Some thoughts on Batteries for Series Landies.

What battery do you need for your Land Rover? Well, I'm not going to recommend any battery manufacturer, that's a matter of personal choice. Some will be better than others, but that is the natural way of things.

Models of series Land Rovers have both negative AND positive earth charging and operating systems. It is very important to check this, early ones were Positive earth, right through from the series one to Suffix D vehicles of SIIa vintage. From Suffix D, Land Rovers were negative earth.

There are also 24 volt operating systems, but the principals about the batteries will remain the same.

So, what is a battery? Well, thinking laterally, any item which stores energy for using later is a battery… If you wound an alarm clock up, and then set it off, that would be the equivalent of a battery, storage and release of energy. We are more interested in batteries which store electrical power though, and that is what we shall be looking at.

Most batteries used in Land Rovers are what could be described as a galvanic cell, a device which converts chemical energy into electrical energy, which consists of two electrodes (an anode and a cathode) and electrolyte. The Land Rover battery consists of several galvanic cells.

Batteries are electrical **storage** devices. They do not make electricity, they store it for later use. As the chemicals in the battery change, energy is either stored, or released. They aren't 100% efficient though, they lose a bit of energy when recharging, through heat and the chemical reactions. (one reason the battery gasses when charging, due to the chemical reaction going on.)

Batteries are classed in two ways, by the application (what they get used for) and by construction. The major applications are Automotive, marine, and deep cycle (leisure batteries). Main types of construction are flooded (wet), gelled, and Absorbed Glass Mat (AGM). The latter are sometimes known as dry batteries, as the fibreglass matting inside them is only 95% saturated with acid, and there is no excess liquid.

Automotive batteries are sometimes known as S.L.I. batteries. That's 'starting' 'lighting' and 'ignition' to you and me. To start an engine you need a large amount of starting current for a short period of time, and these batteries have a very large number of thin plates for maximum surface area. The plates are composed of lead, similar in look to a very fine sponge, which gives a very large surface area for the chemical reactions needed, but if the battery is deep cycled (repeatedly charged and discharged) the sponge will quickly be consumed and fall to the bottom of the cell. Automotive batteries will generally fail quite quickly if deep cycled, often after 30 to 100 charges, where under normal usage during starting they may last for thousands of cycles (2>5% discharge).

Deep Cycle batteries are designed to be discharged down as much as 80% time and time again, and have much thicker plates, a decent deep cycle battery will have solid lead plates. You *can* use a deep cycle battery for starting, though they have lower cranking amps, and allowance must be made for this. And don't do it too often!

We mentioned plates being consumed… this is the major point of failure for batteries, the positive plate gets eaten away after time, and falls to the bottom of the battery cell as sediment. As a general rule, thicker plates last longer, so the battery with the thickest plates will have the longest life.

Sealed batteries or 'maintenance free' batteries… are not actually sealed, they still need to breathe when charging and discharging so have vents for this. They can lose a large amount of electrolyte if overcharged too many times, and will consequently fail before their time (typically a fortnight after

the warranty ran out.)

Gel Batteries . These contain acid which has been turned into a gel by the addition of silica gel, which turns the electrolyte in to a jelly like substance. The big advantage of these is that it is almost impossible to spill the acid even if they are broken. They do have disadvantages, though, they need to be charged at a lower rate to stop excess gas damaging the cells. They must also be charged at a lower voltage than conventional wet batteries, ion fact, some 2/10ths less. Otherwise if overcharged they form voids within the gel of the battery and the result is lower battery capacity.

Absorbed Glass Mat (A.G.M.) batteries . These are a newer type of battery, and use a Boron silicate glass mat between the plates. They have a lot of advantages over standard wet cell batteries, as they will not leak, even if dropped, and as there is no liquid as such, they won't freeze in winter either. They are sometimes known as dry, or starved, batteries, as the mat is only about 95% wet with acid.

Cold weather and batteries Funny isn't it? The Landy started first time yesterday, but it's freezing now, and it won't even turn over!

Battery capacity (how many amp hours it holds) drops as the temperature goes down. The standard a/h rating for a battery is at room temperature, say about 20>25 degrees C. When the temperature drops, capacity is reduced. At -27 the battery will be at about half its capacity, and at freezing point, it will be reduced by around 20%. It is important to take this into account if you live in very cold climates!

Conversely, battery capacity is increased with higher temperatures! At around 50 degrees C battery capacity would be about 10% higher.

Voltages All lead acid batteries supply about 2.14volts per cell. A fully charged 12v battery would show about 12.6 to 12.8 volts. Batteries that are stored or unused for a long period will eventually lose their charge entirely. By far the biggest killer of batteries though, is being stored or unused in a partially discharged state for a few months. It is important to keep them topped up, by using a trickle charger or similar. Batteries remaining unused and stored at a higher temperature will lose charge even faster.

State of charge. A fully charged battery in good condition will read around 12.7 volts for a 12v battery. The only way to be sure of the state of charge (or discharge!) is to measure the voltage and/or the specific gravity of the acid with a hydrometer. This will not tell you how good the capacity in a/h is though, only a load test will do that. The specific gravity will be around 1.265 per cell for a fully charged battery.

Here are the figures for no load voltages (not using the battery) versus state of charge on a 12v battery

100% 12.7v
90% 12.5v
80% 12.42v
70% 12.32v
60% 12.20v
50% 12.06v
40% 11.9v
30% 11.75v
20% 11.58v
10% 11.31v
0% 10.05v

Again though, this will not tell you the capacity, but is an indication of how charged the battery is. For a 24 volt battery, multiply the figures by 2.

Some extra facts.

Never add acid to the battery except to replace spilled liquid! You should add distilled water or deionised water to top up non sealed wet batteries. They should be topped up AFTER charging, unless the plates are exposed.

As a battery ages, it will require more maintenance, longer charging, more topping up, and its capacity decreases.

When using batteries connected in series as in a 24 volt FFR system the batteries should ideally be the same size, type, and manufacturer if possible. Ideally, you should not replace one battery in a pair if they are more than three months old, but either replace both with new, or use a good known used battery.

The alternator in most series vehicles is charging at a rate of 14.1 to 14.5 volts, approximately double for a 24 volt system.

Batteries can…..

Explode. Charging a battery releases hydrogen which is explosive and the least spark can cause the battery to explode!! Ventilate well.

Burn. Metal jewellery, watchstraps, rings, tools or wires can get red hot instantly if batteries short-circuit. Be very careful around the terminals, and disconnect the earthed (negative) lead first.

Corrode. The sulphuric acid will severely injure eyes or any skin it contacts with. Never tip or drain a battery, and take good care to avoid contact with the acid.

Poison. Both the acid and the lead are toxic, and a battery must be treated as hazardous waste. Don't just bung it in a skip or bin, get rid of dead batteries at an approved battery disposal site.

Injure you when lifting. They are heavy and often awkwardly placed and hard to grip. Take great care lifting and putting down – dropping one is a **serious hazard**.

Damage the vehicle. Make sure the battery and the leads are never fitted the wrong way round. Check to see if the system is negative or positive earth! Make sure you secure the battery properly, without over-tightening the clamps. A non secured battery is dangerous, and can make you fail an MOT.

Finally!

What battery do I want in my Landy? Well, a high as possible amp hour… The Land Rover recommendations are:-

For a petrol 2.25, 58 amp hour
For a diesel 2.25, 95 amp hour.
For 2.6 6 Cylinder (straight six) 58 amp hour
and,
For a V8, 60 amp hour. (V8 24V is 57 amp hour)

Again though, these are minimum figures. Nothing wrong with having a higher amp hour battery!