BASIC BATTERY CARE

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I would like to thank Jim Canton, editor of "Freshwater News," who first printed this series. Without his encouragement these articles would never have been available. Be sure to watch "Freshwater News" for the continuation of this series.

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CONTENTS

ARE YOU COMMITTING "BATTERYCIDE?"

Winter is the time of the year that many people are committing "batterycide." Fortunately, in most cases, it is not premeditated and the guilty verdict only results in a fine that empties the wallet.

Most of these cases are actually accidental and can be prevented. There are two ways that batteries are commonly murdered. In the following paragraphs we will talk about these and other ways to keep our batteries alive and healthy.

Probably the most common way that a battery is killed is to leave it out in the cold to starve to death. We button up our boats for the winter and go home to the fireplace. When spring comes we find dead batteries and no amount of charge resuscitation will bring them back to life.

What happens is that batteries slowly lose their charge when left unused. When a battery discharges, sulphur is deposited on the plates (remember this). The sulphur comes from the sulfuric acid that is in the battery. (Please don't stop reading now as this is as technical as we are going to get.) If the battery is left discharged for any length of time the sulphur will crystalize permanently. Then we have a battery that is "sulphated." The battery will no longer take a charge. May it rest in peace; and please don't bury it in the river.

The next most common way to murder a battery is to cook it. Here our perpetrator wants to look less obvious. He puts his charger on and then leaves for Baha for the winter. When he returns the batteries have died of thirst. Now he can claim that the charger directions said it was automatic or that it would never damage batteries. Baloney! No $29.95 battery charger is "automatic". And, if you read the small print of the more expensive so called "automatic" battery chargers, you will find a statement like this: "Check and refill the water in your batteries regularly." What they don't say is that you will ruin them if the water gets below the plates inside.

Now most of us are good, honest people and have no desire to commit "batterycide." So how do we prevent it? Figure I shows a few important voltage levels and what they mean to your battery.

Most inexpensive battery chargers are not automatic and will push the voltage up to 14.2 volts and higher. This includes many trickle chargers. Smaller versions of these (10 amps and under) can be left unattended for 10 hours or so. Larger versions should be checked much more frequently. When 14.2 volts is reached, turn it off until the next charge.

If you have a charger that is really automatic and has a finish voltage of 13.8, check the water level on at least two week intervals.

Now, for those of us who have a charging system that finishes at 13.2 volts, hang this sign on our boats: "Batterycide prevention boat." If your system charges to 14.2v and then returns to 13.2v, use flashing neon lights.

To summarize: Keep your batteries charged (at least monthly). A discharged battery will become sulphated and die. Do not overcharge. Overcharging will cause excessive water loss and, if the plates are exposed, damage will occur.

P.S. Use distilled water or "Bull Run" water to top off your battery.

Charging Voltage	Effect to Electrolyte	What this means to your battery
14.2V	Hard gassing	Needed to fully charge a battery, i.e. remove sulphur from the plates. (Remember?) Also it quickly "boils" the water out. Many alternators/ regulators are set at this level.
13.8V	Light gassing Correct voltage for unfiltered charger (BC911)	A poor compromise used by many charger manufacturers. It never fully charges the battery, often leading to early sulphation. It also slowly "boils" out the water leading to damage if the batteries are not kept full.
13.2V	No gassing Correct voltage for filtered charger (BC928)	A good maintenance voltage. The batteries can be left on "charge" indefinitely without damage. Great for live-aboard use or leaving the batteries unattended.

Figure I

GAUGES, DIALS, POINTERS, AND OTHER SEEMINGLY MEANINGLESS GADGETS!

Previously we talked about the crime of "batterycide" and its prevention. Now let's talk about the meters that are on our boats, and how they can help us prevent "batterycide."

There are two kinds of meters that will help. The first is a voltmeter. It measures the electrical "pressure" of the battery. A good analogy for voltage is the amount of water pressure in a hose. The higher the water pressure, the farther the water will squirt. The higher the voltage the higher the electrical pressure.

The ammeter is the other kind of meter that is useful to us. It measures the amount of electrical current in amps. It too can be compared to water. Here we are concerned about the amount of water (or electricity) flowing. We could compare a large flow of water like the Columbia River to say Johnson Creek which has a relatively small current (I'm sure some Johnson Creek residents would argue the point at times). Relate this to the amount of current your engine starter uses compared to your running lights.

The voltmeter is the most useful of the two meters. There are two basic types: analog and digital. Either type is fine, but they must be accurate and be readable within 0.1 volts. An examination of the following chart will quickly reveal why:

BATTERY VOLTAGE				BATTERY CONDITION
6V	12V	24V	32V	
7.1	14.2	28.4	37.9	-- High gassing level, needed for full charge. Typical alternator regulator setting.
6.9	13.8	27.6	36.8	-- Light gassing level. Typical "automatic" battery charger setting.
6.6	13.2	26.4	35.2	-- No gassing. A good maintenance voltage.
6.4	12.8	25.6	34.1	-- 100% charge on battery*
6.3	12.5	25.0	33.3	-- 75% charge on battery*
6.1	12.2	24.4	32.5	-- 50% charge on battery*
5.9	11.8	23.6	31.5	-- 25% charge on battery*
5.6	11.2	22.4	30.0	-- Completely discharged battery*
<5	<10	<20	<26	-- Battery damaged with one or more shorted cells*

*These voltages are measured when the battery is at rest. In other words, turn off your charger, alternator (engine), or anything hooked up to the battery.

When reading the voltage on a battery, be aware that a surface charge will remain on the battery for several hours after charging. This will cause a falsely high reading. It may be removed by discharging the battery for about a minute at 10 amps. Just turn on a few things for about one minute, then turn everything off, leaving on one small light or the Loran will make little difference in the accuracy of your reading.

The ammeter will tell us how much current is going out or coming into our battery. When we turn things on we can see how much current is going out. If we are only drawing 5 amps, our battery will last a long time, but if we are drawing 50 amps, our battery will be dead soon.

When charging with a conventional charging system, our ammeter will show a high rate of charge at first. This current will reduce quickly as the battery takes a charge. This is why conventional charging systems take longer to charge than the new "intelligent" charging systems. The new systems will continue to charge your battery at a high rate until 14.2 volts is reached. It will then step back to a maintenance voltage and show a low charge current.

Much more could be said, but space here won't permit it. All of the voltages shown are approximate and depend on the battery and temperature, but the above table will suffice in most circumstances. If you want to know more, the best book that I have found is Living on Twelve Volts with Ample Power, by David Smead and Ruth Ishihara, available at most boating book outlets or I have a few copies at our shop now.

BATTERY "AEROBICS"

We have talked about how to keep your battery out of the morgue. We talked about how "batterycide" is committed. That can easily be done by not charging them for months at a time or overcharging them for a long period. Then we talked about a few important voltages that can mean life or death to our batteries. To top it off there was a lesson on how to interpret all those meters on our boats.

I'm afraid by now that fear has struck deep into the hearts of those who sincerely don't want to commit "batterycide." The meters are being read and compared to the charts. Batteries are being charged. Some chargers are being turned on and some off. But the question is, "are we treating our batteries right?"

I think the best way to answer that question is to describe a little device that puts our batteries through an "aerobic exercise program." It is an alternator regulator designed by Dave Smead of Ample Power Company. By studying what it does we will know what has to happen to our batteries for their best health.

The first thing it does when turned on is sense the voltage and temperature of our battery with a sensor at the battery. Let's say it is March 24, 1989 and it is a cold, rainy, miserable day. It doesn't know that; but it does know that the temperature of the battery is 47 degrees and has a voltage of 12.3. It's reaction is simple -- CHARGE!

Our regulator tells our alternator to put out all it can to charge the battery. The alternator will continue to put out its maximum current until 14.6 volts is reached. (At normal room temperature it would stop at about 14.2 volts.) This would give our battery what is called the "bulk" charge and hard gassing will have started.

Now our regulator goes through what is called an "absorption cycle." It reduces the current of the alternator to maintain the hard gassing level of 14.6 volts. This level is held for a time (25 to 45 minutes) relative to how long it took the battery to reach 14.6 volts.

Satisfied that the battery is fully charged, our smart little device reduces the alternator output to 13.5 volts (13.2 at 70 degrees). This is called the float voltage. Our batteries may be left at this level for months at a time without worry of damage.

As you can see, there are three steps to charging our batteries. First there is the bulk charge which gives us about an 80 percent cycle. Then we have the absorption cycle. The hard gassing that occurs here completes the charge and helps reduce sulphation, prolonging battery life. Lastly we reduce the charge to a float voltage for maintaining the batteries without danger of harming them.

"THE BIG COMPROMISE"

To get the best possible life out of your batteries they need to be on a good exercise program. Just like our bodies, poorly taken care of batteries will have a poorer, shorter life.

I told you previously about the Ample Power three step regulators that did everything right. Now I will tell you when and why the old system is an acceptable compromise. We will discuss reasons for improving the system that you have.

We first need a short history on batteries to understand why the stock regulators on our alternators are not necessarily the best. When lead acid batteries were first discovered, they were simply built, used, and then rebuilt. It was a long time before Edison provided electricity to everyone's door and battery chargers were available. "Batterycide" abounded.

The best research on good battery care was done during the beginning of this century. Researchers then knew how to get the best life from lead acid batteries, but the technology was not available to do the job automatically. The first regulators were electromechanical (how's that for a six bit word?) devices that used a vibrating relay to regulate the alternator at one fixed voltage. These regulators were used for more than half a century.

Recently the old regulators were replaced with newer solid state devices. Unfortunately they were no smarter than the old ones. They were set at a fixed voltage around 14.4 volts. This would do little to properly charge a battery setting at 30 degrees which needs about 14.8 volts for a complete charge. The engineers had to assume that you were sitting on an L.A. freeway in August. They hoped that the commute wouldn't take more than a couple of hours and that the water level would be checked sometime. If not, it would just mean that many more millions for the battery manufacturers.

So what do we do? Batteries in your car will usually last three to five years treated this way. Not bad. Some cold morning you go out and the lizzy won't start. You lose a couple hours work, buy a $39.95 special and off you go again. But what about the boat? All but the tiniest boats should have two good batteries. (It is hard to pull over to the side of the channel and hold out jumper cables when needed!) That's at least a $120 investment. Some larger boats have over $2,000 in batteries.

Marine service is also much harder on batteries. I have replaced many batteries after only one year of service. It is very common to see only two years of life. Beyond that it can be assumed that the batteries have seen fairly good care.

Now we get down to where the rubber meets the road. What is our best cost to benefit trade off? If we have a boat with a couple of good small batteries, a VHF radio, running lights and a couple of cabin lights, we should not worry about making any big changes to our charging system. Just do the minimum to prevent gross "batterycide." (Please see previous articles.) Have your batteries checked at the beginning of each season and replace when needed.

If, on the other hand, we have refrigeration (the #1 big one), an inverter, lighted companion ways, and a 12 volt toaster (don't laugh), we need a battery system that will last through at least three cold beers. We also need a charging system that recharges our batteries without running the engines 4 to 5 hours daily. this system should have the capability to give our batteries regular aerobic exercise.

What you invest in your batteries and charging system depends on many factors. These include: all the electrical equipment on your boat, your cruising habits, how reliable you want your system to be, and of course, your pocket book. All this and other factors need to be considered in properly engineering a battery system.

WHAT IS THE BEST BATTERY TO BUY? -OR- HOW MANY BATTERIES DID YOU BUY THIS YEAR?

There are three basic kinds of batteries that are used on boats today. The first is the cranking battery like that found under the hood of our cars. The second is the deep cycle battery that should be used for our house (or cabin, or auxiliary, or spare, or what have you) battery. The last and far from the least are the new gel cell batteries. Much more about these later.

CRANKING BATTERIES have only one real purpose, and that is starting engines. They are made with thin lead plates that are doped with calcium. This allows them to put out high currents for short periods of time.

A good way to ruin cranking batteries is to deep cycle them about twenty times. An exception to this are most 8D batteries. 8D's were designed to start large diesel engines. Since some of these engines are cantankerous, they add a little antimony along with the calcium to allow the batteries to be deep cycled about 40 times. While I'm on the subject of 8D's, we had a customer come in the other day and tell us that a battery dealer claimed that all 8D's were the same. Now let me ask you, are all boats built the same? Neither are batteries! There are poorly built, cheap batteries and well built, expensive ones. It pays to shop wisely.

Like boats, there are many sizes of batteries, including BCI group sizes 8D, 4D, 27, 24, 2HT, etc. Inside these case sizes you can have all kinds of batteries including cranking, deep cycle and gel cell.

This brings us to our next subject -- DEEP CYCLE BATTERIES. Deep cycle batteries are intended to run equipment over a longer period of time without recharging. This would include refrigeration, cabin lights, anchor light, radios, head, inverter, etc. The kinds of things that leave you with dead batteries while on the hook in some wonderfully secluded bay.

Deep cycle batteries are built with thick, antimony doped plates. This allows them to be completely discharged without damage. This assumes that they are immediately recharged, of course. A good quality deep battery will survive about 200 deep cycles before significant loss of capacity is noticed. The "Rolls Royce" of conventional batteries, Rolls and Surette, typically see 800+ cycles. Deep cycle batteries do not have the high current capacities of cranking batteries. However, large ones will start small engines. A battery expert should be consulted for your application.

Last but not least are the new GEL CELL BATTERIES. Actually, these are not so new. Technology has advanced to the point that these high tech batteries are now affordable for boaters. In fact, for many applications, they are by far a "best buy." A comparison will follow.

Gel cell batteries are constructed using many thin plates doped with calcium. The electrolyte is a gel rather than a liquid as in conventional batteries. The plates, separators, and gel are compressed before assembly resulting in a battery highly resistant to damage from shock and vibration. These batteries are truly sealed and may be mounted in any position.

Gel cell batteries have many other advantages. Because they are sealed they never need maintenance. They can survive being left discharged for several days, although I don't recommend treating them that way. Never do that to a conventional battery! You will have a new set of batteries and an empty pocket book. They are capable of putting out high currents for cranking and they can be deep cycled. Recent tests of some Prevailer (R) gel cells by Sonnenschein Batteries have exceeded 1,000 deep cycles an the batteries have not yet dropped to 80 percent capacity!

More advantages include a very low self discharge rate. These batteries can be left unused for as long as two years without need for recharging. Remember our article on batterycide? These batteries are harder than an opossum to kill! They do have one Achilles heel. Overcharging will force them to gas which can result in permanent damage. Have your charging system checked when you install them.

There is one more advantage I will mention here. While gel cell batteries are being discharged, they maintain a higher voltage than conventional batteries. This makes inverters much more efficient, engines crank faster, etc. Now, as I promised, a look at the following chart to see the cost advantages of gel cells:

8D Battery	Cost New	# Cycles	Reserve Capacity	Total Use	Cost/Cycle
Conventional Cranking	$163.95	40	465	18,600	$4.10
Conventional Deep Cycle	$210.95	200	450	90,000	$1.05
Rolls Deep Cycle	$455.00	800	450	360,000	$.57
Prevailer Gel Cell	$496.61	1,000	450*	450,000	$.50

*Gel cell batteries increase their capacity by 15% after the first few cycles. Also note that the above conventional batteries are premium batteries.

This table is a bit of an unfair comparison for the conventional cranking battery because it is not intended for this kind of service. Unfortunately it is pressed into this kind of service perhaps because of its large size. "Wow, look at the size of that battery! It should take anything." Well, it won't. Some have survived as house batteries because they have not truly been deep cycled. In these applications a smaller deep cycle battery would have done the job for a lot less space, weight and money.

To summarize: cranking batteries are intended to start engines. Deep cycle batteries are intended to be used to run the electrics of your boat between charges. Batteries like Rolls and Surette are among the best batteries in the world and despite their higher cost are a better buy. However, they are just as susceptible to batterycide as any other conventional battery. Good gel cell batteries like the Prevailer make better cranking and deep cycle batteries. They are far more rugged than conventional batteries even when abused. They are the best buy.

Have you been buying new batteries every year or two? Now you know more reasons why. A tight budget may prevent you from buying the right choice now, but choosing the right battery for the job will greatly increase battery life and save you money. If you plan to keep your boat three years or more, gel cell batteries are the obvious choice.

HOW TO USE YOUR BATTERY SWITCH
— OR —
ANOTHER WAY TO COMMIT BATTERYCIDE

Case #101A: Problem: 3 dead batteries. Age: all new, less than one year. Murder weapon: two battery switches, both set in "all" position. Accomplice: overzealous battery charger. Suspect: uninformed boat owner. Conclusion of case: the boat owner was arrested and convicted for batterycide. He was charged for a new set of batteries and released with a warning.

The above is a true story. The names and places have been concealed to protect the innocent. Unfortunately, some people never learn. The same person was caught doing it again!

What did he do wrong? How did that hurt the batteries? Isn't that what the switch is for? NO! NO! NO!

To answer these questions, first you need to know the proper use of the battery switch. The simplest electrical system on a boat should have two batteries. One is a cranking battery used exclusively to start the engine. The other is a deep cycle battery used to run lights, refrigeration, electronics, etc. I like to call this one the "house" battery.

The switch has four positions: "OFF," "1," "ALL," "2." The "OFF" position should do just that -- turn everything on the boat off. The only exception to that would be the automatic bilge pump. I prefer to use position "1" as the house battery. When the boat is in use, the switch should almost always be in the house position.

The exception to this is when you start your engine. Then switch to position "2," the engine battery. (Remember positions "1" & "2" could be reversed depending on your boat's wiring.") Start your engine. Allow the engine battery to recharge. In most cases this should take only a few minutes. Then switch back to the house battery. Leave it there! Please read our previous articles to learn how to properly charge batteries.

Did you notice that we said nothing about the "ALL" position! We had to go through it to get from 1 to 2 and back, but we did not stop. The only time that switch is in the "ALL" position is when the engine cranking battery is too weak to crank the engine. In this emergency situation we switch to the "ALL" position to parallel the house battery to the cranking battery to get the engine started. How often do you jump start your car with battery cables? That's how often that switch should be in the "ALL" position.

Now for "ALL" the reasons not to use the "ALL" position. The first and most important is that you won't drain "ALL" of your batteries leaving you with no way to start your engine. "ALL" of us have sail boats and don't care, right? Another good reason is that very high circulating currents (sometimes in the 100's of amps) can occur. This is also hard on batteries.

Then there is the reason with which this article started. A battery charger is attempting to charge a group of batteries that are inadvertently hooked together by the switch in the "ALL" position. Not all of these batteries are the same. One is weaker than the other. The stronger battery circulates current into the weaker. The charger tries to charge the weaker. The stronger battery gets overcharged and the weaker battery is undercharged. This process starts slowly and accelerates quickly. It is not unusual to see batteries destroyed in a year this way.

Need we say more? Keep that switch in the "house" position. Only switch to your cranking (starting) battery to start the engine. If you want, use the "OFF" position when you leave the boat. Never use the "ALL" position except in the emergency situation when the cranking battery is too weak to start the engine.

One last thought. Switching the battery to the off position when the engine is running can damage your alternator. If you have a battery isolator, a snubber (available from Ample Power Company), or a field disconnect wired on your battery switch, you can switch your battery switch to any position, including off, without worry of damaging your alternator.

WINTERIZING YOUR BOAT

Freezing weather brings more concerns to boaters as they try to keep their boats safe from the damage caused by freezing.

A couple of years ago I was asked aboard a fairly large motor vessel that had caught on fire. This fire started at the shore power inlet connector and caused considerable damage. Fortunately the fire had just started when someone leaving work late at night reported it. A few more minutes and the boat would have been a total loss.

As a marine electrician, I have seen the potential for this kind of problem many times. This particular boat had a 50 amp circuit breaker protecting a 30 amp shore power cord and inlet. Not much imagination is needed to understand how this fire started. Many older boats are poorly wired with bad connections, corroded or wrong connectors, undersized wire, and a host of other problems.

The lack of inspections, coupled with the unfortunate problem that we all make mistakes occasionally, leads to potential hazards. Even if the boat is wired correctly, things can go wrong. One of my customers almost found this out the hard way. He had dutifully turned on as much heat as he could and not overloaded his circuits. What he had forgotten was that his water heater automatically turned on causing his main circuit breaker to trip. Fortunately while checking several of my customers' boats, I discovered his boat was without power and very cold.

How do we boat owners prevent these kinds of problems and reduce unnecessary worry and concern for our beloved crafts? The threat of cracked engine blocks, damaged through hulls and even frozen batteries is very real. Even if a boat is properly winterized, glycol and alcohol can't protect everything.

Therefore I recommend that the boat be heated. The best solution to this problem is to head out the mouth of the Columbia, turn left, and keep going until the thermometer reads about 80 degrees. The next best solution is to use a combination of heaters or strategically placed flood lights to keep the interior of the boat at about 40 degrees. Any higher temperature than that is not necessary. If you are living aboard, remember that lazarettes or aft engine compartments can get very cold while you are toasty warm in the main cabin.

In our attempts to keep our boats warm, how do we keep from overloading circuits which could trip circuit breakers or worse yet, start a fire? The first thing we should do is inspect our AC electrical system. Start with the shore power cord and the inlet connector. These should be in good condition, free of any kind of damage, and the terminals without corrosion. Connectors should only be of the corrosion resistant type. Non-corrosion resistant connectors can lead to a fire.

The current rating of the power cord and shore power inlet is the next thing that we want to know. The most common sizes are 30, 20 and 15 ampere. An ampere is the measurement for electrical current.

This might be easier to understand if we think of a small stream with 15 gallons per minute of water flowing in it. If the water flow is increased to 30 gpm, the amount of water moving in the stream has doubled. To carry our analogy a little further, let's assume that our little stream is very small and the most water that it will handle is 30 gpm. If for some reason 45 gallons try to flow through the stream, it will overflow, causing flooding. A similar situation occurs with our electrical circuits, except that too much current will result in overheating and possibly a fire.

Next, check the wire between the shore power inlet and the AC distribution panel. For a 30 ampere service it should be #10 AWG/600 volt wire. For a 20 and 15 ampere service the wire should be #12 AWG/600 volt. Larger wire is OK, but smaller wire is a definite no-no. (#10 AWG is larger than #12 AWG.)

Somewhere in this wire, usually at the main distribution panel, is a two pole circuit breaker. It is intended to break both sides of the incoming line and should be rated no more than the shore power cord and inlet, i.e., a 30 ampere cord should have a 30 ampere circuit breaker, etc. (Remember our boat that had a 30 ampere power cord and a 50 ampere circuit breaker?)

Next on our inspection tour is the branch circuits. Each branch circuit should be protected by a fuse or preferably a circuit breaker. There is not enough room in this article to discuss all the factors involved in determining the size of these breakers. However, if the breaker is no larger than 30 ampere when #10 AWG wire is used, 20 ampere for #12, and 15 ampere for #14, you can assume that at least some thought went into the wiring of your boat. It would be a good idea to get a copy of "Your Boat's Electrical System" by Miller and Maloney. I have used this as a text in teaching marine electrics and consider it to be one of the best.

While doing your inspecting, be sure the power is disconnected from the dock. 120 volts AC can kill! Look for any burned or discolored connections or wires. Your nose will sometimes help in this. Check for loose connections. A firm pull on a wire should not pull it loose. If it does, you have just discovered a potential fire hazard.

You have just completed the inspection and you should feel pretty confident that you would have found the most obvious and common electrical hazards on your boat.

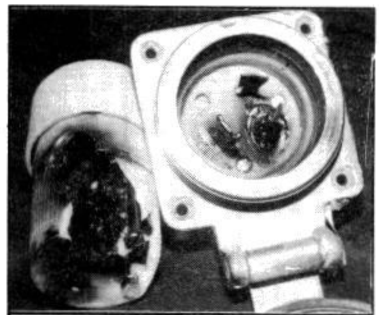
Now that we have determined that the 120 VAC system on your boat is reasonably safe, how do we insure that we don't overload it? The maximum power available to your boat is limited by that umbilical cord and its connectors that hook the boat to the dock. A 30 amp cord is limited to 30 amps, a 20 amp cord to 20 amps, etc. But, remember if any adaptors are used, the maximum current is limited to the smallest cord or connector in the system.

We need to find out what the current in amperes each appliance on the boat will draw. Sometimes this is real easy because there will be a little plate that will have something like "120 VAC/12.5A" written on it. This is what you will find on most boat water heaters. Other times it might have "120 VAC/1500W." What does this mean?

1500W means that the water heater uses 1500 watts of power. It also means that it will draw 12.5 amperes when in use. We arrive at that by the formula "P equals A times V," or Power is equal to the Amps times the Volts, or the Amps is equal to the Power divided by the Volts. In this case 1500W divided by 120 volts equals 12.5 amps. If you have an AC ammeter on your boat, forget all of the above. Just turn on the heater or whatever and see how much it draws.

Now add up the current in amperes of everything that you want to have on. This sum should not be greater than what your shore power cord and connectors should allow. With a 30 ampere system, this would allow one 1500 watt heater at 12.5 amps, one water heater at 12.5 amps, (25 amps so far), and maybe a battery charger, depending on its size. I would turn the water heater off and put the electricity to better use. If you have a 15 amp service, you will be limited to one 1500W heater and two 100W light bulbs and no more! Surprised? Many people are. We are all so used to our 240V, 200 amp (48,000 watts) service in our homes that we have no idea of the limitations we have on our boats.

One more little item. Keep your batteries charged. A discharged battery can freeze, and if left discharged it will become sulfated and ruined.



Damage to 30 Amp plug caused by improper wiring.

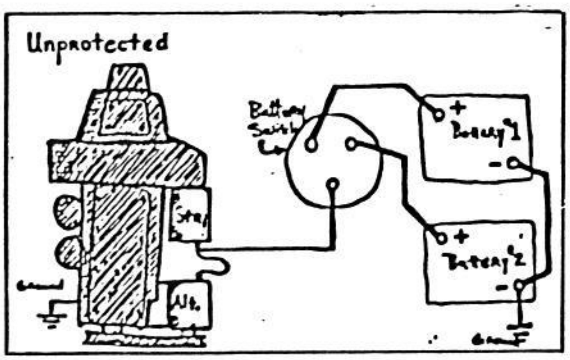
The Tragic result of poor or improperly used wiring.

ISOLATORS, SNUBBERS & SWITCHES
— OR —
HOW NOT TO BLOW YOUR ALTERNATOR

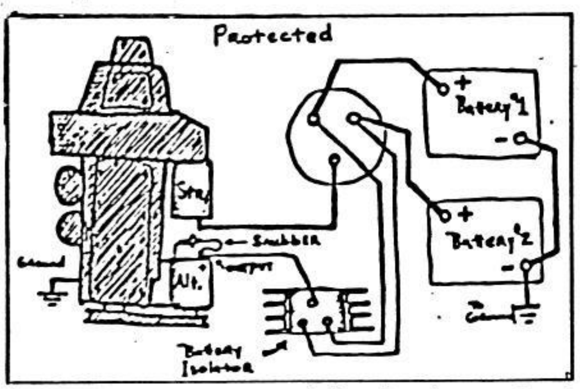
We have talked so much about "batterycide" in previous articles it was a temptation to coin the word "alternatorcide." You be the judge. Try to pronounce "alternatorcide." Don't feel bad. I couldn't say it either.

Well, whatever we call it, what we want to do is prevent it. As most of us have heard, if we turn our battery switch off while the engine is running, the alternator will be damaged. That is true in many cases. Let's find out what causes the damage and what we can do to prevent it.

Let's look at the drawing of a boat's electrical system that has no protection for the alternator. You can see that the alternator is connected to the battery via the starter cable and through the battery switch.



No protection for alternator-greatly simplified drawings of a typical Boat Electrical System.



An Alternator protected by both an isolator and a snubber. Either one will protect the Alternator.

As long as the switch is in one of the on positions, the alternator is connected to a battery. All the energy that is being converted from the engine by the alternator is being dumped into the batteries. If you turn the battery switch off, that energy will have no place to go.

In the alternator this energy is in the form of a current and a strong magnetic field. By shutting the switch off, the current is stopped and the magnetic field collapses causing a very high voltage. This high voltage is what damages the alternator. Faster than you can realize that you shut the switch off, the damage is done. Don't do it in Barkley Sound. It's a long way home on one battery charge.

Having said this, you are probably afraid to touch your switch when the engine is running. Many people say that you should not change the battery switch at all when the engine is running. This is not true in most cases.

With most battery switches you can switch from "1" to "ALL" to "2" and back again without disconnecting the alternator from the batteries. That is because most of these switches have what are called "Make before brake" contacts. In other words, before you disconnect from "1" going to "ALL" -- positions "1" and "ALL" are shorted together. The alternator is not disconnected from a battery. The same is true from "ALL" to "2" and back, but not to "OFF"!

To insure that you have the right kind of switch and that it is working properly, try this little trick. Turn on a light that you can observe while turning your battery switch. (Do not run your engine while doing this!) Rotate your switch slowly through all positions both ways. The light should burn steadily through the complete test except when the switch is in the off position. Also try "rocking" the switch in each position. If the light flickers at any time, you have a problem with the switch. Remember, in less than the flicker of your eye (or the light) your alternator could be blown!

If I haven't got you in a total dither by now, think about this conversation. Skipper: "Will someone switch the battery back to number one?" Crewmember: "Oops! I just switched it off. Will that hurt anything?" (The rest of the conversation is censored.) Either call your psychologist now, or better yet, read on.

Here are two good ways to protect your alternator from such accidents. The first is to install a snubber across the output of the alternator. These simple devices (manufactured by Ample Power Company) sell for only $10 and they just take a few minutes to install.

Now would be a good time to look at our second drawing that shows both a snubber and a battery isolator installed. (Both are not needed.) The alternator is hooked to the batteries through the isolator and directly to the heavy cables going to the batteries. No matter what position the switch is in (even off) the alternator is still electrically connected to the batteries. Now you can cancel your appointment with your psychologist.

Not only will the isolator protect the alternator, but it will allow both batteries to be charged at the same time. This eliminates the necessity of switching from one battery to the other for charging purposes. Also, the battery that is the lowest will take the most current until it is equal to the other battery. One disadvantage is that you lose about 0.6 volts across the isolator. This can result in improperly charged batteries, if the correct regulator is not used. (Please see our earlier articles on proper battery charging.) Other complications can occur with isolators, but most applications are straight-forward. If you install one yourself, follow the directions carefully.

The snubber is the simplest and least expensive way to protect your alternator. The isolator is more expensive to install and can have some complications, but in many cases the advantages outweigh the drawbacks. The use of either will greatly reduce anxieties and the number of visits to your psychologist.