

# VIBS 2018 PYS Presentation

## Choosing the Right Battery for your Boat

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Pacific Yacht Systems Inc.

design • installation • service • support

# A Little about PYS



- 11 years in business
- Genesis: wanted a reliable and safe electrical system
- What makes us different
  - Expertise through specialization & repetition
    - 2017: Over 750 boats
  - Teamwork breeds synergy
- Team members
  - Detailed oriented
  - Passion for doing it right the 1<sup>st</sup> time
  - Our installations are safe and follow:  
ABYC and NMEA standards



# Engine Batteries (AKA cranking battery)



- Used to start the engine
  - OR Run a thruster
- Designed to deliver high current for short period of time
- Immediately recharged by engine alternator
  - NOT designed to be left uncharged
  - NOT designed for deep discharge
- Capacity measured in Cranking Amps

# Example: 8D Engine Battery



# Deep Cycle Batteries



- Used to supply power to all devices on boat
- Designed for deep discharge over longer time
- Charged by charger, alternator, solar, wind generator, etc.
- Capacity measured in Amp Hours (AHr)

# Lead Acid Battery Choices



- Flooded Lead Acid (Starter, Deep-Cycle, or Hybrid)
- Sealed Valve Regulated Lead Acid
  - GEL
  - AGM
  - Carbon Foam AGM (i.e. Firefly)

# Flooded Lead Acid Batteries



- Flooded lead acid purchase cost (\$)
  - If properly maintained
- Liquid acid electrolyte
- Must use watertight battery box to contain any spilled battery acid
- Maintenance - top up with distilled water only
- Self-discharge of about 15% per month
- Practical available battery capacity about 35%
  - Bulk range: 85% to 50%
  - Example: 600 AHr battery capacity for 200 AHr useable capacity

# Example: L16 Flooded Lead Acid





# Gel Batteries



- Gel purchase cost (\$\$)
- Electrolyte is in gel state
- Sealed Valve Regulated: Limited gassing
- No maintenance required
- CAUTION: Easy to overcharge with alternator and charger
  - Need specific gel charge profile
- Self-discharge of about 2% per month
- Practical available battery capacity about 55%
  - Bulk range: 85% to 30%
  - Example: 400 AHr battery capacity for 200 AHr useable capacity

# AGM Batteries



- AGM purchase cost (\$\$)
- Electrolyte is in Absorbed Glass Mat (AGM)
- Sealed Valve Regulated: Limited gassing
- No maintenance required
- Self-discharge of about 2% per month
- Practical available battery capacity about 55%
  - Bulk range: 85% to 30%
  - Example: 400 AHr battery capacity for 200 AHr useable capacity

# Example: AGM



# Firefly Batteries



- Carbon foam AGM purchase cost (\$\$\$)
- All benefits of AGM
  - Leak-proof, limited gassing, maintenance-free, faster recharge acceptance rate, limited self-discharge
- **Battery Life: 12 Times of Flooded**
  - (FF 3600 cycles versus FLA 300 cycles at 50% DOD)
- **No premature aging at partial state of discharge**
- 2 Sizes: Group 31 and L15
- Practical available battery capacity about 65%
  - Bulk range: 85% to 20%
  - Example: 300 Ahr battery capacity for 200 Ahr useable capacity

# Example: Firefly Group 31



# Calculate Your Power Needs



- What is your daily power need?
  - Varies depending on the season, examples:
    - Lights are run earlier in winter
    - Heating in the shoulder and winter season
- Largest DC loads
  - Refrigeration is the largest draw: 50 – 125 Amp-Hour per day
  - Inverter powering AC loads
  - DC loads from running diesel heater (especially hydronic)

# Typical Daily Battery Usage



Typical daily AHr budgets	AHr
Beneteau 33	85
Catalina 36	150
Suncruiser 38	225
Grand Banks 42	175
Ocean Alexander 48	375
Meridian 580	500

# Electrical Cornerstone: Battery Monitor



- Monitoring for system health
  - Available capacity
  - Usage patterns, planning
- “Fuel gauge” & “speedometer” functionality for your batteries
- Information on your system
  - Current draw/charge
  - Amp hours
  - Voltage





# Sizing Your Useable Battery Capacity



- Criteria to choose your battery bank
  - Daily Amp-Hour (AHR) budget
  - Estimated time between charging? How often do you charge your batteries?
    - Every ½ day
    - Every 2 days
- At a minimum, **useable** battery capacity needs to be
  - Daily AHR budget X Estimated time between charging
  - Example: 200 AHrs X 2 days = 400 AHrs of useable battery capacity

# Recap: Lead Acid Battery Stats



## **BATTERY “FLOOR”**

- To balance battery cost and life, you should never deplete your lead acid batteries below the following capacity:
  - Flooded: 50%
  - AGM/GEL: 30%
  - Firefly AGM 20%

## **BATTERY “CEILING”**

- Due to lead acid battery chemistry, charging above 85% of capacity (absorption stage) is time-consuming
- Therefore: while cruising effective battery capacity is:
  - Flooded: 35% (50% to 85%)
  - AGM/GEL: 55% (30% to 85%)
  - Firefly AGM 65% (20% to 85%)

# AGM vs Firefly vs Flooded



	AGM	Firefly AGM	Flooded
Initial Cost	\$\$	\$\$\$	\$
Battery Life	1X	<b>4X</b>	1X
Useable capacity	55%	<b>65%</b>	35%
Maintenance	None	None	Regular top-off
Self-discharge	2% per month	2% per month	15% per month
Purpose	Dual	Dual	Single
Sulfation	Yes	No	Yes

# Sizing your Battery Bank



- Depending on your choice of lead acid battery, you will require the following:

Type	Useable battery capacity
Flooded	3 Times
AGM/Gel	2 Times
Firefly AGM	1.5 Times

- Examples, if you need 200 AHr of useable battery capacity, you will require:
  - Flooded: 600 AHr
  - AGM/GEL: 400 AHr
  - Firefly AGM: 300 AHr

# Battery Sizes and Types



- Batteries come in all sizes
  - Group 24, Group 27, Group 31
  - 4D, 8D
  - Golf Carts
  - Slimline
  - L16
- All battery sizes come in different lead acid types:
  - Flooded , AGM, Firefly AGM, Gel
- Flooded batteries are built specifically for a purpose
  - Starter
  - Deep cycle
  - Dual purpose

# What is the Right Charge Rate?



- Importance of sizing **minimum** charge rate to battery size
  - **Minimum: ~ 10% of capacity**
- Reduce your charging time by increasing your charge rate
  - **Maximum: ~ 25% of capacity (AGM/Gel: ~ 40%)**
  - How often to you want to run genset/engine per day?

# Different Charge Methods



- Ways to create power
  - Charger(s)
  - Alternator(s)
  - Methanol Fuel Cell
  - Solar
  - DC Genset
  - Wind Turbine



# Smart Battery Charger



- Charges batteries from AC shore-power
- **Reduce** the charge time
- Choose the right charge curve
  - Flooded, AGM, Gel, Custom
- Three-phase smart charge cycle:
  - Bulk, Absorption, Float
- Right rate of charge for extended battery life
  - Minimize sulfation





# Smart Charger Application - Multiple Units



- Reduce genset runtime by adding 2<sup>nd</sup> or 3<sup>rd</sup> charger in parallel
  - E.g. 1 hour morning and evening
- Charge at the right rate
- Min and Max Charge Rate
  - Flooded: 10% to 25%
  - AGM: 10% to 40%



# Old vs New Chargers



- Ferroresonant vs Smart Charger

	Ferroresonant	Smart Charger
Rate of charge	Half rated output	Full rated output
Charge curve	Simple	3 stage
Overcharging	Yes - Trickle	No - Float
Battery type settings	Flooded	Flooded, AGM, Gel
Temperature - compensated	No	Yes
Looks	Ugly	Pretty
Weight	Heavy	Light

# Making it Work vs. Doing it Right



# The PYS Difference



- We are boaters too!
- Expertise through Repetition
- Many electrical “fixes” are indicators of the bigger picture.
- We can help you prioritize safety.

# Connect with PYS



- Starting Point: PYS Electrical Audit for your boat
  - 90 minutes: Batteries, DC distribution, charger, alternator, inverter
  - Written report: observations & recommendations
  - Cost: \$189
- PYS Design Services for DIYers
  - Electrical system designed by PYS (collaborative and to code)
  - Installed by yourself or other outfit
- Pacific Yachting magazine - Monthly Tech Talk Column
- [www.pysystems.ca](http://www.pysystems.ca) 100s of articles
- Monthly email newsletter



Questions?



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