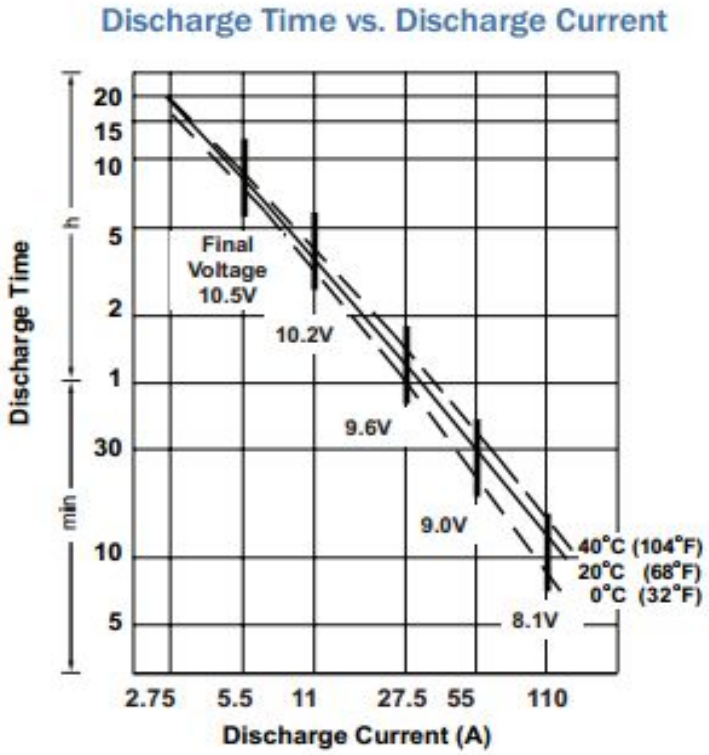
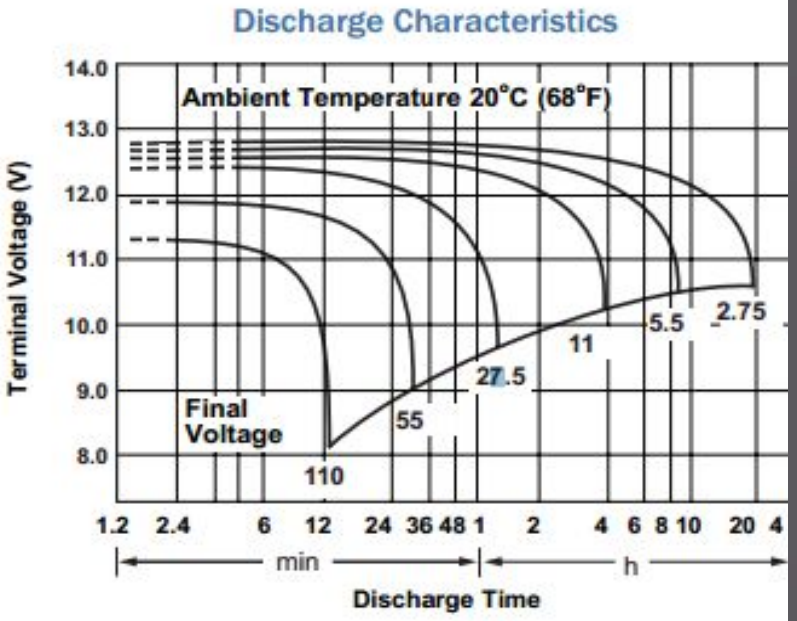
BATTERY TECHNOLOGY AND POWER

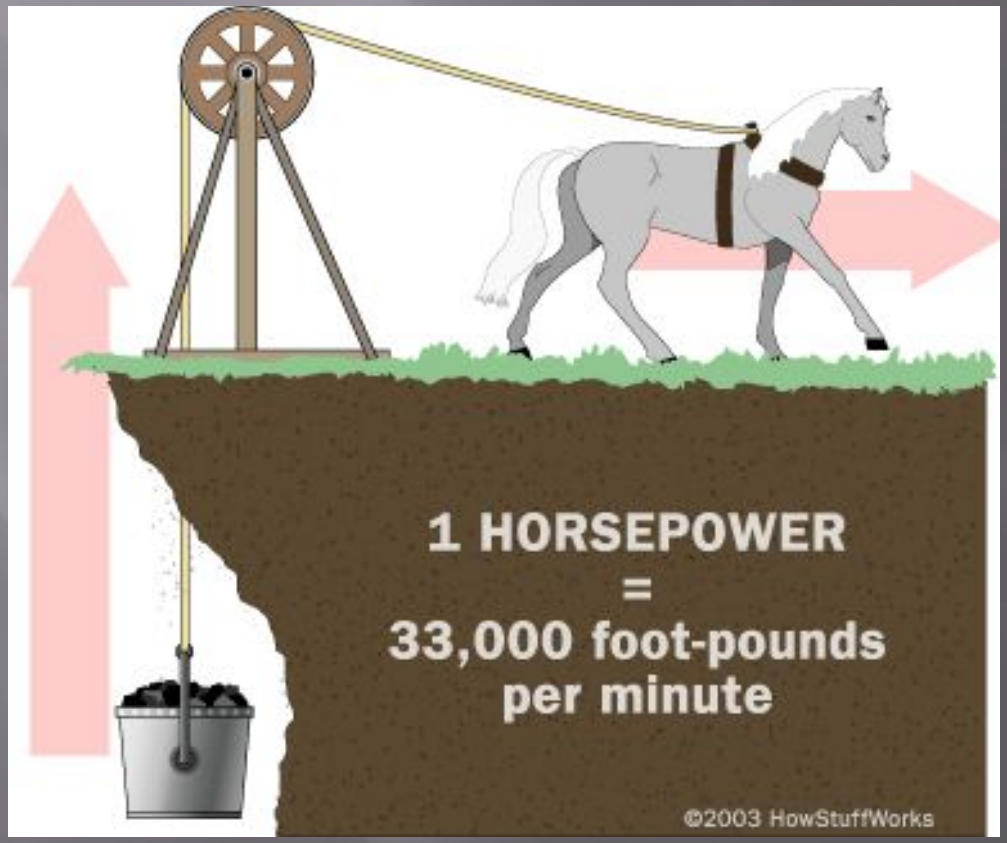




Shelf Life & Storage

Horse Power

The force required to lift 550 Pounds 1 foot per second = 1 Horse power

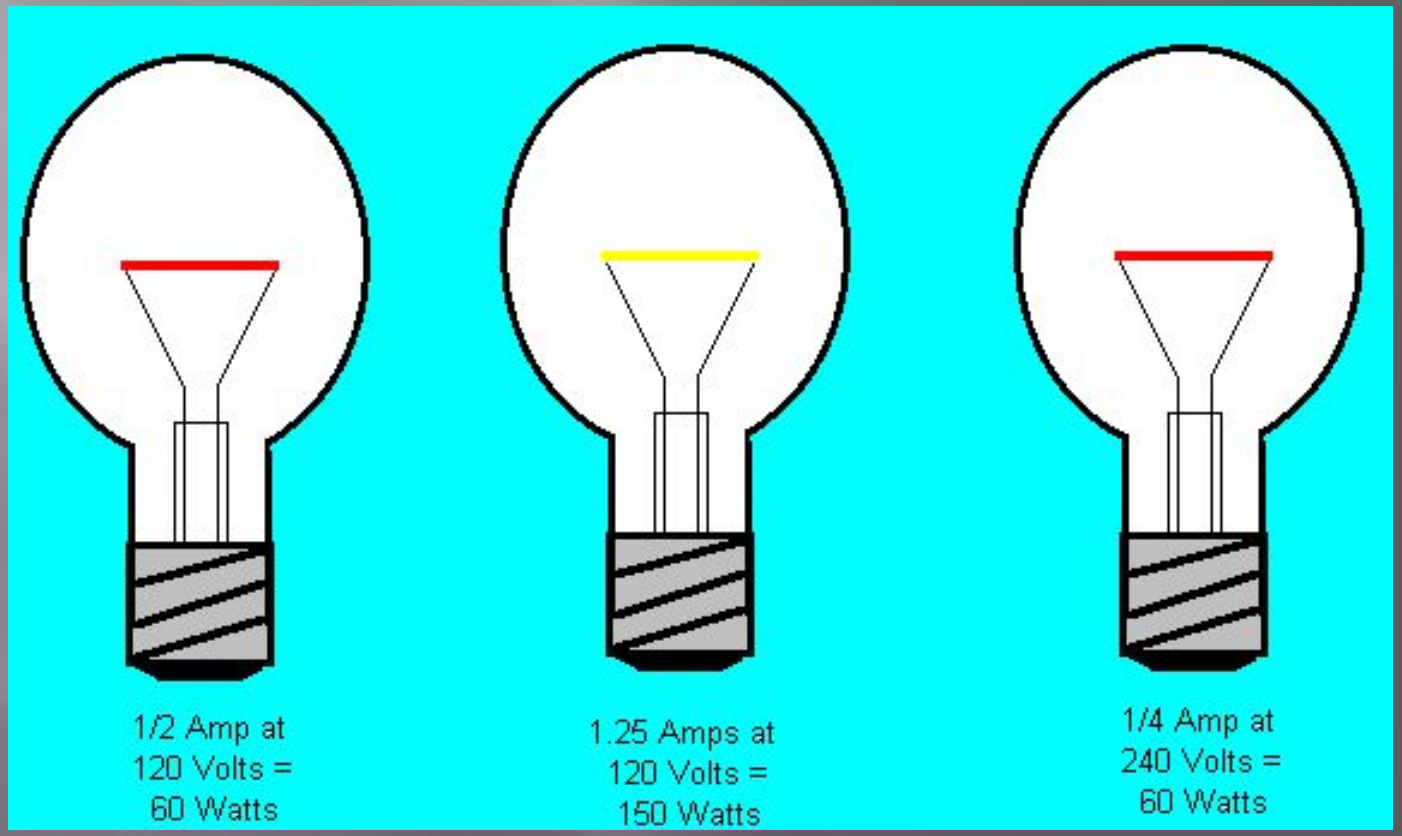


Measuring Power

- A **dynamometer** or "**dyno**" for short, is a device for measuring force, torque, or power.
- For example, the power produced by an engine, motor or other rotating prime mover can be calculated by simultaneously measuring torque and rotational speed (RPM)

What is a Watt

A Watt is a measure of electric power that depends on amps and volts. Volts Times Amps = Watts
Voltage is electrical pressure Amps are electron flow



Watts to HorsePower

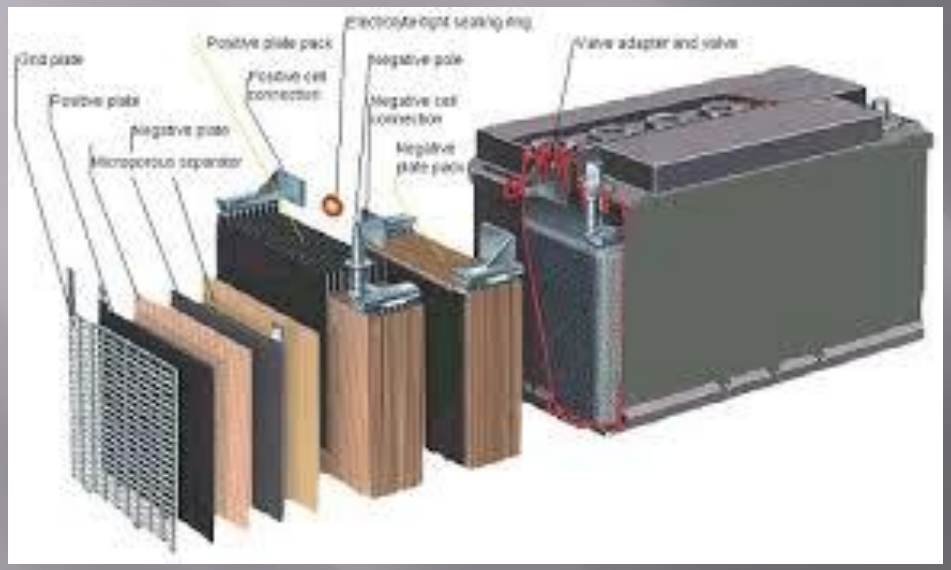
- 1 watt = 0.00134102209 horsepower
- One mechanical or hydraulic horsepower
- is equal to 745.699872 watts: 1 hp(I) = 745.699872 W

Amp/ Hours & Final voltage

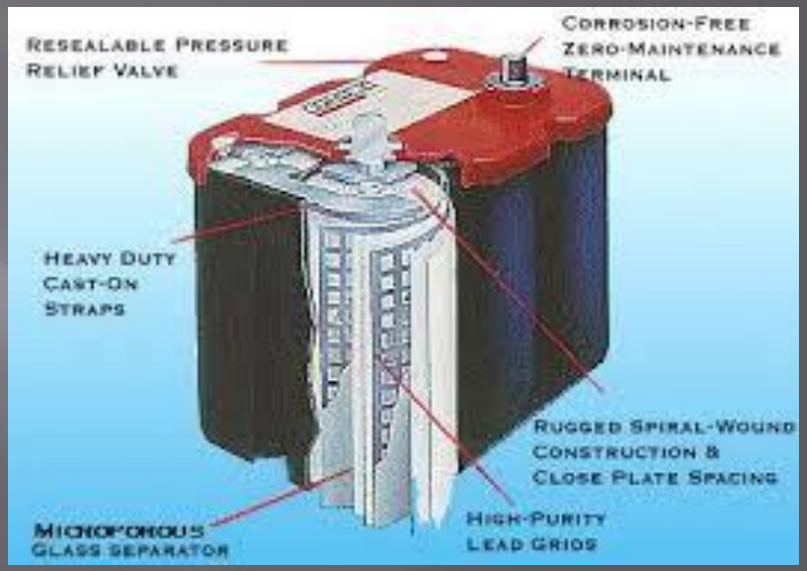
- *A coulomb* is 6,250,000,000,000,000,000 or 6.25×10^{18} electrons flowing
- 1 *amp* is actually a flow rate of 1 coulomb of electrons per second
- A battery with a capacity of 1 amp-hour should be able to continuously supply a current of 1 amp to a load for exactly 1 hour, or 2 amps for 1/2 hour, or 1/3 amp for 3 hours, etc., before becoming completely discharged (Final Voltage)
- Final Voltage in a 12 Volt lead Acid Battery is **10.5 Volts** if energy is taken past this point the battery will never recover fully and the Amp hour capacity will decrease. Discharged Lead/acid batteries must be recharged to at least %50 of the amp/hr rating within an hour.

Types of Lead / Acid Batteries

Flooded Cell



OPTIMA is a sealed,
AGM (Absorbed Glass Mat)



VRLA battery (**valve-regulated lead-acid battery**) There are two types of VRLA batteries, **gel cells** and **AGM**. Gel cells add silica dust to the electrolyte, forming a thick putty-like gel. These are sometimes referred to as "silicone batteries". AGM, "absorbed glass mat", batteries feature fiberglass mesh between the battery plates which serves to contain the electrolyte.

Cranking Amps, Starter Batteries

- Typical Car batteries are measured in C.A. (Cranking Amps) and C.C.A. (Cold Cranking Amps)
- SAE J537, a CCA reading of 500A delivers 500A at -18°C (0°F) for 30 seconds without dropping below 7.2 volts.
- Starter batteries are not the best for sustained power consumption.

Optima spiral VRLA batteries

- Yellow Top Deep Cycle Red Top Cranking

Reciprocity

Performance Specifications

Nominal Voltage ..... 12 volts (6 cells)

Nominal Capacity

20-hr. (2.75A to 10.50 volts) ..... 55.0 AH

10-hr. (5.1A to 10.50 volts) ..... 51.0 AH

5-hr. (8.8A to 10.20 volts) ..... 44.0 AH

1-hr. (30.6A to 9.00 volts) ..... 30.6 AH

15-min. (96A to 9.00 volts) ..... 24.0 AH

Approximate Weight ..... 36.0 lbs. (16.33 kg)

Energy Density (20-hr. rate) ..... 1.64 W-h/in3 (100.30 W-h/l)

Specific Energy (20-hr. rate) ..... 17.65 W-h/lb (38.91 W-h/kg)

Internal Resistance (approx.) ..... 7 milliohms

Max Discharge Current (7 Min.) ..... 165.0 amperes

Max Short-Duration Discharge Current (10 Sec.)..... 410.0 amperes

Shelf Life (% of nominal capacity at 68°F (20°C))

1 Month 97%

3 Months..... 91%

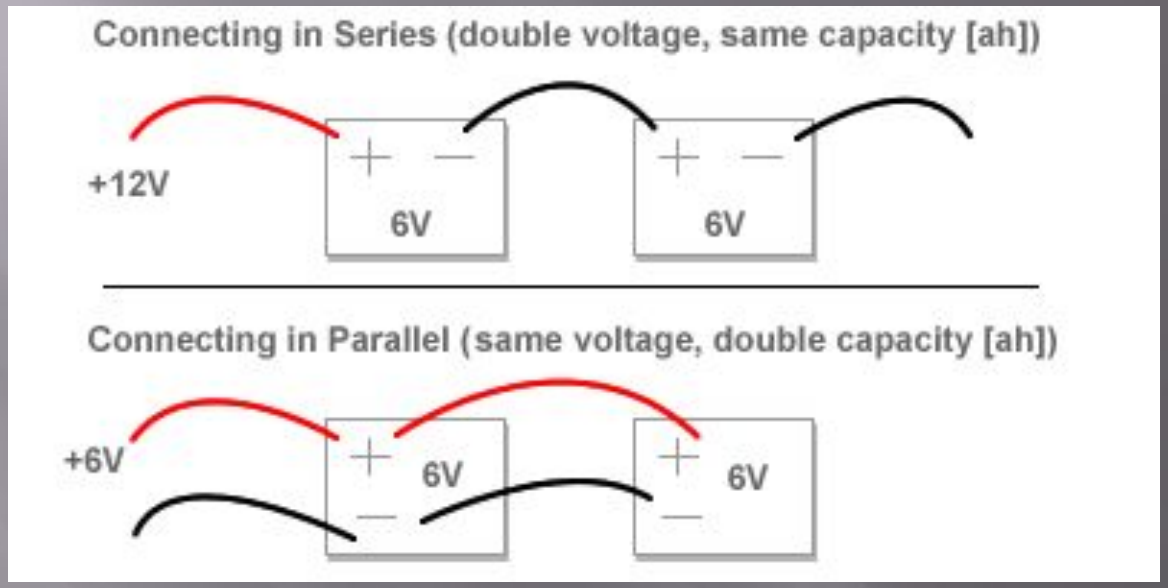
6 Months 83%

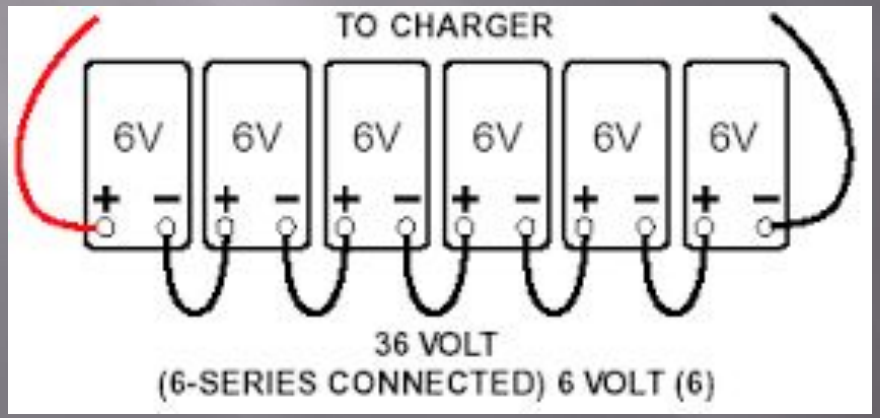
Operating Temperature Range

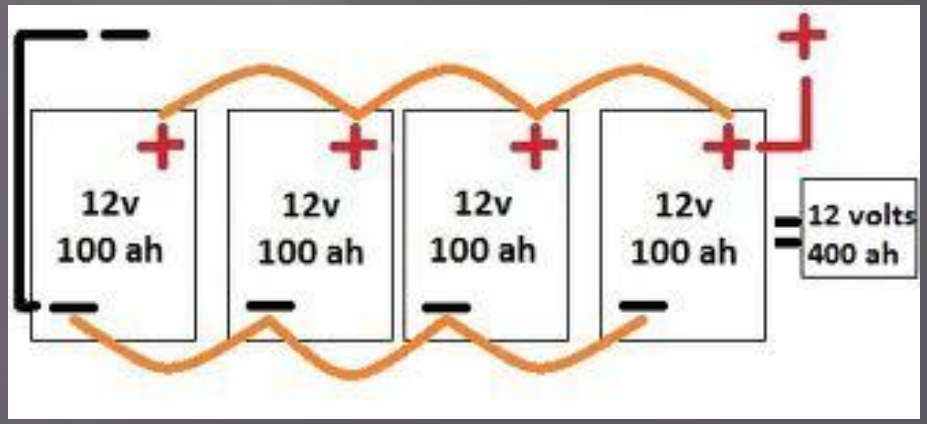
Charge.. ..... -4°F (-20°C) to 122°F (50°C)

Discharge..... -40°F (-40°C) to 140°F (60°C)

Series and Parallel connections

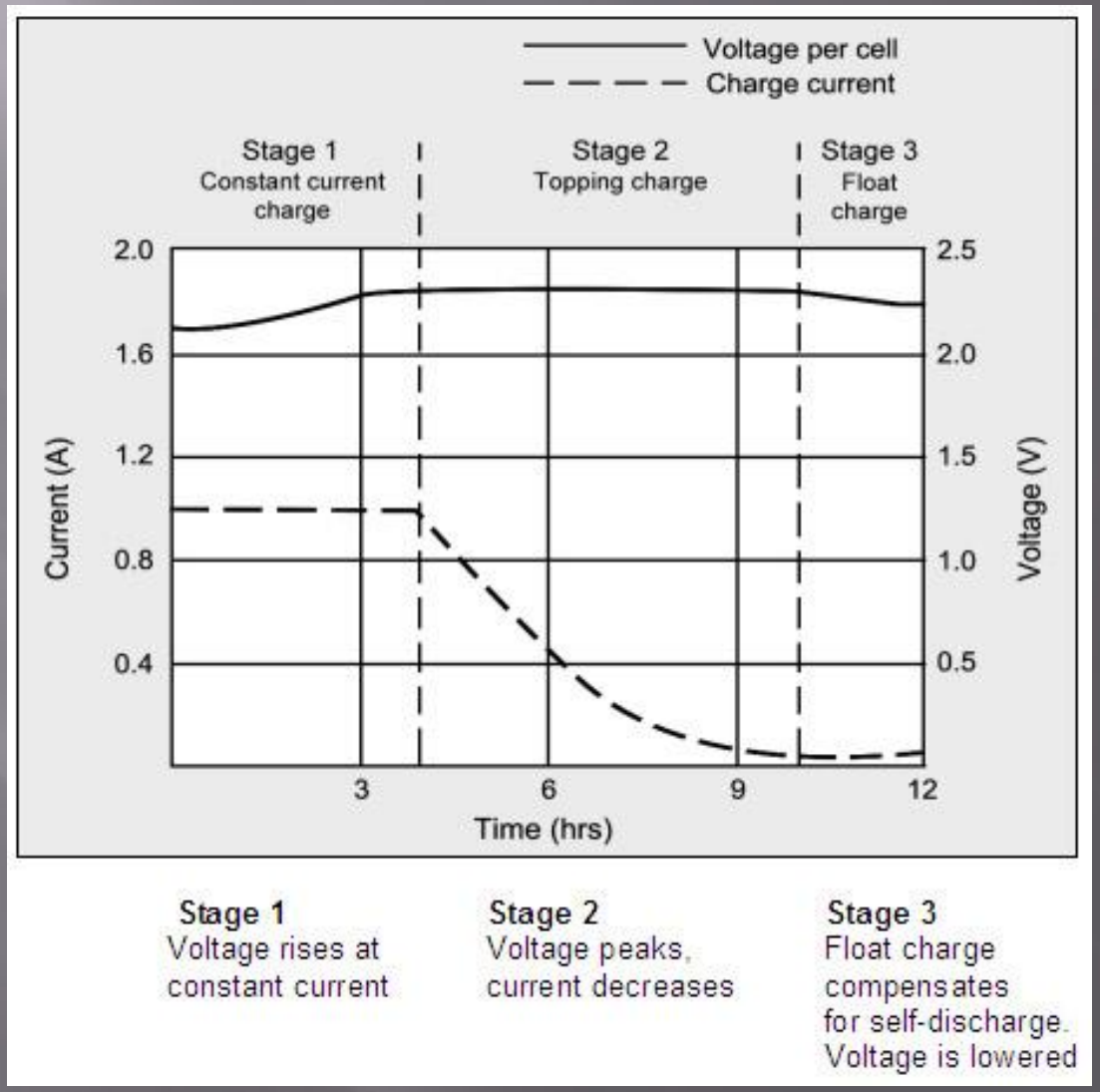






Battery Charging

- Battery charging takes place in **3 basic stages**: Bulk (constant current), Absorption (constant voltage), and Float.



Battery Rules and Safety

- 1. Never charge a VRLA battery higher than 14.5 volts
- 2. Never let a Lead Acid Battery discharge past 10.5 volts
- 3. Always recharge a battery to at least 50% of the amperage that was taken out.
- 4. Gassing takes place when the battery is 90% full.
- 5. Always place a fuse as close to the battery as possible.