PROLONGING THE USEFUL LIFE OF A LEAD-ACID BATTERY

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Part One

Very few lead-acid batteries are replaced because they stop working, in almost every case the battery is replaced because it doesn't work well enough any more. What is not generally realised is that something can be done at this stage which may well prolong the useful life of the battery—quite often by many years, and that the same treatment carried out earlier may well have stopped the symptoms from occurring in the first place.

To understand what can be done requires a simple appreciation of how a battery works. All lead-acid batteries are a series of cells, the most common is the 12 volt battery which is simply six cells in series. Each cell consists of a plate of lead and a supported plate of lead (IV) oxide, both immersed in fairly concentrated sulphuric acid. The lead (IV) oxide plate is the positive pole, the lead plate is the negative pole. As the battery discharges, electrons flow from the negative to the positive pole; when we charge the battery, we simply drive electrons back in the opposite direction.

The reason for a battery failing to work properly any more is due to the chemical processes which take place within each cell. As the battery discharges, the positive plate can react with the sulphuric acid to produce some lead ions. The negative plate on dissolving can also form lead ions in the process which finally leads to the battery's complete failure. It is the lead ions which are incidentally formed in the discharge cycle which cause problems. They combine with sulphate ions in the sulphuric acid to form highly insoluble lead sulphate. When this coats the plates of the battery, it fails to deliver enough power to be of use. The battery may well be thoroughly serviceable in every other way - only the "sulphating" stops the battery delivering enough power to be useful.

The sulphating can effectively be removed, or prevented, by adding to each cell a chemical called tetrasodium ethylenediaminetetra-acetate (often abbreviated to tetrasodium EDTA or just "EDTA"). This chemical forms co-ordination compounds with many metal ions, including the lead ions formed in the discharge cycle of a battery. The compound formed by lead ions and EDTA ions is not particularly stable in the acid medium of a battery, but when it breaks down again any lead sulphate regenerated drops to the bottom of the cell where it lays harmlessly since it doesn't conduct electricity. Any regenerated EDTA ions are free to continue their work.

As can be seen from above, treating a battery with "EDTA" is likely to be most effective when the battery, for one reason or another, spends periods when it is not fully charged, and so contains too many lead ions. This is likely to occur if it is used for just short trips, is infrequently used, or suffers from an inefficient charging system.

To treat a battery with "EDTA" you simply add the powder to each cell - the exact amount is not critical, but an average size car battery needs about one heaped tablespoon, and smaller batteries proportionately less. After addition of the powder, the battery needs some form of agitation for a day or two (just using it normally is sufficient), and then a thorough charge to build up on the cleaned plate areas. On the assumption that sulphating has been affecting the performance of the battery, an increased performance will be noted from here on.

If you cannot track down any "EDTA" locally, I can provide you with enough to treat two average size motor-cycle batteries for £1.50, inclusive of postage, packing and instructions. My address is: K.L. Martin, 19 Brookmead, Meppershall, Shefford, Bedfordshire SG17 5SA. [Mr. Martin is not a Club member and sent this article unsolicited. I would be interested to hear from any member who tries EDTA-Ed.]

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Part Two

The electrolyte in a battery is sulphuric acid at a concentration about midway between the dilute and concentrated acids which you may have met when at school. As such, you have to take care when handling it. The one thing you must never do is get the acid in contact with your eyes. Don't peer into a cell if you are charging the battery with the caps off, the spray from the fizzing can get into your eyes and will cause permanent damage if it does. Remember that the gases given off during charging constitute an explosive mixture—if they are as much as sparked by even static electricity the explosion which occurs can splash acid out of the battery all over your face. If you think that there is ever any possibility of the acid getting into your eyes then wear goggles whilst you work close to, or with, your battery or its acid.

Battery acid spilled on you or your clothes will cause burns if left for very long - the treatment for acid spillages wherever they occur is always the same - wash down with large amounts of cold water. Beware of where you keep old or new
batteries - think of what could happen if one were to fall off a high shelf, split and deposit acid all over the garage and you.

If you store battery acid, do so in only glass or thick polythene screw-topped containers, leaving a space for air at the top. Label the containers permanently, keep them out of the reach of children and store where they can't fall and nothing can fall on them. All this should also apply to batteries.

By far the most common problem which people seem to encounter is what to do with a battery during a period of inactivity; or if it is superfluous to needs, what needs to be done to store it for future use. If you can't get into the habit of charging it regularly and often, it must be stored dry and the following procedure can be adopted. Firstly, the electrolyte must be carefully removed from the battery. The simplest way of removing it is to take off the cell caps, turn the battery on its side with the terminals uppermost, and then completely upside down, over a polythene bowl. Never do this over a metal container, the acid may react with it - the battery also still works at this stage and any dead short across the terminals may well burn a hole through the container. The electrolyte will probably be re-usable, even if it looks dirty, so if it is caught in a bowl it can be kept for future use and should be stored as described above.

After the battery has been emptied, it should be washed out with copious amounts of cold water. Don't stint on this, keep filling and tipping out until the last trace of sediment emerges. If you don't remove all of the acid at this stage, it will cling to the plates and coat them with lead sulphate, leading to all the familiar problems associated with sulphating. Store the battery on its side with the cell caps removed.

When the battery is to be used again, the acid can simply be poured back in, followed by recharge. Before that, the plates can be cleaned of any sulphate deposits which may have built up during its working life by using the chemical tetrasodium EDTA which I mentioned in my previous article. Divide about a third of a tablespoon of the powder between each cell and then top up with warm water. "EDTA" works slowly in battery acid, but extremely quickly in neutral or alkaline solutions, so only leave the "EDTA" solution in the battery for an hour or so, shaking it occasionally, and then remove and wash out well with water. After the "EDTA" treatment, put the acid back in and recharge. If you are short of electrolyte you shouldn't be if it was drained properly - get a little from your local battery supplier. If he won't co-operate, ask a local chemicals supplier if he will make you up a little 4 M (8 N) sulphuric acid (one part concentrated sulphuric acid to four and a half parts water).

Batteries which are completely dead, or more commonly have one dead cell, can often be rescued, depending on how and why they failed. Checking the voltage may not tell you very much - a reading in the range of 13 or 14 volts is nearly always obtained. [This, presumably, applies to 12 volt batteries-Ed.] Testing the specific gravity with a hydrometer can also be misleading, different manufacturers use slightly differing acid concentrations and so interpreting readings can be a problem. As a rough and ready guide, a battery which suddenly and spectacularly failed, or fails to start a vehicle after a long static charge, might as well be thrown away. Those most likely to be resurrected are ones which were in good condition, but have stood neglected for some time. These need the electrolyte removing and a treatment with 'EDTA' as described above. In one, albeit spectacular, case, someone recently returned to use a battery which was 14 years old and had laid out of use for 10 years!

Distilled water is not strictly necessary for topping up and it certainly isn't worth the cost if you have to buy it. If you have a refrigerator or a freezer, you can collect the frost that forms due to condensation of water vapour in the air and use that. Failing that, you can use tap water which has been boiled and allowed to cool, but it is better to prepare yourself a topping up solution. To do this, put a very small amount of the tetrasodium salt of EDTA in a jug and add some hot water, allow it to cool and carefully decant the water off, leaving behind any sediment which might fall to the bottom. Preparing yourself a topping-up solution like this is far more economical than continually buying distilled water for batteries and has the advantage over distilled water in that the solution you are adding has something in it to prevent sulphation of battery plates.

Finally, I am very happy to try and answer any queries which you may have about batteries, but please can you include a stamped addressed envelope? My address is, as before, K.L. Martin, 19 Brookmead, Meppershall, Shefford, Bedfordshire SG17 5SA.

[The above is a follow-up article to the one which appeared in MPH 465, October 1987 and created a great deal of interest, so I thought you would like to see this one. Mr Martin, a non-member, certainly seems to know his subject. Part One appeared in MPH 465-Ed.]