MARINE BATTERY CARE AND MAINTENANCE

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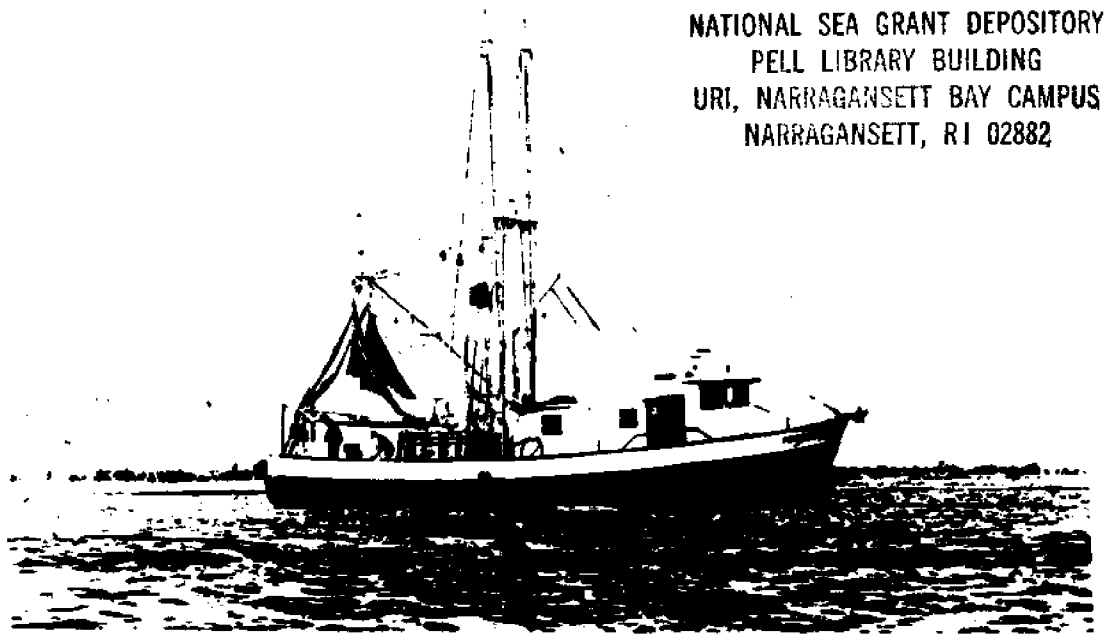

Louisiana Sea Grant College Program

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February 1988

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Many marine batteries die before their time. Some are "murdered" before they start their first motor. Here is what typically happens. The battery's owner fills the battery with tap water, attaches a carrying strap to the terminal, and lugs the battery into the boat's engine room. This is a hard job so he is a bit irritated, especially when the cable terminal won't quite fit. But a few raps with a 12" crescent wrench make it seat on the post. Then he uses the crescent wrench again to get the terminal good and tight, but he notices that the bolt turns a little at the end. Knowing how important a tight connection is, the owner grabs the terminal and tries to twist it. He can barely turn it, so he decides that it is tight and that any corrosion build-up will have been cleaned off by the final turning.

Do these procedures sound familiar? Many boat owners have been guilty of all of them at one time or another, and have had to replace quite a few batteries. It may be that they killed their batteries. Let's take a look at how and why.

Installation: Common Mistakes

Water. The first error was when the battery was filled with tap water. City water usually contains chlorine which destroys a battery. Even well water or city water without chlorine contains minerals such as iron, which will greatly shorten the life of a battery. The only kind of water that should be used to fill a battery is distilled water. Don't make the mistake of being "penny wise and pound foolish." Distilled water is cheap and the battery should not require much.

Actually, before water is put into the battery, you should ensure that the battery does not discharge because of conductive paths on its case. This is done by thoroughly cleaning the battery's case with a solution of baking soda and water, a procedure that is easier if there is no water in the battery. When you clean the battery, be very careful that you do not get any of this solution into the battery itself. The cleaning is followed by rinsing with distilled water and then, after allowing the battery case to dry, spraying it with three or four coats of a clear acrylic paint. The acrylic coating prevents an accumulation of moisture, which could provide a conductive path between the terminals of the batteries. A conductive path causes the battery to discharge and could also lead to electrolysis because of a difference in potential along the battery case. Cleaning and sealing should be done for new batteries as well as for older ones that have been in service. Even though the new batteries with plastic cases are quite good, they may still offer small leakage paths, particularly in a marine environment. For this reason, cleaning and sealing with acrylic are recommended for all batteries, even a new one.

Terminals. The next potentially fatal mistake was using a carrying strap that attached to the battery terminal. The terminal attaches to the battery plate and must have a good connection. It is vulnerable to damage and the stress caused by carrying the battery by the terminal can severely damage or destroy a battery. Use a battery carrier that clamps to the side.

The next mistakes were seating the terminal with a crescent wrench, tightening it with only one wrench, and twisting the terminal to see if it was tight. All of these can

damage the connection between terminal and plate and can destroy the seal around the terminal. If the seal is destroyed, it allows gases to escape which will promote corrosion at the terminal. Incidentally, the pads that fit on battery terminals absorb and neutralize the gases and thus prevent corrosion.

The correct procedure is to open the cable terminal wide enough to slip it on, then tighten it using two wrenches to prevent twisting the battery terminal. It is a good idea to use anticorrosive pads.

Battery Care

Temperature. The battery will probably be in a battery box. Plastic, perhaps with a fiberglass bottom, is the preferred material for the box because of its nonconductivity and its resistance to corrosion by electrolysis. However, many battery boxes are built of metal. In both cases, there should be sufficient space around the battery so that it can dissipate the heat that it generates internally. It is important that there is some space for air movement so that the battery will not overheat.

Air space can be provided by using plastic strips about 1/2" thick on the bottom and sides of the battery case. If it is a metal case, this will also isolate the battery from the metal and tend to reduce discharge or electrolysis damage to the metal. In addition, the strips can be chosen so that the battery is held firmly in the box, preventing movement and subsequent damage to the battery. The battery will last longer if it does not reach 100-110°F. One contribution to high temperature is radiant heat from an engine, which can be reduced by a heat shield placed between the battery and the source of heat. It is important that the battery be properly vented and, if possible, that a source of cool air be provided. When the battery is charging or when it is at an elevated temperature, it emits hydrogen gases which can explode. The explosion of the Hindenburg in the 1930s was caused by hydrogen gas, and similar accidents have happened on fishing boats.

For example, a captain comes in after several days of fishing, docks his boat, and turns off the engine. The battery, which has been under a charge in a hot engine room, is giving off hydrogen. When the engine stops for fueling, the ventilation fan also stops. The gas has accumulated at the top of the cabin where rafters trap the hydrogen in a closed area. After a few minutes, the captain decides to use his radio. There is a relay in the area where the hydrogen gases have accumulated, and when the captain presses the microphone button, the cabin explodes.

Power. Once the battery is secure in its battery box, the next thing you must consider is getting the power from the battery to the starter. In mass automotive production, a few cents saved by shortening a cable adds up to a great deal of money. Therefore, the battery is usually grounded to a convenient spot close to the battery--most often part of the engine block. This can present problems. One, the connection between the cable and the block, if not tight, presents resistance to the flow of electricity. Another problem is that the engine block is made of cast iron which is not a good conductor of electricity. The resistance does not have to be great, as the starter may pull a current of several hundred amps.

Suppose, for example, that a resistance of .02 ohms existed on the negative side of the battery and a current flow of 100 amps was required. One hundred amps times .02 ohms would give a 2-volt drop between the negative terminal of the battery and the starter. Thus, a 12-volt battery would actually be working at only 10 volts. For the same power, the starter would need at least the same value for the product of the voltage and the current.

Thus, the lower voltage would require an additional 25 amps to provide the same power to the starter. When this voltage drop is coupled with a possible voltage drop in the positive side of the circuit, a sluggish response and a high-amp draw on the battery can result.

These conditions are much harder on the starter as the higher currents cause it to operate less efficiently and to generate much more heat. One solution is to eliminate as many of the resistance points as possible. A way of doing this is to run the negative cable directly from the battery to the starter instead of using the engine block as a connector between the cable and the starter. Not only does this reduce the possibility of heavier battery draw and slower starting, but it also reduces the possibility of electrolysis caused by stray voltages which can occur with voltage drops of this type. Drops of 2 or 3 volts between the battery and the starter on each side are not uncommon. In light of this, it is very important that we have efficient connections and high-capacity cables.

You may want to increase the size of your starting cable. In some cases you may even want to double up, particularly if you will be starting in cold weather. The use of large, high-capacity cables along with a direct battery-to-starter connection for the ground terminal should result in faster starts. In addition, the cables should be flexible since the cable will move with the motion of your boat. A stiff cable can break.

Voltage Regulator. One other thing should be considered to extend the lifetime of your battery. Make sure that the voltage regulator is set correctly, as overcharging causes premature failure. One sign of this is a rapid gassing of the battery or a boiling condition. The charging voltage should be no more than 1.1 times the nominal battery voltage. For example, 13.2 volts is adequate for a 12-volt battery.

Alternator. Another part of the battery starting system often taken for granted is the alternator. Automotive alternators are cheap, but they are made to develop their output at a higher rpm than usual for diesel engines. This can lead to discharged batteries, particularly if the fishing method used requires frequent starting and stopping of the engine and much idling or running at a slow speed. One way of overcoming this is by the use of large high-capacity alternators that have sufficient capacity to keep the batteries charged, even when operating at low speeds and greatly reduced capacity. A cheaper method is to increase the speed of the alternator by changing its pulley for a smaller one. The smaller pulley increases the rpm of the alternator as well as its output.

The amount of current put out by the alternator is small compared with the current the starter uses. However, since the alternator is putting out current for a longer time, it is still important to pay attention to the wires and electrical connections. While the wire from the alternator does not need to be as large as the starter cables, it should still be sized carefully to be sure that it is adequate. Connections are also important because voltage drops can be severe if the connections are poor. Not only will this reduce the alternator's ability to charge the battery but it will cause electrolysis and corrosion. Corrosion can be severe even if only a fraction of a voltage drop occurs because of the long times of operation.

Another area where poor connections are common is the ground side of the alternator. Commonly, the ground is from the alternator case to the engine block through the belt-adjusting bracket. A preferable method is to ground the alternator directly to the negative terminal of the battery. Some alternators are even equipped with a ground terminal that makes this method easy.

By taking care of your battery, you can make it last longer and prevent other problems such as corrosion from electrolysis. Corrosion is a particularly important problem in the marine environment.

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