LEAD ACID BATTERY BASICS

FLA, AGM, Gel, Etc…

An Introduction to:

- Chemistry
- Construction
- Installation
- Charging
- Maintenance

A Bit About Me

- Lifetime in the Boating World
- SAMS® Surveyor Associate
- ABYC® Certified Master Technician
- 40 Years of Battery Sales & Service
- Cruising Editor of Waterway Guide™
- Past President of SSCA
- USCG Licensed Deck & Engine Room

What IS a Battery??

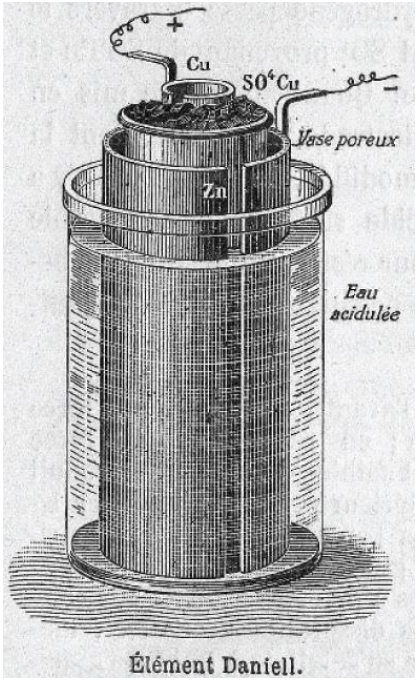
A collection of one or more cells in which:

Potential ENERGY

is stored **CHEMICALLY**,

and converted to,

ELECTRICAL ENERGY

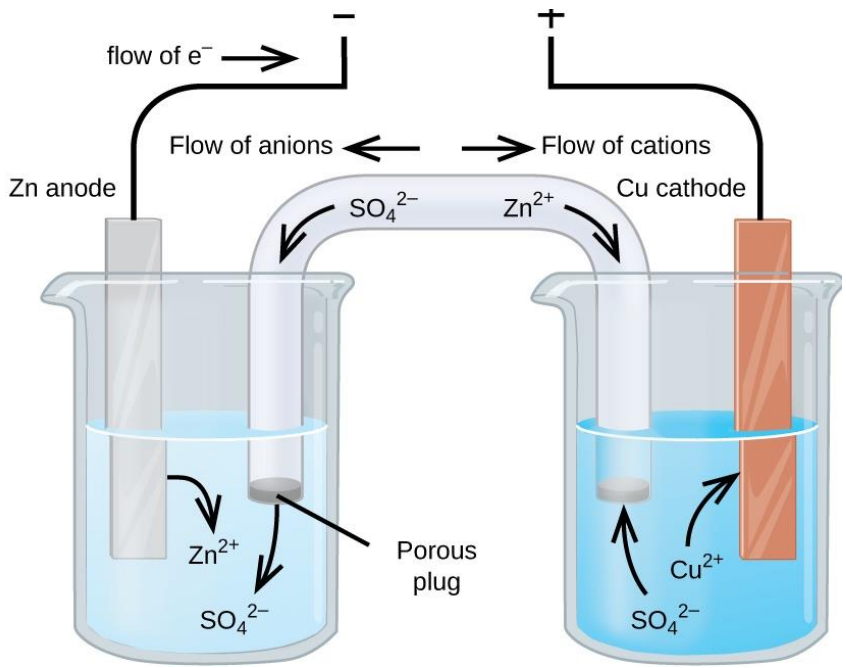


How Does It Do That??

[redacted]

→

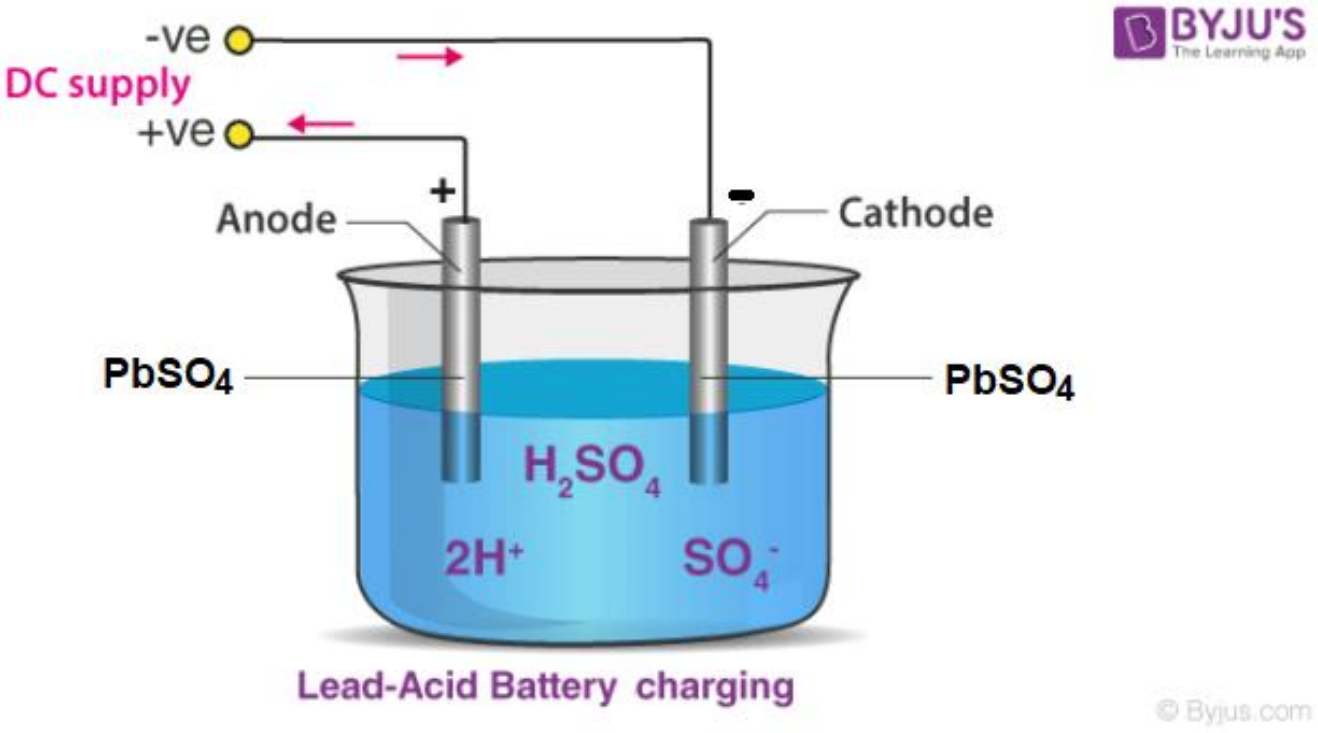
[redacted]



Well, You Did Ask!!

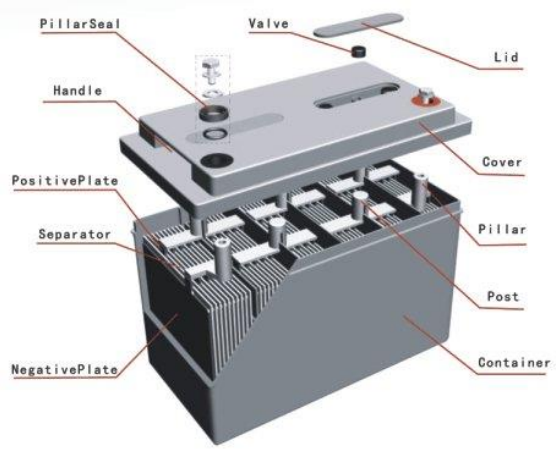
Back to Chemistry Class

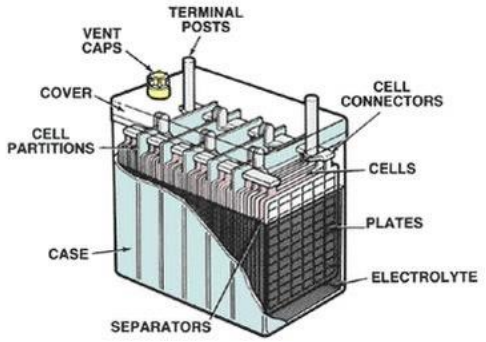
1			16		8			82
1.008	2		32.066	4	15.999			207.2
H			S		O			Pb
Hydrogen			Sulfur		Oxygen			Lead
$1s^1$			$[Ne]\ 3s^2 3p^4$		$[He]\ 2s^2 2p^4$			$[Xe]4f^{14}5d^{10}6s^2 6p^2$
Nonmetal			Nonmetal		Nonmetal			Post-Transition Metal



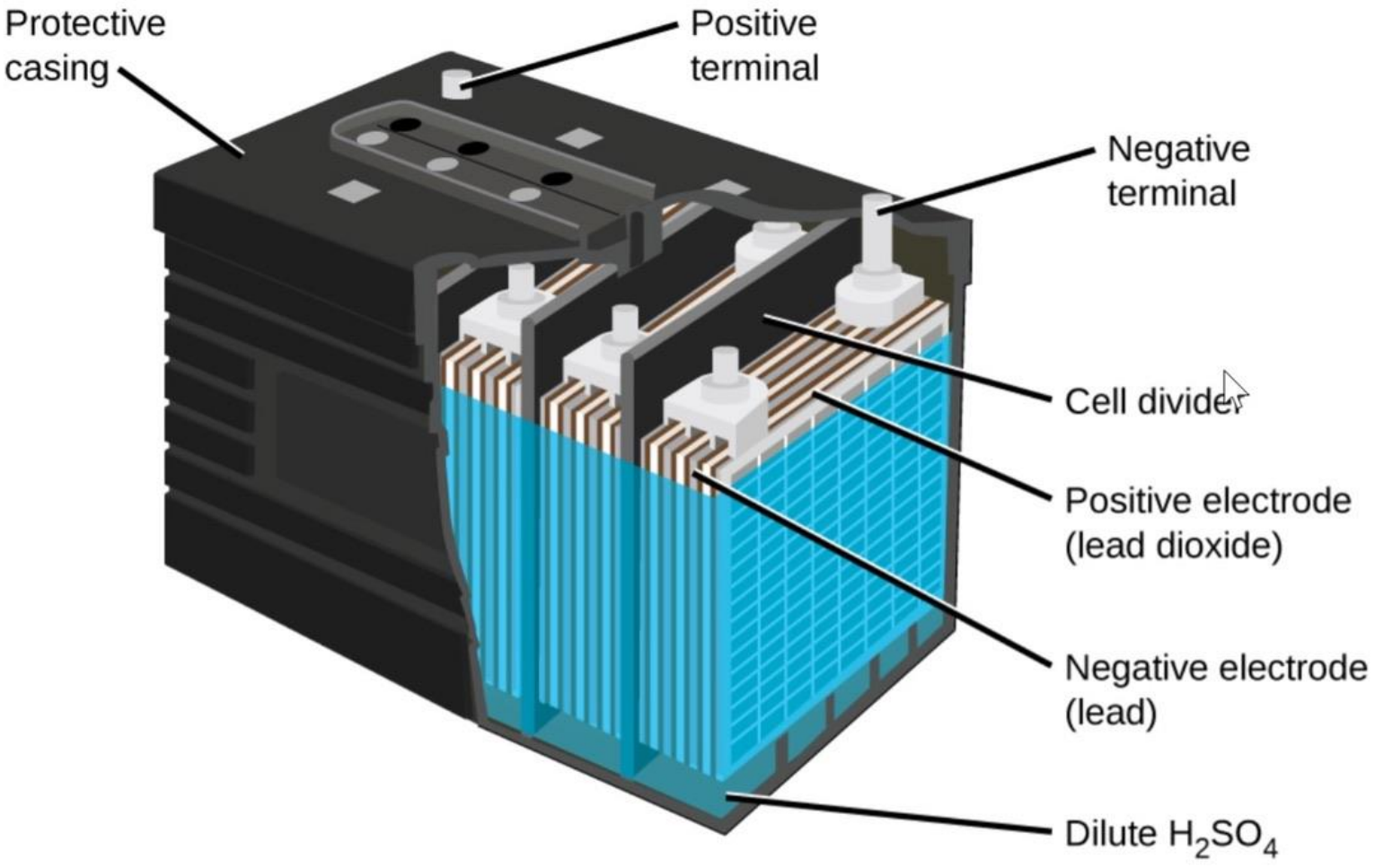
Building A Battery

- Plate options (Material Choice Matters)
- Construction Options (Flat, Spiral)
- Flooded Lead Acid
- Electrolyte Options (To Gel or not to Gel)
- Flooded Lead Acid
- VRSLA (Valve Regulated Sealed Lead Acid Battery)

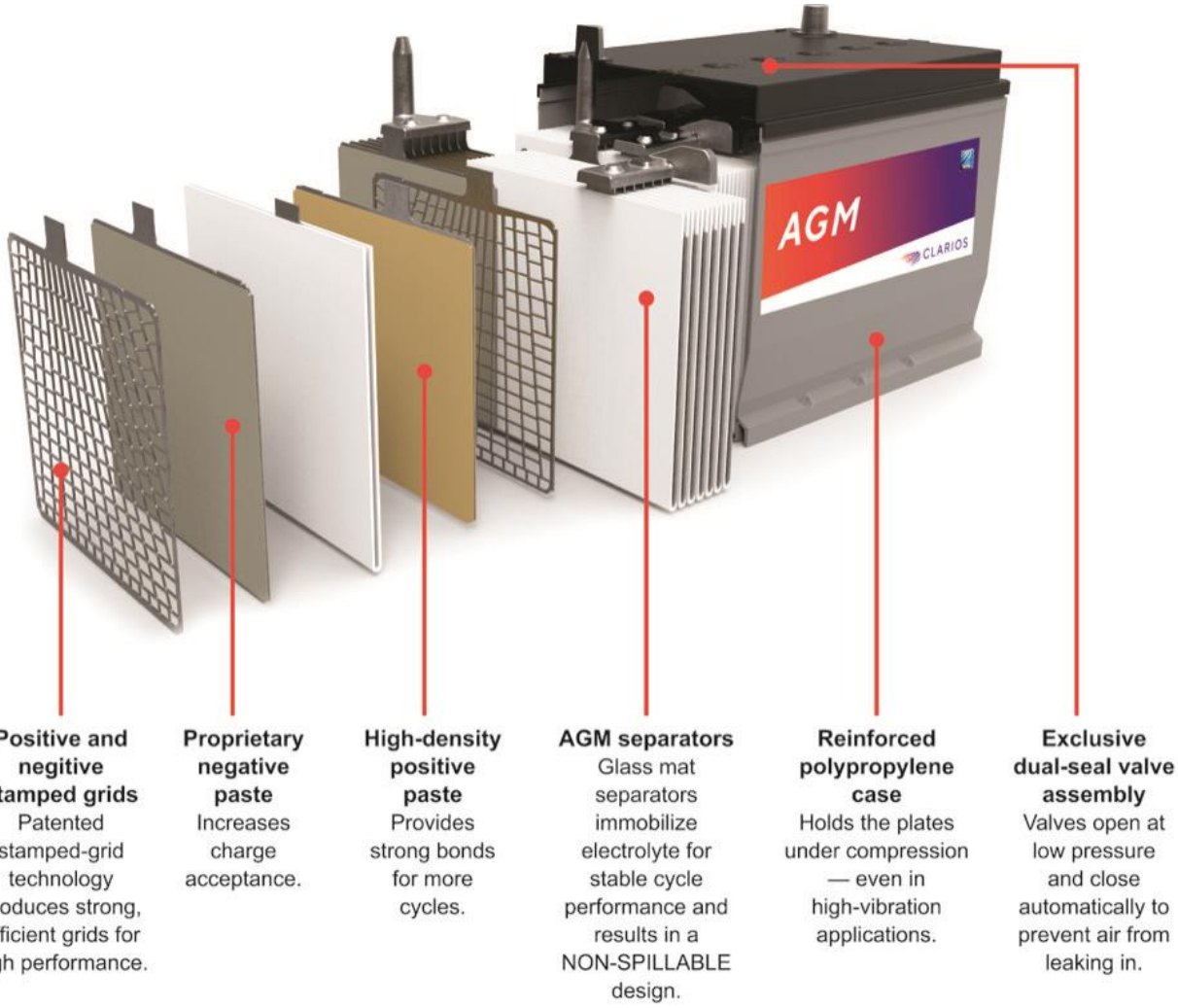




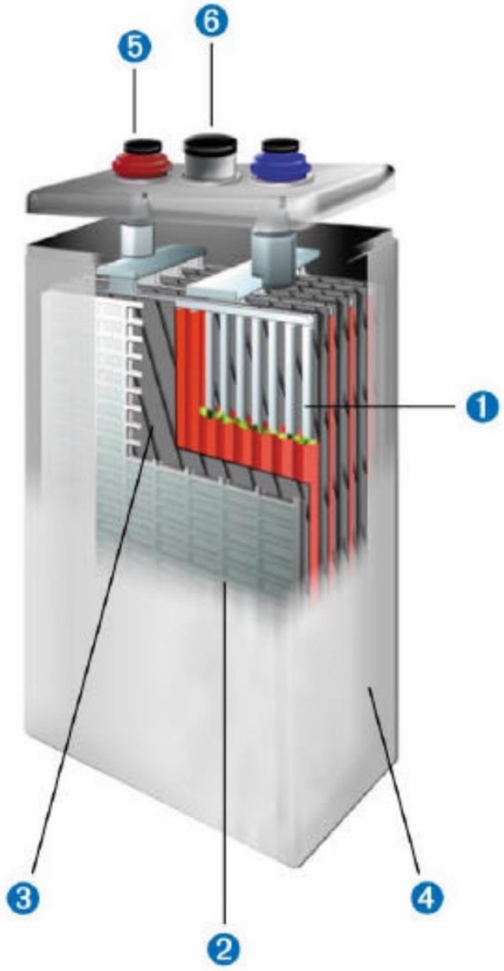
A Closer Look
”FLA”



A Closer Look
‘AGM’



A Closer Look
‘Gel’



❶ *Pos. plates: Robust tubular plates consisting of a lead calcium alloy, optimized for high corrosion resistance*

❷ *Neg. plates: Grid plate construction consisting of lead calcium alloy*

❸ *Separator: Microporous and robust, for electrical separation of the positive and negative plates and optimized for low internal resistance*

❹ *Housing: SAN, on request flame retardant ABS according UL 94-V0*

❺ *Poles: Screw connection for easy and safe assembly and maintenance-free connection with excellent conductivity*

❻ *Valves: Release gas in case of excess pressure and protects the cell against atmosphere*

Chemistry Class Dismissed

Choosing The Right Battery

- Start with the APPLICATION
- Then your BUDGET
- Think TCO^2
- Starting, House, Windlass/Thruster
- Will you REALLY add WATER??
- How do you use your boat
- And for how long?

Service Matters Most

- Engine Starting
- House Loads/Deep Cycling
- Windlass/Thruster
- Radio/Electronics
- Special Needs

Starting Batteries

- More, Thinner Plates
- Short Bursts of Energy
- Measured in Cranking Amps

  What are CCA? MCA?

30 Sec

$0^{o}F/32^{oF}$

7.2V

Deep Cycle Batteries

- Fewer, Thicker Plates
- Longer Output at Lower Amp Draw
- Rated in Amp Hour

So, What is an Amp Hour

20HR 77°F
5% 10.75

Marketing Fails

There is NO SUCH. THING as a Dual Purpose Battery!

A 100a/h Battery

Can give you 5a for 20 hours

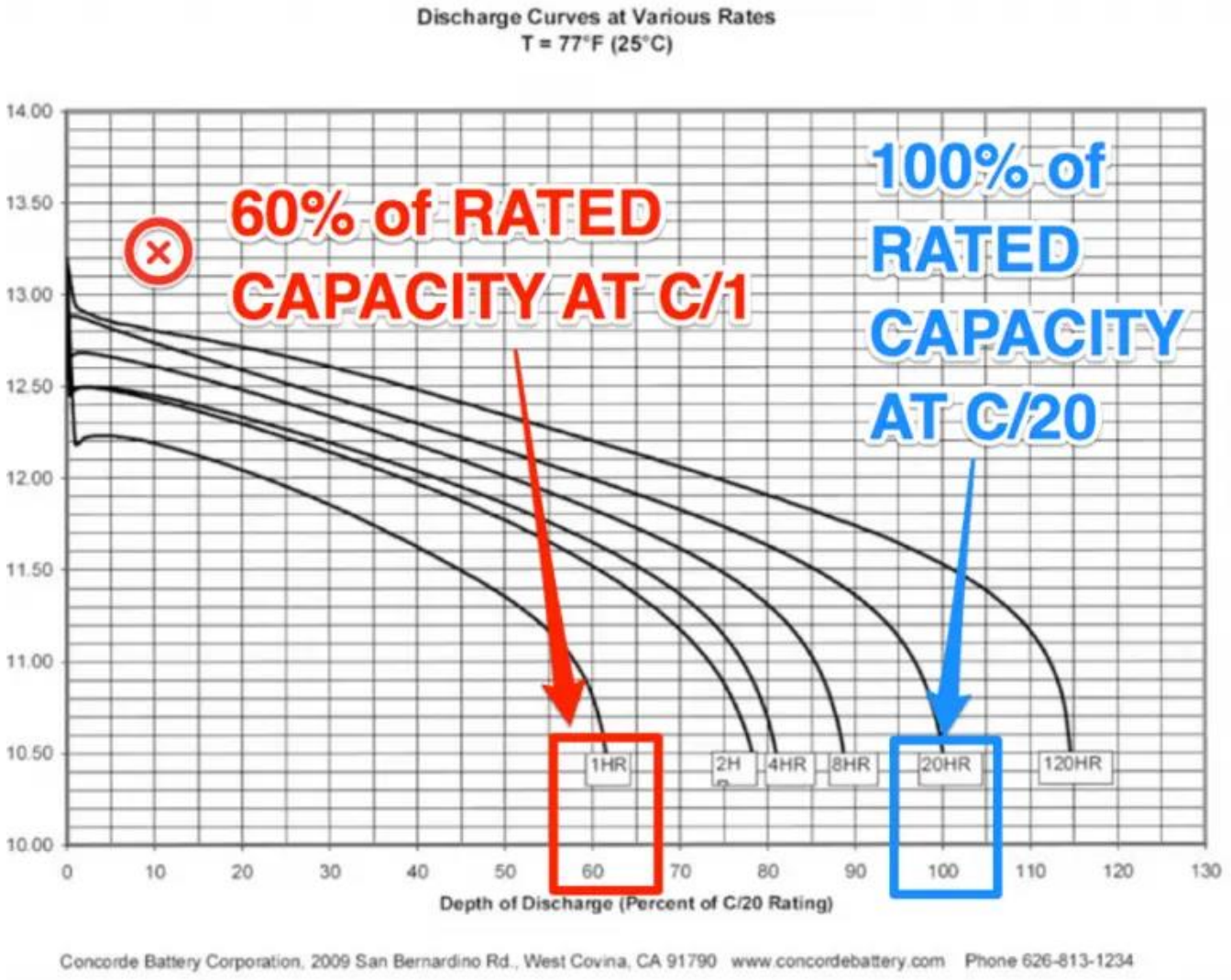
The Higher the Load the Shorter the Cycle

You can have 1A for 100HR

But NOT

100A for 1HR

Discharge Power Curve



Installing

- Secured: 1” in any direction with 90# Load in all directions
- All B+ connections covered to protect from accidental shorting
- Electrolyte containment
- Wires secured every 18”
- Overcurrent Protection (OCP) within 7/40/72” of the battery post
- Switches on all batteries over 800cca

Installing

What about this? Does it pass?

Charging

Charging, like Discharging, is
NOT LINEAR
The Last 20% is Critical to Battery Life

AC2DC Chargers

- FerroResonnant
- SCR Converters
- Modern 3-Stage
- Inverter/Charger

Old chargers are good for battery sales!

Alternators

- Engine Mounted
- Internal Regulator
- External Regulation
- Modern 3-Stage
- Battery Temperature
- Alternator Cage Temperature

DC2DC

- Two Brands Dominate
- Becoming more common
- Echo & Duo Charge
- 3-Stage (again)
- Buck & Boost
- Different Chemistries
- Special MPPT Cases

Relays & Isolators

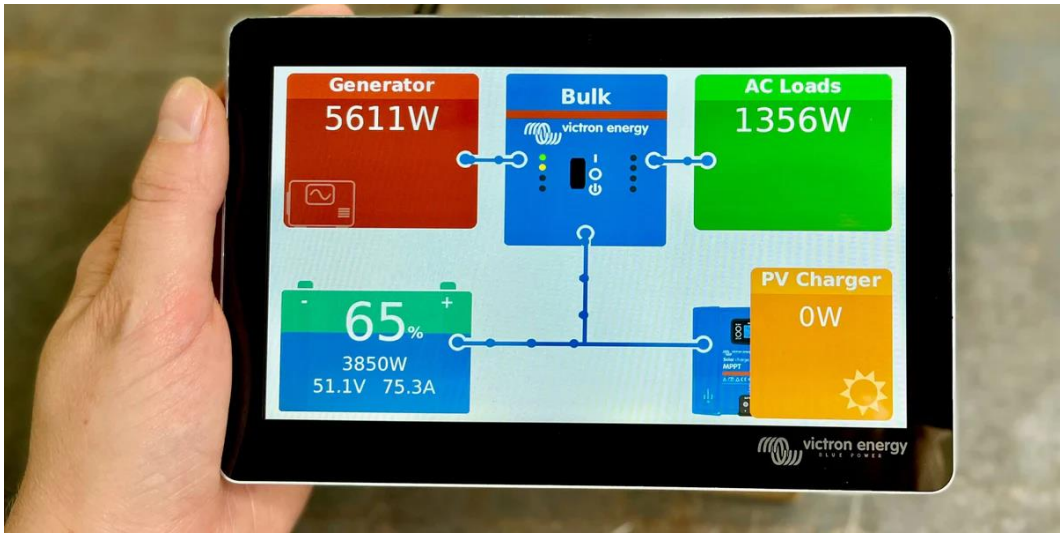
- Relays with the same chemistry batteries
- Avoid Old Diode Models
- FET Models are very flexible

Solar & Wind

- Boats vs Home Costs of Energy
- Best way to top up AGM & FLA Batteries
- Solar much cheaper and more reliable
- MPPT vs PWM
- The last 5% is what matters

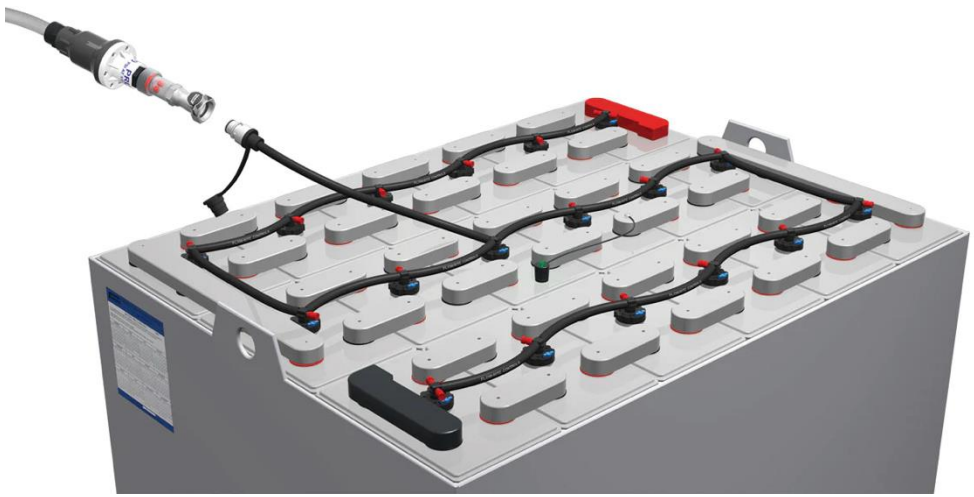
Monitoring

- 1 amp for 1 hour is 1 amp/hour (a/h)
- Many Cruising Boats monitor AH used from a House Battery using an Amp Hour Meter that reads all power in and out of the battery bank.



Maintenance

- Yes, you DO need add water to FLA
- Yes, you MUST Fully Charge AGM's every 14 days (or more!)
- Never overcharge Gels (14.1v MAX for most models



Homework

- Best Site on the WWW
  - *marinehowto.com* (Rod)
- Best Online Clases
  - *boathowto.com* (Nigel & Jan)
- Best Facebook Group
  - *Boat Electrical Systems* (Scott & Rod)
- What kind of Batteries do you have???

QUESTIONS