Tony Bingelis

MINIMIZING YOUR BATTERY PROBLEMS

I have it all figured out. The way to avoid Gel/Cell battery problems is by installing a lead-acid battery, and the way to avoid lead-acid battery problems is by using a Gel/Cell. Come to think of it, if you want to avoid all battery problems, don't install either kind. How's that for problem solving?

Gel/Cell Batteries

It is well to remember that the Gel/Cell battery was not developed for the homebuilt market but for a larger one aimed at the golf cart set, wheel chair users and the recreational vehicle market.

I have been using Gel/Cell batteries for several years. My first battery lasted over a year. The second lasted almost two years. The third, only two months, and the last one just a bit past the "90 day" guarantee. This involvement with Gel/Cells has cost me, to date, almost $300 for batteries over a four year period. A number of local amateur builders have had somewhat similar but less costly experiences with their Gel/Cell batteries. So it seems that installing a Gel/Cell in your aircraft is a matter of "you pays your money and you takes your chance".

Still, if ever a battery was conceived for the homebuilder, the Gel/Cell is it. It is perfectly suited for aerobatic flight as it has no liquid electrolyte that can spill out when the battery is inverted. And, except for checking it for security of installation and keeping the terminals clean and tight, it is virtually maintenance free. The battery is "sealed" in that it cannot be opened and requires no servicing.

It does, however, have tiny vents, and corrosive fumes can still be vented, especially during periods of charging and discharging. This, in my estimation, means that installing the battery in the cockpit area without a battery box or some other sort of vented enclosure is not recommended.

A Gel/Cell battery that has been idle in an aircraft equipped with an electric clock and has, say, a computer memory current requirement as well, will ultimately (in two or three weeks) be drained of its stored energy.

When you finally get out to the airport again, the battery will be dead. Then when you try to recharge the battery it may appear to be "open circuited", or you may find that it will not accept the normal amount of current when the charger is hooked up. All you can do is be patient and leave the charger connected . . . and hope.

Then, providing the battery hasn't failed internally, after a period of several hours it will ordinarily start to accept larger and larger amounts of current. This will continue until the normal fully charged current level is reached. If you are lucky, the battery should recover and thereafter accept normal recharges unless, of course, you again let it remain idle for a long period of time in a discharged state.

Never store a Gel/Cell battery, or for that matter a lead-acid battery, in a discharged condition. The risk is great that the battery will not respond to your attempts to recharge it.

I found that a Gel/Cell appears to operate most efficiently at somewhat higher voltage charging rates.

NOTE: It is easy to moniter the system voltage and battery condition when you have a voltmeter installed in your plane. On the other hand, an ammeter is more commonly installed but it doesn't tell you much, only that the system is charging or not. It cannot show that the voltage regulator/alternator team is producing the voltage your system needs . . . or that the battery is fully charged.

The manufacturer (Globe) of the Gel/Cell batteries used most by homebuilders recommends in their Charging Manual that a constant voltage-limited current charger be used for recharging their batteries (at 14.4 volts . . . maybe as high as 14.7 volts).

Since you can't get a hydrometer into one of these "sealed" batteries, another way to determine if the battery is fully charged is to moniter the battery charger needle. The battery will be fully charged once the current stays stabilized at a low level indication for a couple of hours or so.

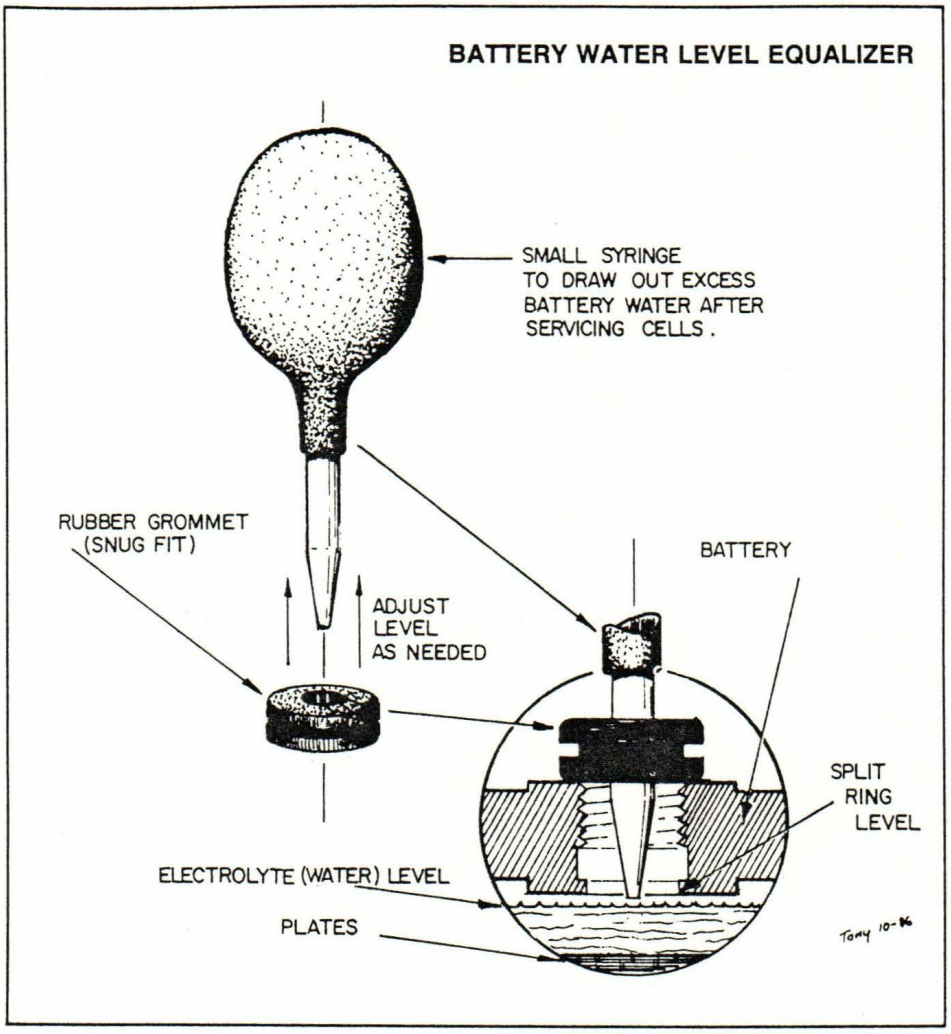
The Lead-Acid Aircraft Battery

A lead-acid aircraft battery is the most reliable choice you can make. A lead-acid aircraft battery, unlike the automotive type, has spill proof caps that automatically seal the cells when the battery is inverted. That makes the aircraft battery suitable for use in an aircraft that is only occasionally flip-flopped. (No, amigo, those no-spill caps will not fit an auto battery.) If your aircraft doesn't have an inverted oil and fuel system capability, the lead-acid aircraft battery is the most dependable one to use. It does require the installation of a battery case. However, as previously pointed out, a battery case installation is advisable regardless of whether a lead-acid battery or a Gel/Cell battery will be installed. Besides, you might want to be able to switch from one type of battery to another.

Activating A New Lead-Acid Battery

Here is where many of us get off to a poor start (ugh!). We spend good money to buy a new battery, and all we do is yank out the old one, slip in the new battery, connect the terminals and away we go. I doubt if one out of three of us ever takes the time to read, or to abide by, the battery preparation and installation instructions.

Anytime you have to replace the battery, ask yourself, "Why?". Was it due to old age? If so, that was to be expected. On the other hand, did the battery fail because of a charging problem? If there is a charging problem, the new battery will also fail prematurely unless you correct the charging system malfunction.



Most batteries received via UPS are "dry charged" and are accompanied with a plastic container packed alongside containing the battery acid (electrolyte). Here's the basic procedure for activating a lead-acid battery properly.

Unpack the battery, the acid and read the instructions.

Manufacturers differ in the battery activation procedures recommended, but typically you will be instructed to remove the vent caps and remove or destroy any sealing device which is incorporated to seal the cell openings.

Next, they'll have you fill each cell of the battery with the electrolyte furnished.

NOTE: Some experts say all electrolytes are the same. The Gill battery people, however, say differently. I'd guess that the difference may only be in the proportions of sulfuric acid and water ratios they prefer for their battery to increase or decrease the specific gravity of the electrolyte. So, just to be sure, use only the electrolyte acid furnished with your battery.

You will need about two quarts so don't carelessly spill it. That plastic bag containing the battery acid can be tricky to handle. Be careful, too, not to splash any of the acid in your eyes or on your clothing. That stuff eats holes in everything so don't dump the excess acid just anywhere.

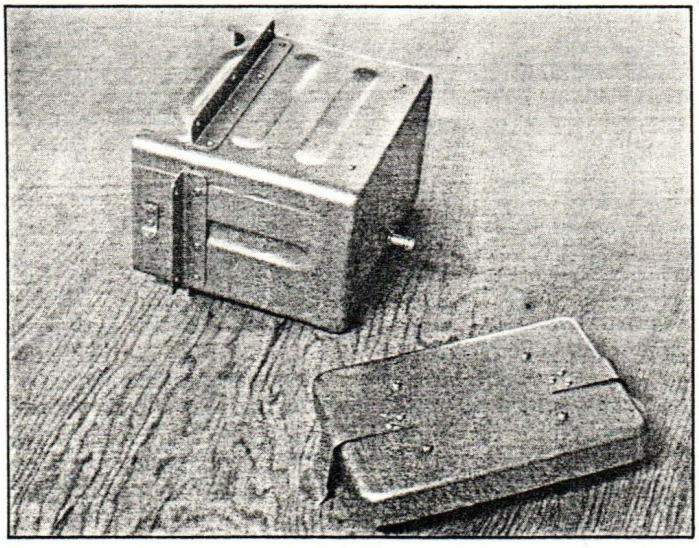
Now, here is where many of us might go wrong. Fully charge your new battery at the rate specified, and not the way you assume would be all right.

There are those who say it is not necessary to charge a "dry charged" battery . . . just go fly it. Still others swear by a high booster amperage charge of about 25 amps for 10 minutes, while some say use a slow 3 ampere charge and continue charging until the specific gravity of the battery reaches a fully charged 1.240 or higher. So whose right? The correct recommendation is the one made by the manufacturer of your particular battery.

Periodic Servicing Is Essential

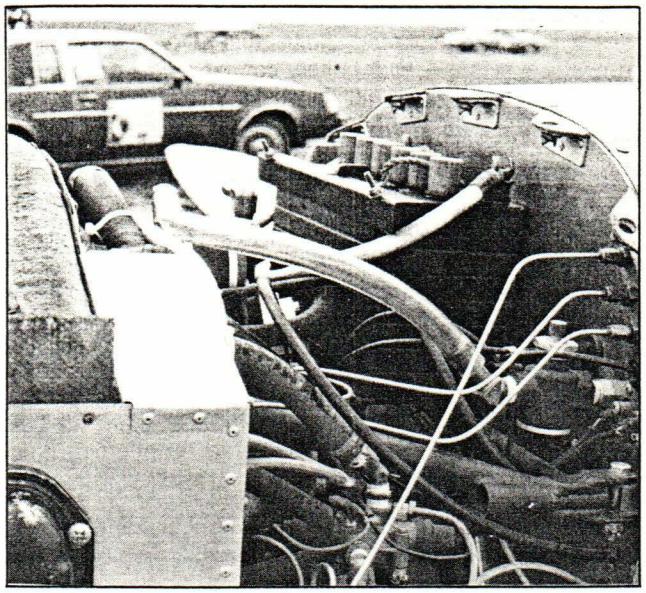
Your battery should be inspected and serviced periodically. By periodically, I mean at least once a month . . . every two weeks if you fly a lot. What does this involve? Not much. Would you believe about 10 minutes of your time?

1. Keep the top of the battery clean,

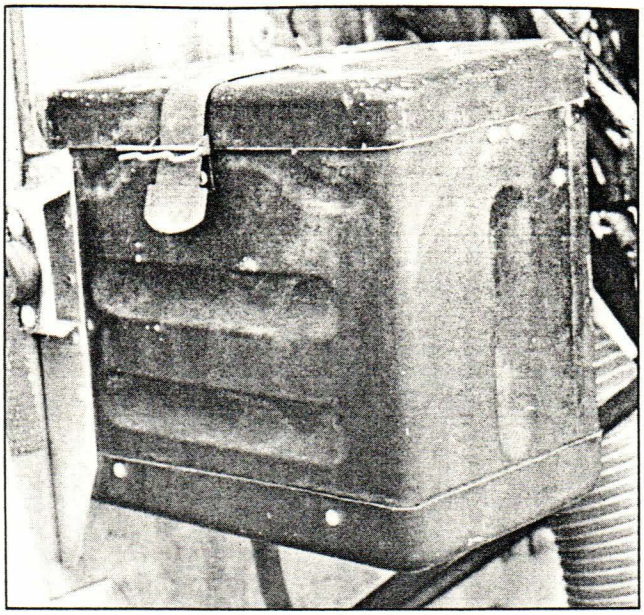


The battery box has been modified so that it can be partially recessed in the battery compartment floor. This will improve accessibility and permit the cells to be easily serviced with water as needed.

The same battery box recessed in the battery compartment floor. Ease of acess is obvious. The wires are from a battery charger which is giving the new "dry charged" lead-acid a boost to fully charge it.



The high location on the firewall gets the battery away from most of the direct engine heat. However, a battery box should always be used with a lead-acid battery.



Here is what one manufacturer considers to be a proper battery installation. Note the drain tube at the bottom of the case.

the cables tight (very important) and the battery secure in its mount.

2. Add sufficient water, if needed, to bring the level up to the bottom of the split rings.

Never, ever, permit the electroltye level to drop below the top of the plates and separators. To do so is to condemn your battery to a very short unpredictable life.

Sometimes a battery is installed deep in the fuselage or some other hard to reach location. Servicing a battery so located is difficult and is likely to be ignored for longer periods of time than one that is easy to reach. Complicating your efforts to service a battery in such a location is the difficulty in seeing inside the cells. Filling the cells to the correct level becomes a messy effort with the likelihood that some of the cells might be overfilled and others left with the inplates exposed.

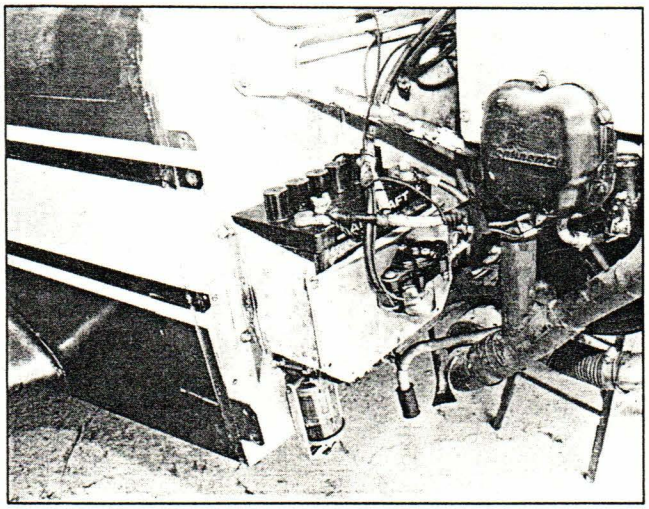
A syringe similar to the one illustrated in Figure 1 will enable you to adjust the water level in each cell uniformly, even if you can't peer into it. Simply insert the nozzle into the battery cell up to the grommet stop, squeeze the bulb, relax the pressure, and lo! The excess water in the cell will have been removed down to the exact level recommended. You should be able to do this even if you cannot peek into the battery cells.

Proper Venting

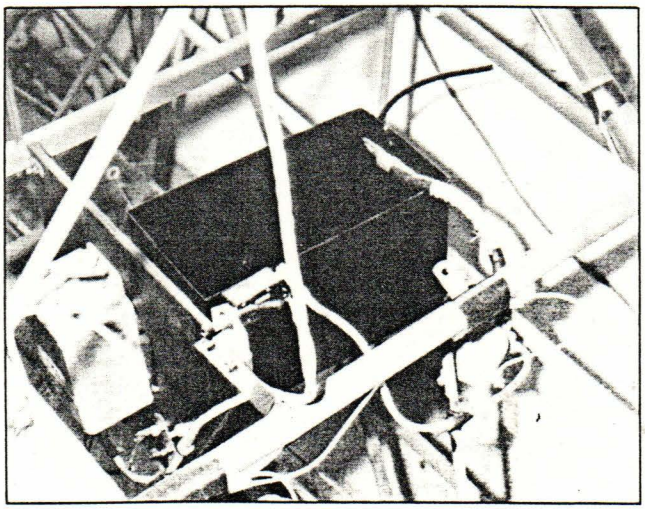
A lead-acid battery can cause unexpected problems when it is located inside the fuselage. A firewall mounting also shares in some of these problems, but accessability is not one of them.

For example, the gases given off by a battery, lead-acid type primarily, are highly corrosive and explosive. So it is obvious that these gases and mists must be carried away rapidly. The safest way to accomplish this is by installing the battery in a properly vented battery box. Its sump outlet must be connected to a tube or hose which is routed to some point overboard. That overboard point should be well clear of any structure as the corrosive fumes will play havoc with metal parts, paint and fabric.

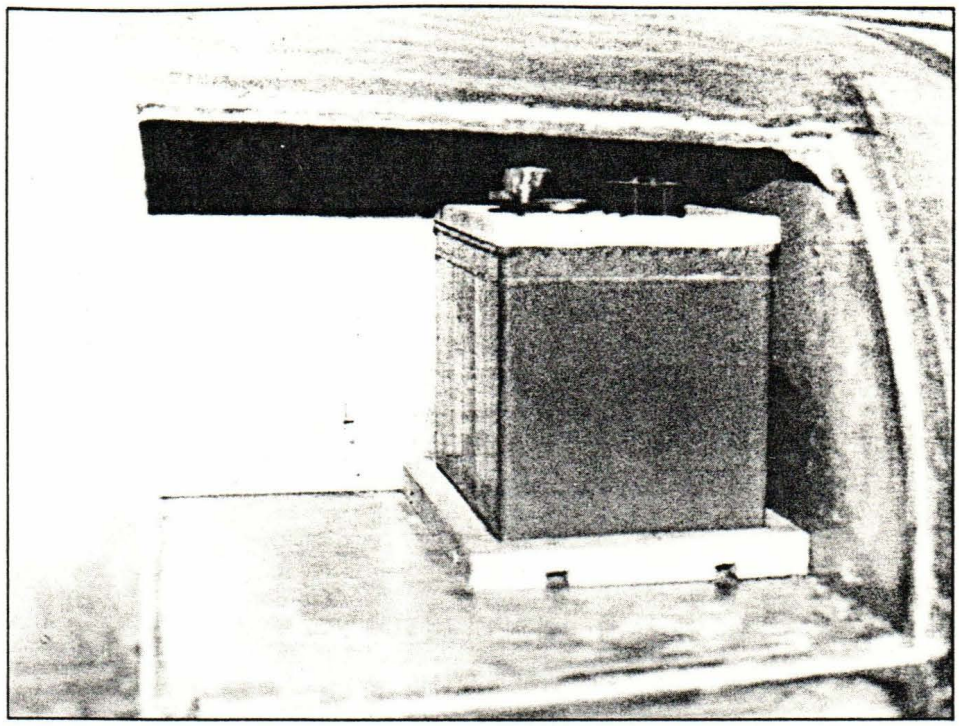
In addition, I believe that an air vent should be located in the top cover of the



This firewall location is convenient for the owner but bad for the battery due to the proximity of the hot exhausts. Lack of a battery box cover subjected the engine mount, firewall and adjacent areas to the corrosive effect of the battery acid fumes.



This battery is buried deep in the fuselage where access is difficult as is servicing the battery. Case must be very well ventilated lest the battery fumes corrode the structure and control cables.



A Gel/Cell being installed. Note, that if this were a lead-acid battery how difficult it would be to check and service it with water. The battery would have to be removed to do that.

battery box to improve circulation through the battery case.

Overcharging

If you find that you have to keep adding water to the battery frequently, or that there are signs of electrolyte wetness on top of the battery, your voltage regulator may be set too high and the battery water is "boiling over" due to overcharging. A voltage regulator set to produce 14.4 volts for a 12 volt battery is high enough for most any climatic condition. If you live in an area of great temperature extremes, your local maintenance people will recommend that voltage regulators be readjusted with the seasons. The general idea being that a battery can accept and needs a higher voltage input at lower temperatures than is required for extremely hot conditions. However, in examining the charts for recommended seasonally adjusted voltage regulator settings, I find that a voltage regulator set to produce approximately 14.4 volts would be just about right for most U. S. regions. In any event, even under the hottest of blazing temperatures, your voltage regulator should permit no less than 13.5 volts to be produced in order for the battery to get any charging benefit.

Overcharging a battery with a battery charger is equally bad. When you notice that all the cells are bubbling furiously and splashing out fluid, you can assume that it is due to too high a charging rate, or from continuing the charging rate too long. Do your battery charging at a slower rate and do not allow the battery to get too warm to the touch of your hand. You know the battery is fully charged when its specific gravity measures 1.240 or above with a hydrometer.

If you are using a lead-acid battery you should invest in a good hydrometer. (Auto parts stores sell them.) Get a small one that has numerical calibrations. Don't waste your money buying a cheapie that has floating balls and colored stripes to indicate the battery condition.

Use your hydrometer regularly and you may even be able to detect the battery's declining condition well before an impending failure. Sometimes electrical problems are caused by low voltage.

Undercharging

Yes, undercharging can lead to low battery power but it can also be detrimental to the life of your battery. That is, if you continue to operate your battery with a low state of charge — or worse, allow it to sit idle for a long period of time, it will become less active chemically, and will eventually become unable to accept a charge. It may never again regain its full vim and vigor due to a process called sulfation (the formation of a hard, dense crystalline substance — sulfate — on the plates that cannot be electro-chemically converted to normal active material).

A battery can be subjected to an undercharging condition even when your generator/alternator and voltage regulator are effectively producing the required voltage. This unusual discrepancy can occur when your battery cable connections are poor (high resistance). For this reason, you should break, clean (brighten) and reconnect your battery connections several times a year. At least do it during your annual inspection.

Batteries Don't Like Generators

Generators are lazy. They will cut in and go to work at the start of the take-off run and, ordinarily, not much sooner than that. This means that starting the engine and all the radio work you have to do to get to the take-off position is done under battery power alone. This imposes a considerable drain on the poor battery with absolutely no help from the generator. A generator is totally ineffective below 1000 rpm.

Of course, after take-off and during flight, the generator is busily producing electricity to operate the equipment (radios, strobes, etc.) turned on in flight. The excess current is automatically dribbled to the battery to recharge it. If your flying consists mostly of short (30 minute) weekend hops to nearby airstrips, the battery will never get enough charge to bring it up to a fully charged condition.

Unless an aircraft is used frequently for cross country trips, it is not uncommon for a generator equipped aircraft to have a battery that is chronically in some stage of discharge. This is bad for the battery as it could reach a state where it can no longer take a charge and the battery will fail.

If this is your situation, you should, every couple of weeks, remove the battery and take it home to be recharged. If you have a hangar with an electrical outlet, you could trickle charge the battery during the aircraft's inactivity. Be advised, however, that some battery manufacturers don't approve of the so-called trickle charge treatment.

Another way to cure this lazy generator problem is to remove it and replace it with an alternator . . . at least an alternator will work full time, and batteries like that.

In Summary

We will always have our battery problems as long as we continue to depend on them.

Here is my not too surprising conclusion.

With the exception of a battery giving up the ghost due to old age, most battery problems can be directly attributed to a lack of attention and inadequate servicing. Think about it.

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