BATTERY CHARGING AND VOLTAGES

(12 volt system)

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THE DISCHARGING AND CHARGING PROCESSES

Charge and discharge of lead acid batteries is a chemical process.

Discharge
A chemical action within the battery causes a voltage difference between the positive and negative sides of the battery. In a typical automotive battery with 6 cells, this will be a nominal voltage of twelve volts (2 volts per cell).

If an electrical load is placed across the battery, such as lights, etc., an electric current will flow and a gradual change will take place within the battery as a result of the chemical action occurring there. This action is 'discharging' the battery. From the moment this action begins, the voltage between the positive and negative sides of the battery begins to reduce.

Charging
To replace the charge lost while an electrical load was drawing power from the battery, the chemical action must be reversed. To do this a current flow is introduced to the battery in the opposite direction to the current flow that discharged the battery. The voltage put across the battery to achieve this is typically in the region of 14 volts for a twelve volt battery.

Soon after this charging process begins the voltage at the battery terminals (known as the 'terminal voltage') can be measured as something in the region of 13 to 14.5 volts, depending on the type of charger and how far discharged the battery was.

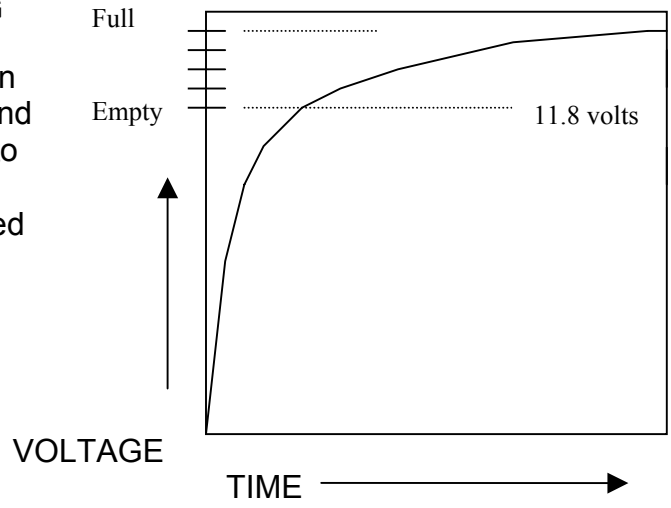
If at this time we look at our voltmeter and see that it is reading 14 volts we might assume that the battery is fully charged (because after all it's only a 12 volt battery and it's now showing much more than 12 volts). This is an incorrect assumption and is a common mistake. In order to replace the 'charge' that was taken from the battery we must reverse the chemical process. The discharge process took quite a long time and the recharge process also takes time. The length of time depends on the design of the charging system used. We need to keep that higher 'charging voltage' on the battery for quite a long time while the internal chemical process slowly achieves the recharging of the battery.

Even when we remove the charging voltage from the battery, we can expect to read a rather high voltage (known as a surface charge) across the battery for an hour or two. To get an accurate reading of the state of charge of our battery we need to check the voltage a couple of hours after the battery charging process has stopped.

I get concerned boat owners calling to say that something must be wrong because they have just charged their battery and at the time they stopped charging, the battery voltage was over 13 volts. But with most electrical equipment switched off, within an hour it has dropped way down and is now only about 12.5 volts. Something must be seriously wrong. In fact nothing is wrong. Every lead acid battery will do this. The full charge voltage is about 12.6 volts. Anything above that is either a charging voltage or a temporary surface charge.

LEAD ACID BATTERY CHARGING

This charge graph gives an indication of how long it takes to get the final and most important part of the charge into the battery using a charging system with a fixed voltage regulator (as used In most standard alternators)



When the battery is on charge the voltmeter reading should rise to approximately 14.2 – 14.5volts.This may take a few minutes but should not take more than 30 minutes.The battery should be kept on charge at this voltage for at least one hour. If you don't have a smart regulator in the charging system it will probably take much longer than this to fully recharge a battery. The actual time depends on the state of discharge and design of the charging system.

LEAD ACID BATTERY VOLTAGES

The longest battery life will be achieved if the batteries are always fully charged. Every discharge cycle reduces the life of the battery. Long discharge cycles reduce battery life more than short discharge cycles. Deep discharge cycles reduce battery life more than shallow discharge cycles.

VOLTAGES representing PERCENTAGE CHARGE :

Wet cell lead acid – Full charge = 12.6 volts	**Gelled** lead acid – Full = 12.9volts
75% charge = 12.4 volts	75% charge = 12.65 v
50% charge = 12.2 volts	50% charge = 12.35 v
25% charge = 12.0 volts	25% charge = 12.00 v
Fully discharged = 11.8 volts	Fully discharged = 11.80 v

Maintain battery voltage above 50% charge for better battery life (below 50% is a very deep discharge).

BATTERY MAINTENANCE

Periodically ensure your battery is fully recharged. Without use some batteries discharge up to 10% of their capacity each month (flooded, or wet cell, type)

Failure to keep a battery properly charged will cause sulphation leading to a shorter battery life and poor performance.

Ensure battery terminals are clean and secure (tight connections). If corrosion occurs, pour boiling water over the terminals then cover them with petroleum jelly, grease, or a battery terminal protectant.

ELECTROLYTE LEVELS

Battery electrolyte levels should be checked **monthly**. Top up with distilled water.