lead sulfation in storage.
- Loss of electrolyte due to overcharging or heat which accelerates internal corrosion.
- Undercharging which reduces capacity due to incomplete conversion of sulfate back to lead.
- Old age (positive plate shedding), "sludging", or **excessive** deep discharges.
- Excessive vibration.
- Freezing.