

1016 NORMANDY CRES., OTTAWA, ONT., K2C 0L4

G'Day eh:

May 10/90

THIS ISSUE: Tech tips for a happy battery, OVLRL celebrates birthday six, updates on local projects, summer trekking plans, a visit to Solihull and Transfer Box grinds to a halt.

HAPPY BIRTHDAY OVLRL. We've set the menu for the sixth anniversary party, scheduled for the June 16-17 weekend at the country home of Mike Dolan near Almonte (see map). It'll be roast pork done on a charcoal pit with roast potatoes, potato salad, green salad, rolls and applesauce. Treasurer Tom Mayor, currently a computer whiz of sorts, has come out of the closet and admitted to being a professional baker for ten years some time ago. Of course, he immediately became responsible for baking the traditional LR cake. We'll serve up coffee but if you're drinking anything else, bring your own.

Activities will get underway around noon Saturday. First up is a demonstration on safe winching practices. We'll discuss different types of winches, related equipment and recovery techniques. Later on, we'll go on a little light off-road jaunt around the forest and do a little nature watching. For members who want to take things a little easier, there's the old swimming hole which doubles as the old fishing hole, complete with stocked trout. We'll also stage a couple our infamous Land Rover "games" before settling into the lawn chairs (be sure to bring yours) to await the barbecue's feast.

After supper we'll cosy up to a campfire and maybe a few marshmallows. If you're planning on staying the night, there's plenty of space for tents. Be sure to bring breakfast. Sunday is an "open" day, with no specific events planned although the backwoods trails might tempt some back for another try.

Price for the weekend is \$10 adults, kids under 12, \$5. A convoy will leave Shoppers City West (Baseline and Woodroffe roads) near the beer store at 10 am sharp. If you're coming separately, see the attached map.

MAY MEETING HIGHLIGHTS. The bad news this month is the demise of Transfer Box, organ of the Association of Land Rover Owners of Canada (ALROC). Difficulties in regular publishing and financial problems are cited as reasons for ending the magazine's 10-year-plus life. In a letter to members last month, ALROC founder and current president Harold Huggins, said the future of the organization will be discussed at the Annual General Meeting later this summer. OVLRL is a chapter member of ALROC. Part of Harold's letter--edited for space--is attached to this package as well as a statement from the organization's treasurer.

IN OTHER NEWS: We now have a nomination committee to look for potential candidates for next year's election. Well, actually, we have half a committee. Elizabeth Johnson has agreed to the task and we need one more volunteer. Please contact Pres Robin ASAP.

The exec is looking at a serious off-road trip in the fall. If you're interested in testing your skills--and your LR's mettle--call editor McD.

Plans continue for OVL'R's journey to the Atlantic British rally in Mechanicville NY July 14 weekend. Plan to take the Friday and Monday for travelling. Full details next newsletter.

McD is co-ordinating our August 25 weekend trip to Picton and a get-together with Toronto's Rover Club of Canada. July's newsletter will have all the poop.

And the exec is looking for suggestions on how to invest some of our money. We're shopping for a fire extinguisher for use at outdoor events like the birthday party and heavy-duty boxes for our off-road, camping and kitchen gear. Any suggestions should go to Prez Robin or the letterhead address.

And Treasurer Tom reports a current bank balance of \$1,567.

Secretary Harry "Pack Rat" Bligh is busy unpacking after moving house from Chesterville to Smiths Falls. Harry and Lady Lyne thank members Bates, Jason and Jerry, Yves and McD for the move which twice filled a large U-Haul truck. Lyne was ready to go with packed boxes. Harry, with his collection of used, nail-infested lumber, toxic waste drums, cracked patio stones, dried up paint cans, dismembered tools, rusted LR parts and hardened bags of cement, seemed unaware of the move at all. Best line of the day: "Harry. Next time you move, call Tricil."

NEWS...RUMOURS...TALL TALES...TRUTHS...FOR SALE...WANTED...SNICKERS

*-Harry Bligh looking for a used "Jackall" jack 1-284-0228

*-Speaking of McD, his 2-1/4 engine rebuild is complete, thanks to mechanic VP Jason. The project will form the basis of a club instructional video which should be available to members later this summer.

*-Joel Harris is slowly amassing the bits for his Series 111 rebuild. He has an 88 military frame, a rear box from Stephane and McD and Jason lined up for welding, mechanical and electrical work. If you're interested in seeing how it's done, work gets underway May 19 at Jason's farm.

*-Glen Massie made the "Letters" column of the April Land Rover Owners magazine with a question on tire sizes and speedos.

*-Bob Wood and Richard Owens contributed \$5 each to the club coffers in towbar rentals.

*-Bernard Sherwin is looking for a 109 station wagon. Overdrive would be nice. 416-889-0851

Still to come in this issue: Photos and story of Richard Owens' visit to Land Rover in Solihull; All you ever wanted to know about batteries but were afraid to ask and Peter Whitworth's list of thingies for sale.

NEXT ISSUE: All kinds of good stuff on winches and how to use them safely to get your hiney out of the goop.

That's all for now;
Editor Mcd 224-8300

Prez Robin 738-7880

VP Jason 731-5098

Treas Tom 234-8611

Sec Harry 1-234-0228

FOR SALE

PARTS REMOVED FROM A 109" FIVE DOOR STATION WAGON (1966)

- GAS TANK in good condition
- AIR FILTER ASSEMBLY
- FRONT AXLE WITH WARN HUBS, STEERING LINKAGE BUT BRAKE BACKPLATES ONLY
- BOTH REAR SIDE DOORS COMPLETE
- LONG ROOF WITH TROPICAL PANEL, EYEBROW, SIDE AND CORNER WINDOWS. COSMETIC DAMAGE TO FRONT OF ROOF AND TROPICAL PANEL.
- BOX (FLOOR, REAR WHEEL ARCHES, SIDE PANELS) IN POOR CONDITION- CENTRE PILLAR (FOR SIDE DOORS, ONE ONLY)
- REAR PASSENGER SEAT UPHOLSTERY (3 ACROSS) IN EXCELLENT CONDITION
- PAIR REAR SIDEWAYS BENCH SEATS FRAMES AND UPHOLSTERY IN EXCELLENT CONDITION
- MISCELLANEOUS TRIM AND OTHER PARTS

WANTED

WOULD SWAP SOME OF ABOVE FOR - FRONT SEAT UPHOLSTERY, IN EXCELLENT CONDITION, FOR SERIES III

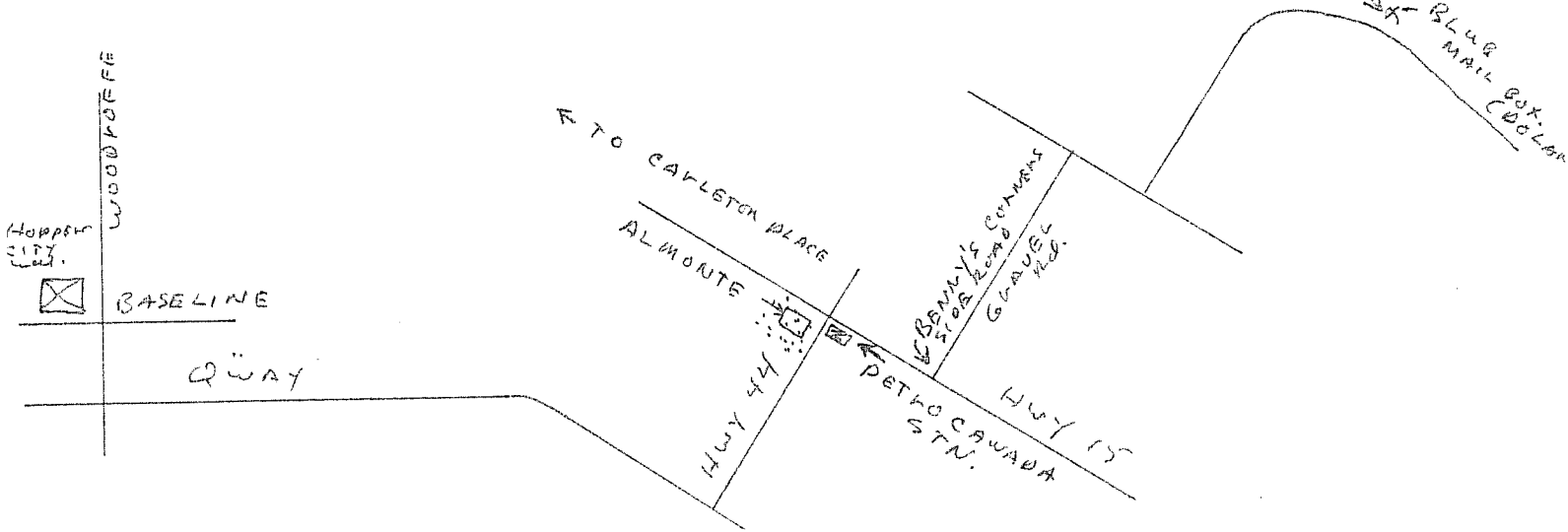
PHONE PETER WHITWORTH OFFICE 990-8413
HOME 692-2270

APRIL 24 1990

DEAR D. V. L. R.
JUST A NOTE TO
THE 'SHEP' OUR NAME TO
IF SEND - OFF, THANKS FOR
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ANNUAL BECOME TRUE FOR
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ENJOYED AND I THOROUGHLY
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OF THE MANK, THE MEMORIES
WITH THE MANK, THE MEMORIES
PLEASE PASS ON OUR
INVOLVED THANKS TO ALL
TO MIKE AND THANKS TO ALL
- IT WILL FOR THE SPECIAL
NEW HONOUR OCCUPY A PLACE
NEIL HOME IN OUR
NEIL, JULIE & ASHLEIGH
BREWER

MIKE DOLAN
LOT 3 CONC. 5
RR 1 PAKENHAM
737-8000

BIRTHDAY PARTY MAP



ALROC

TRANSFER BOX

To: Paid-Up Members and Advertisers

April 10, 1990

It is with no small measure of regret that we announce we are compelled, for reasons beyond our control, to end publication of Transfer Box, the official publication of ALROC, Canada's first and original Land Rover owner group (the newsletter itself being a first in Canada also).

The demise of the publication does not necessarily mean that its parent body must be buried with it. It is our intention to hold the Annual General Meeting of ALROC around mid-year at which time the future of the organization will be a major item on the agenda. Meanwhile, the way is open for those familiar with the habit of command and who feel in need of challenge, to step forward and declare themselves a candidate for the job of running this organization. For, know ye all men by these presents the present incumbent of the office of president will be out of here at the Annual General Meeting next.

Special Notes

1. We are returning with this mailing all funds received here later than 31 January 1990. We thank all those concerned for this expression of their faith in our endeavours.
2. Our mail-box rental contract ran out the end of March. Kindly address all future mail to ALROC at the address given on this letterhead.
3. Please give serious consideration to ALROC's future and plan to attend the Annual General Meeting to be held mid-year; you will be notified well in advance of the meeting details.

With all best wishes and our sincere thanks for your past support and encouragement. Keep the faith!

Sincerely,


Harold C. Huggins

ASSOCIATION LAND ROVER OWNERS OF CANADA
NOTES TO FINANCIAL STATEMENTS
January 31, 1990
(Prepared Without Audit)

Upon discussion with and the direction of the President, I have prepared the foregoing Statements. As a professional accountant, I have advised Mr. Huggins that I do not believe that the Association can continue with its present location and structure.

As the statements indicate, the only liabilities of the Association are to its Officers - principally its president, Mr. Huggins. Regrettably, in spite of his best efforts, this money is probably a write-off to him, and does not even have the advantage of providing any tax relief.

In my view, based upon my short experience with ALROC, it relies upon too small a population base situated, as it is, on the west coast. I believe it should be headquartered in central Canada, and should maintain good liaison and provide commonly needed services to operating clubs across the country, as well as again producing its official organ, Transfer Box after it is properly established. There are many services ranging from technical and promotional through to legal services which a central umbrella organization might provide in support of operating clubs upon request.

It would seem to me that in this day of Regional awareness in Canada, any central organizations would need regional representation in the form of Directors at large whose function would be to maintain liaison with clubs in the region, and to provide input to the central organization.

If any member has any questions concerning data in the financial statements, I would advise that transactional detail is available on my computer, and I would be happy to field any questions addressed to me.

WILLIAM CRASTER
WEST COAST ROAD
R.R.#2, SOGIE, B.C.
V0S 1N0

PHONE:

(604) 646-2382

05 March, 1990

REPORT ON VISIT TO LAND ROVER PLANT IN SOLIHULL, ENGLAND

By Richard Owen

During March this year, my wife and I visited the UK to see family and friends. While we were there we had a rare opportunity to tour the Land Rover facility in Solihull, Warwickshire.

We made arrangements to be at the plant at 10 a.m. on March 22nd and to meet Vincent Hammersley, their Communications Manager. After introducing ourselves and telling Mr. Hammersley the details of our involvement with Land Rovers, including OVL, we were taken into the final assembly area for Land Rovers and the new Discovery. The floor of this huge area is painted blue and is known as "the blue lagoon". Here we saw a completed Discovery chassis being mated with a body. The Discovery chassis looks very similar to the Range Rover, with a 3.5 litre engine and permanent four wheel drive.

We then moved on to the Land Rover assembly lines. The most noticeable aspect about these lines is the variety of vehicles being assembled. Customer requirements from all over the world, which include various different bodies and chassis, are brought together on just a few assembly lines, creating, I imagine, some very interesting problems in inventory control and scheduling.

After looking enviously at some of the gleaming new vehicles being driven outside, we were taken on an out-of-doors tour of the facility in a Range Rover. One of the first things we saw was a line-up of about ten Discoveries painted in the colours for this year's Camel Trophy expedition, along with a number of Land Rovers painted in the same colours to be used as support vehicles. This year's expedition, I believe, is to be undertaken in the Soviet Union.

Next, we saw the outside of various facilities such as the Range Rover assembly line, before being taken on the test track. We were warned that we may see our breakfast again, so we hung on tight. The first stage of the test track is known as the jungle track, with lots of water and deep ruts. We then went up the forty-five degree incline, which is not as bad as coming down it. From the top, we had a good view of the whole facility which covers about three hundred acres and employs about 10,500 people. The test track continued with the log road, the stepped hills and various other obstacles which left us, if not the Range Rover, pretty battered. On our way back to the main building, we saw a proud and battle-scarred survivor of last year's Camel Cup, held in South America.

Following the test track experience, we were showered with Land Rover memorabilia, and given a few statistics and facts to boggle at, e.g.:

- the only two countries Land Rover has never sold to are Albania and North Vietnam.
- seventy per cent of all Land Rovers produced are still "alive" (I'm sure members of OVL can believe that).

But most amazing of all is this:

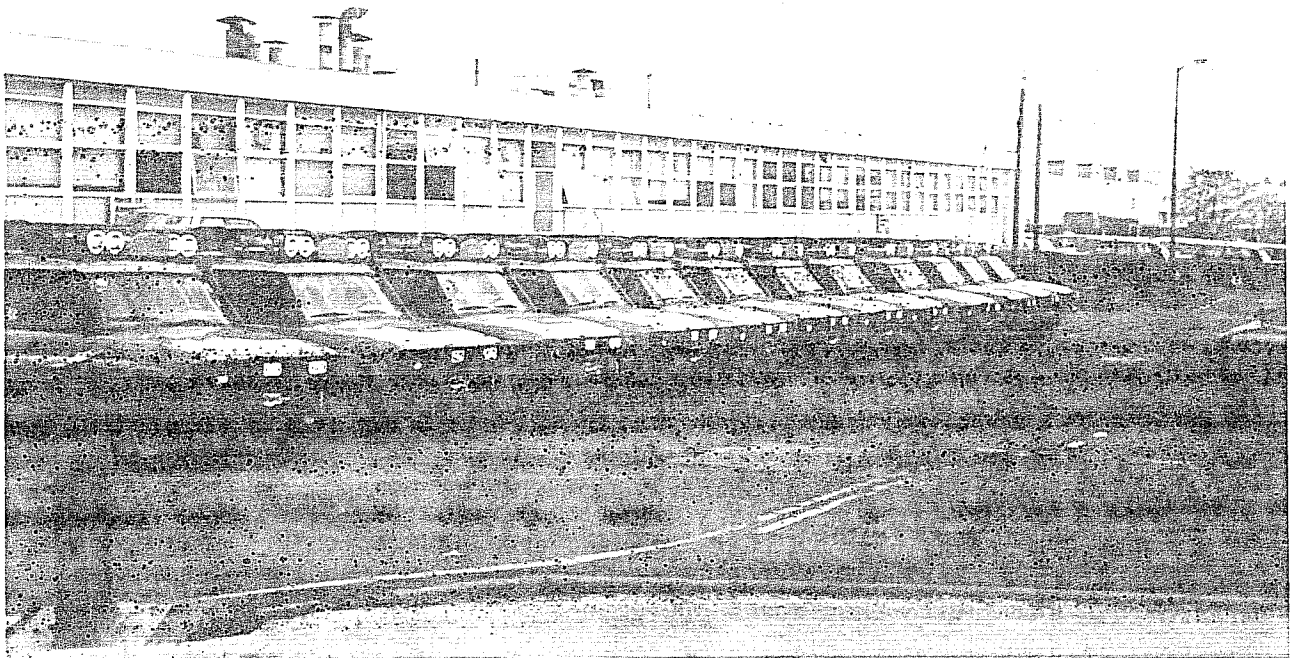
- the first vehicle that twenty per cent of the world's population ever saw was probably a Land Rover. (Don't ask how they came up with that one - the "probably" covers a lot.)

In conclusion, I have to thank Land Rover, and particularly Vincent Hammersley, for their hospitality in consenting to give my wife, Pat, and myself this insight to Land Rover operations, and I hope that the name of Ottawa Valley Land Rovers will be remembered by the people at the plant.

We wish Land Rover all the best for the future.



Ninety gets the final touches near the end of assembly line at Solihull



New Discoveries are fitted for the Great Britain and Ireland Motor Vehicle

Battery Basics

All the battery stuff you were wondering about

By Rich Johnson

LIFE USED TO BE SIMPLER. Once upon a time, you could just wander into your local auto supply emporium and pick out whatever kind of battery would fit the tray. No problem. Then came progress, and right behind progress came complication. Now, you actually have to know something in order to make the proper selection of such a simple thing as an automotive battery.

Not only that, but there are now various levels of maintenance requirements for batteries. Some make no pretense about relieving the owner of routine maintenance; others claim to be maintenance-free. A few fall in between. All together, it adds up to a bit of confusion for the consumer, especially if he or she is a do-it-yourselfer when it comes to routine automotive maintenance.

Automotive batteries are a fairly misunderstood electrical component, especially with the advent of the "maintenance-free" battery. The duties of an automotive battery cover four functions. First, it must supply the initial power to start the

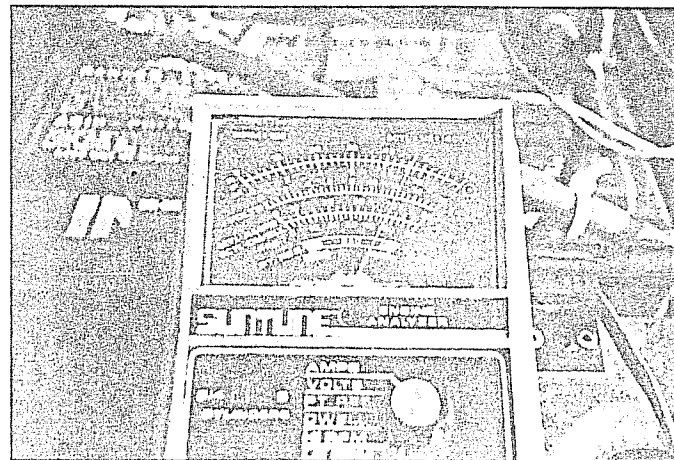
engine. Secondly, it supplies power to accessories when the engine is not running (for example, operating a winch when the engine cannot be turned on). Its third function is to supply additional power to the electrical system when demand exceeds alternator output; an example of this would be when the engine is operating at idle and several accessories are placing a heavy load on the system. (Imagine crawling along a trail at night with the powerful driving lights turned on, but the engine barely turning over at an idle.) Finally, it acts as a buffer in the electrical system to absorb volt-

age spikes and surges, and to stabilize the system-charging voltage while the engine is running.

Understanding the chemical process of an automotive battery is less important than knowing what kind of battery we need, how to use it and maintain it properly, and how to test it for proper function. So, we're going to ignore all the theory and get right down to the important stuff.

BATTERY RATINGS

First, let's take a look at how batteries are rated. These specifications are important to understand



Sealed batteries can't be tested with a hydrometer, so a voltmeter is used. A digital unit is preferable, but an analog meter will work. A fully charged battery (after the surface charge has been removed) should indicate 12.6 volts at rest.



ILLUSTRATION BY MIKE CUKAR

when shopping for a new battery, otherwise it would be difficult to make a fair comparison. These numbers relate to test procedures that have been used in the past and are still currently used to rate a battery's performance and durability.

Ampere hours is an obsolete test procedure that has been replaced by the following two procedures. Nevertheless, you may run into this term. Ampere hours is a measurement of the current-delivering capability of a battery. The rating is in amps for a given period of time (usually 20 hours). To arrive at an Ampere Hour Rating, simply multiply the amperes by the length of time in hours. For example: 5 amperes for 20 hours = 100 ampere hours.

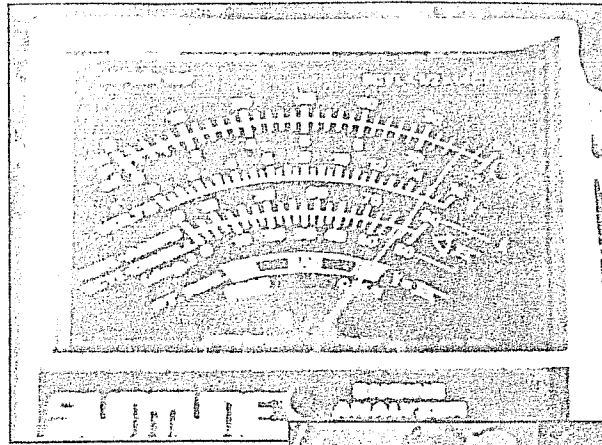
Cold cranking amps (CCA) is a measurement of the battery's capability to deliver high current (in amps) under extremely cold conditions. Testing is conducted with the electrolyte in the center cell of the battery at a temperature of zero degrees F. While maintaining voltage at the terminal posts of 7.2 volts, current is drawn from the battery for 30 seconds. The CCA rating for the battery is equal to whatever the current is during those 30 seconds.

Although this is an excellent dynamic test for a cranking battery's capability in cold climates, in hot climates a high CCA rating can actually shorten battery life because of higher ambient temperatures. Therefore, it is important to select the right battery for your region.

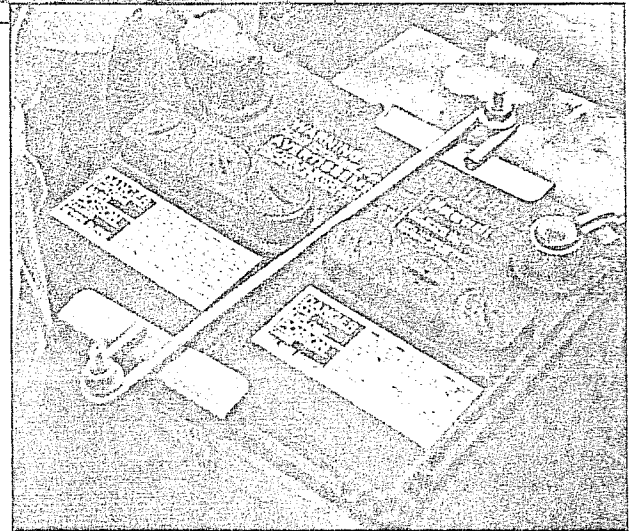
Reserve capacity (RC) is often referred to as a battery's "staying power." It is the measurement of the battery's ability to supply power to the vehicle's electrical system without the charging system in operation.

For example, the alternator fails or the fanbelt breaks. It is a dark and rainy night and there are still five miles to go before you get home. Will the battery have enough power to supply the ignition system, the headlights and the windshield wipers long enough? That's reserve capacity. The way reserve capacity is tested determines the battery's ability to deliver 25 amps of current without falling below 10.5 volts at the terminals. The RC rating relates to the amount of time the battery can do this, measured in minutes. The higher the reserve capacity, the better.

Deep cycling refers to a battery's



To protect the battery from vibration damage, a solid battery tie-down should be used. Vibration can dislodge active material from the plates.



To check the charging system to see if it's providing enough voltage to the battery, start the engine and connect the voltmeter to the battery terminals. Charging voltage should be between 14.4 and 15.0 volts.

ability to endure repeated discharge/recharge cycles and still deliver performance standards established by the Society for Automotive Engineers (SAE). The results of the test indicate how many times the battery can go through the cycle and still hold an adequate charge after recharging. Deep cycling, which is a complex procedure that is affected by several factors requiring that it be performed only under strict laboratory conditions, is the most stressful dynamic test that is performed on a battery, but it gives the best overall indication of severe-condition performance.

BATTERY SELECTION

If the area where you live has seasonal extreme high or low temperatures, check with your battery dealer before you plunk down your money. In cold areas, the higher the CCA rating, the better, but in hot areas, a high CCA rating can lead to a short battery life. Generally, however, when you replace a battery that has provided relatively good service and a long life, it's not a bad idea to stick with the same type and rating of battery. If your luck has been good with the

old battery, the rule of thumb is to replace it with a new battery of equal CCA and equal or greater RC.

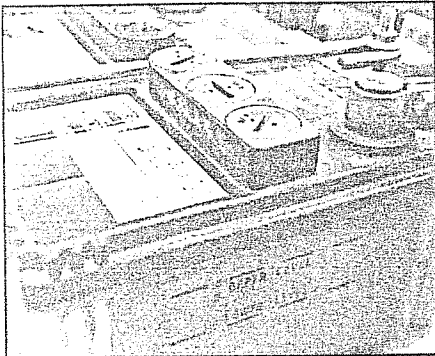
For starting an engine, a standard automotive cranking battery is best. A deep-cycle marine or RV battery is designed for applications that call for deep discharge and frequent/repeated recharge. These batteries are less than ideal for starting a cold engine on a chilly morning.

Different types of batteries have their own characteristics, based upon the different materials used to make up the plate grids in the battery cells.

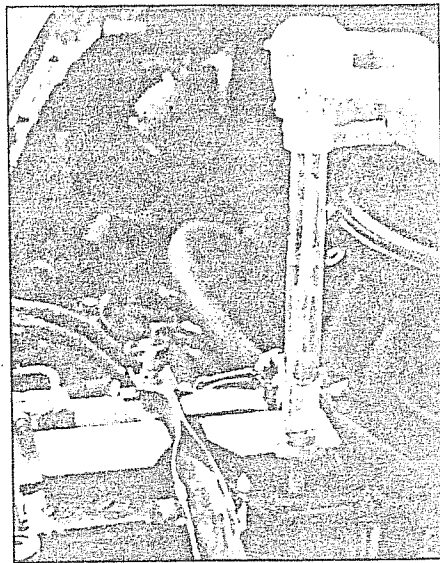
In the beginning of the automotive era, the lead-acid battery was the original automotive battery. The makeup of the grids employs a high percentage of antimony to provide strength. There are both pros and cons to the characteristics of high-antimony batteries. On the plus side, they are well suited for deep cycling, they deliver a high CCA rating and offer excellent recycling characteristics.

On the down side, they gas heavily during a charge cycle, they consume a lot of water and they develop a relatively high level of

Battery Basics



When the water level is low in a cell, nothing except distilled water should be used to top it off. Note the "high" and "low" electrolyte level marks on the side of this battery. Still, check each cell individually for water level.



Maintenance-type batteries with removable caps that allow water to be added are checked for state of charge by using a hydrometer. Each cell must be checked to detect any defective cells.

corrosion at the terminals. This results in a relatively short life due to a tendency to self-discharge. In addition, they are adversely affected by high ambient temperatures.

Both antimony and calcium are used in the grids of low-maintenance batteries, which are also known as dual-alloy batteries. These units require little or no maintenance during normal operation, and they gas less during the charge cycle, resulting in less water consumption. Normally, these batteries have removable filler caps that permit the owner to check the water level and add distilled water if necessary. Under normal operating conditions, these batteries are capable of going about 125,000 miles before any water needs to be added. Low-maintenance batteries exhibit excellent deep cycling characteristics. Because these batteries can handle large charge currents over a long period and serve as an excellent voltage buffer even when fully charged, they are ideal for cars with sensitive electronic equipment on board. Moderate shelf life is the main disadvantage to the low-maintenance battery. If it sits idle for a long period of time, it must be monitored, and water may need to be added due to gassing during the charge cycle or after enduring a long period of severe service.

A few years ago, "maintenance-free" batteries emerged. The early versions usually used a calcium/calcium grid design that did away with

the addition of distilled water during their life under normal operating conditions. (Life can be as much as 250,000 miles.) The drawback to these batteries is that water cannot be added should the battery be subjected to heavy use, nor do these batteries fare well under repeated deep discharge cycles (winching, for

example).

When severely discharged, these batteries require a much higher voltage than the other types to recharge to full capacity. In order to do this, the typical charging system generates a little more heat that could adversely affect sensitive electronic/computer equipment.

Another "maintenance-free" battery on the market adds a new twist: the sealed gelled electrolyte lead-acid battery. Marketed as Sealed System batteries by Faradane Inc. (Dept. OR, 5202 Oceanus Dr., Huntington Beach, CA 92649, 714/891-1331), these new batteries use electrolyte immobilized in a gelling agent so sulfuric acid can't splash or spill should the battery be turned over. (These batteries can actually be mounted upside-down, if needed.) Another unusual property allows it to operate unimpaired should it be temporarily immersed, such as during deep-water fording.

According to Faradane, this type of battery handles deep discharging and recovery with equal aplomb because of special, high-strength glass mat separators that prevent the loss of the active ingredients on the plate surfaces, a problem com-

FACTORS THAT ARE DEADLY TO A BATTERY

Batteries have eight deadly enemies. You can establish a line of defense for most of them, even though there isn't always a procedure you can follow to protect against all of these battery killers. At least you can be aware of them.

Sediment: Accumulations of sediment beneath the cells of the battery can short out the cells, ruining the battery. The only way you can prevent sediment from accumulating is by never putting anything other than distilled water in the cells.

Freezing: To prevent freezing, it's critical to keep the battery fully charged during cold season. Freezing can result in a broken battery case and leakage of electrolyte. Frozen electrolyte dislodges active material from the plates. If the battery freezes, slowly thaw it before attempting to recharge.

Overheating: Chemical action in the electrolyte increases when the temperature of the liquid reaches 125 degrees F. This results in increased plate corrosion and decreased battery life. Overheated plates can buckle and become structurally weak.

Sulfation: A battery that's permitted to remain discharged over a long period of time tends to accumulate hardened lead sulfate on the plates. This prevents the battery from recharging or holding a charge. The way to avoid this is to maintain the battery at full charge at all times.

Corrosion: A buildup of corrosion on the battery terminals or cables can cause battery drain because the charge will gradually be conducted away by the corrosive material.

Low electrolyte level: When the upper surface of the battery's plates are exposed to the atmosphere, it allows sulfation to occur more rapidly. Higher than normal internal resistance also results from low electrolyte level, as well as quickened plate deterioration due to high sulfuric acid content. The obvious preventive medicine is to maintain the proper electrolyte level by adding distilled water to each cell as needed.

Overcharging: When a battery is overcharged, water boils out of the electrolyte, leaving a low electrolyte level and high acid concentration. To prevent overcharging, follow the instructions in the section on charging.

Vibration: Vibration of the battery due to improper installation can shake loose the active material from the plates, shortening battery life.

tion to standard batteries.

FACTORS THAT ADVERSELY AFFECT BATTERY PERFORMANCE

Cold temperatures deliver a double-punch to battery performance. On the one hand, cold tends to slow the internal chemical process that produces an electrical charge. For example, at zero degrees F, a fully charged battery can deliver only 40 percent of its capacity. As if that wasn't enough, starting an engine at zero degrees requires twice as much cranking power as it would at 80 degrees. The engine's resistance to cranking increases when engine oil thickens due to cold temperatures.

The state of charge of the battery is especially critical when the temperature plummets. When a battery is nearly discharged, and the ambient temperature is zero degrees, cranking power is reduced to only 1/10th of that delivered by a fully charged battery at 80 degrees.

Maintaining a proper level of electrolyte in the battery is vital to long life and optimum performance. If the upper surfaces of the cells are exposed to the atmosphere, lead sulfate builds quickly. A buildup of sulfate reduces the battery's ability to accept and hold a charge.

In addition to that, a low electrolyte level indicates that the water has boiled out of the cells. This results in a higher-than-normal concentration of sulfuric acid, which then speeds deterioration of the plates.

GENERAL BATTERY MAINTENANCE

Proper installation and maintenance of a battery increases its useful life. Follow this checklist of maintenance procedures to help keep your battery from dying at the wrong moment.

1) Use a hold-down to secure the battery in its tray to prevent vibration-related damage.

2) Maintain the electrolyte level in maintenance-type batteries by inspecting the cells and adding distilled water as needed.

3) Use a wire brush or terminal cleaning tool to maintain the battery terminals and cables in a clean condition by removing the buildup of corrosion. Apply a thin coat of high-temperature grease to exposed cables and terminals to prevent corrosion from forming.

4) Install the battery in a location that doesn't increase heat damage.

For example, don't put it in close proximity to the exhaust manifolds.

5) If the battery is to lay dormant for an extended period of time, periodically monitor it and maintain it in a fully charged condition.

CHARGING

It's difficult to give exact figures regarding how long to charge a battery and at what rate. Charge durations and rates of charge are affected by several factors, including the temperature of the electrolyte, the age of battery, the state of initial charge, the battery's condition and its capacity. With that in mind, these general guidelines will give you a place to start.

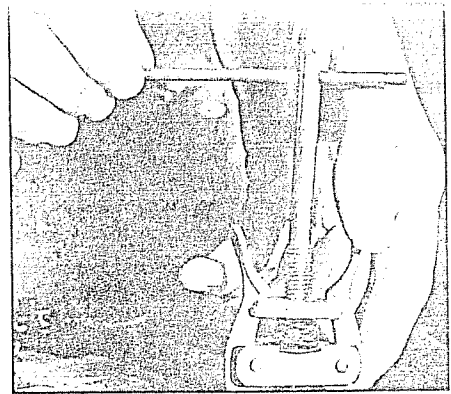
The charging rate for all batteries is determined by the battery's reserve capacity (RC). The accompanying chart will help you determine the charging rate for your battery. If you recharge at the slower rate, the battery life will be prolonged.

With a maintenance-type battery, you can determine when the battery is fully charged by measuring the specific gravity of the electrolyte with a hydrometer. Check each cell to test for any weak or failed cells. A fully charged cell in normal condition should measure a specific gravity of 1.260 to 1.270. Try to measure the state of charge in a battery at normal temperature. If the electrolyte is extremely warm or cold, you will have to compensate for electrolyte readings.

With a maintenance-free battery, it's possible to test the condition of charge by using a voltmeter. A digital voltmeter is best, although an analog unit can be used for a rough determination.

A fully charged battery in good condition will indicate 12.6 volts after the surface charge has been removed. If time is no object, remove the surface charge by allowing the battery to sit at rest for 24 hours after charging. To burn off the surface charge quickly, either turn on the headlights for two to three minutes or disable the ignition spark and crank the starter for 10 to 15 seconds. Then check voltage; it should read 12.6 volts if the battery is charged and in normal condition.

When checking the charging system with the engine running, the voltage between the battery terminals should read in the vicinity of 14.4 volts. Some systems may read a little above or below this, but it



When removing battery cables, use a cable puller to prevent damage to the battery terminals. When installing the cables, don't pound the clamps down on the terminals because this may cause structural damage inside the battery. Simply press the clamps onto the terminals as far as they will go and then tighten.



Inspect the battery terminal posts and cable clamps for any buildup of corrosion that can reduce the battery's ability to conduct electricity through terminals to the cables. Remove the cables and clean corrosion with a wire brush. Baking soda and water is effective at removing corrosion, but you must be careful to prevent the solution from entering the battery cells.

shouldn't exceed 14.4 volts by very much (not over 15.0 volts) or you risk overcharging the battery and boiling the water out of the electrolyte.

When using a battery charger, monitor the charging rate on the battery charger. The battery is fully charged when the rate has stabilized at a low rate for an hour or more. The best type of battery charger is one that has a constant charging voltage but reduces charging current (amps) as the battery becomes fully charged. **OR**

CHARGING RATES

RC (min)	Slow charge (hours @ amps)	Fast charge
80	10 @ 5	2.5 @ 20
80-125	15 @ 5	4.0 @ 20
125-170	20 @ 5	5.0 @ 20