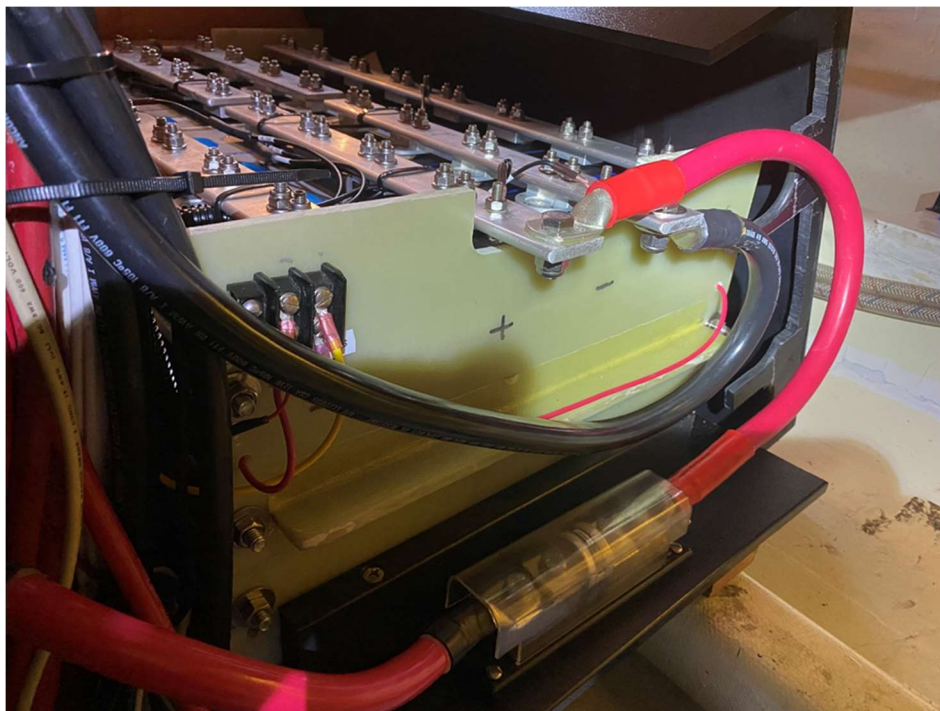
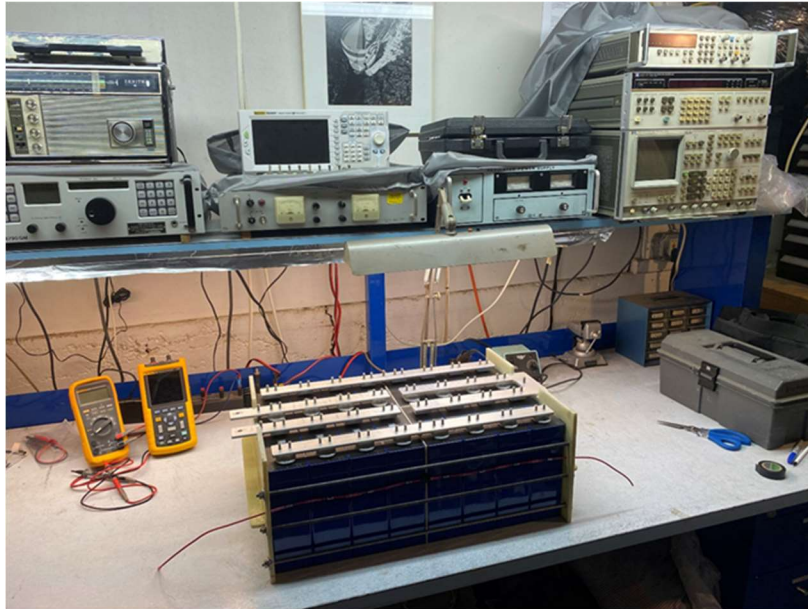


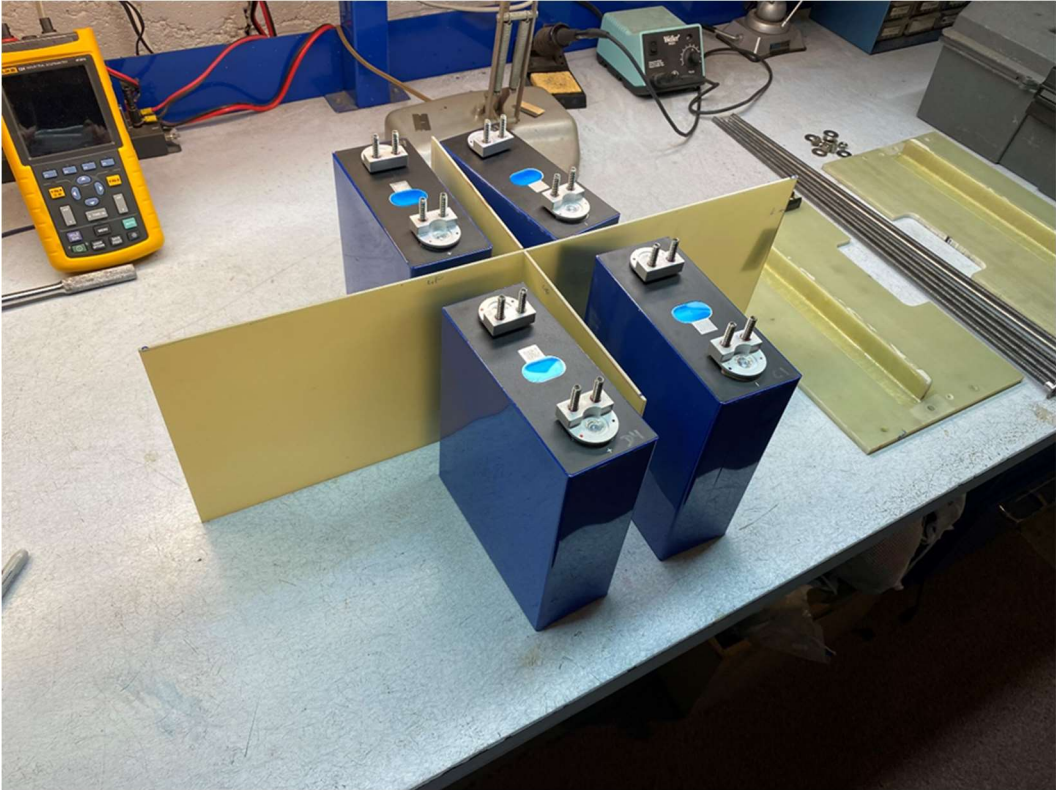
1216 AH 12v LFP battery
Sarissa 48 foot Michael Peters motorboat
25 Nov 2024
Stan Honey

These notes described a 1216 AH LFP battery assembled for the MV Sarissa using 16 EVE 304AH LFP Grade A cells in a 4P4S configuration.

4P is controversial but I ended up deciding that the simpler BMS, charging, and switching make up for the increased risk from paralleling cells. Of course opinions vary.



Dividers between each of the four banks of parallel cells 3/32" G10



- Busbars

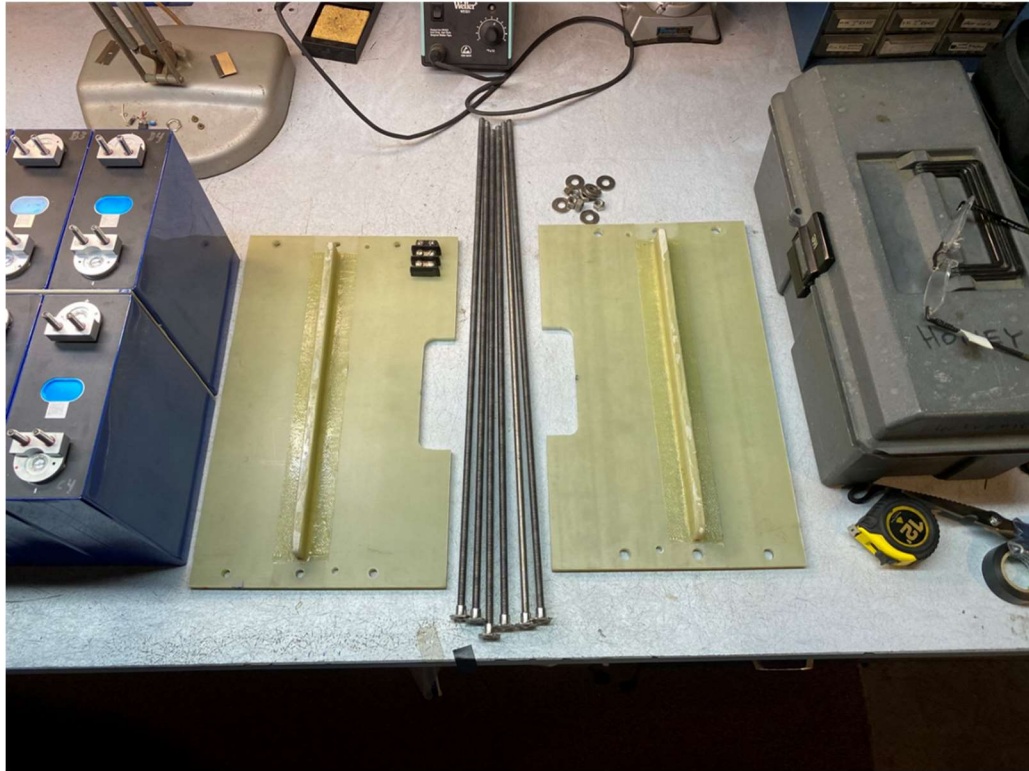
- Five continuous busbars with no intercell overlaps or interconnections.
- 6101 Aluminum $\frac{1}{4}$ " thick x 1.5" wide. Note that 6101 is slightly more conductive than other aluminum alloys and so is often used for aluminum busbars.
- U-shaped busbar was cut from 6101 Aluminum $\frac{1}{4}$ " thick x 5" wide with each arm the same cross section as the linear busbars. This results in exactly identical series busbar resistance for each of the 16 cells in the 4P4S battery.
- Busbars and battery terminals block sanded and coated with No-Ox-ID Special A immediately prior to assembly.
- Busbar resistance of 50 microohms/foot is less than that of 4/0 awg wire
- Battery terminals are also aluminum. Aluminum busbars eliminate galvanic corrosion between busbars and battery terminals. Formation of aluminum oxide is avoided by the No-Ox-Id Special A and the sanding immediately prior to assembly.
- Separate threaded studs for cell sense wires.
- The only dissimilar metal electrical contacts are at the final battery cable connections, from the aluminum busbars to the tinned copper FTZ HD lugs on the copper cables. The busbars are sanded and coated with No-Ox-ID special A just prior to the terminal attachment.



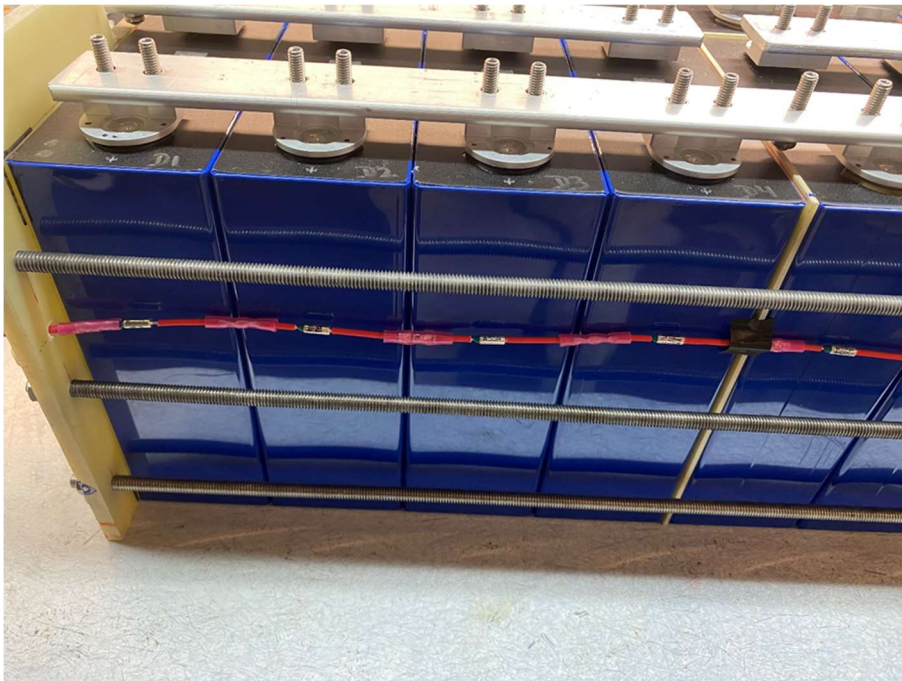


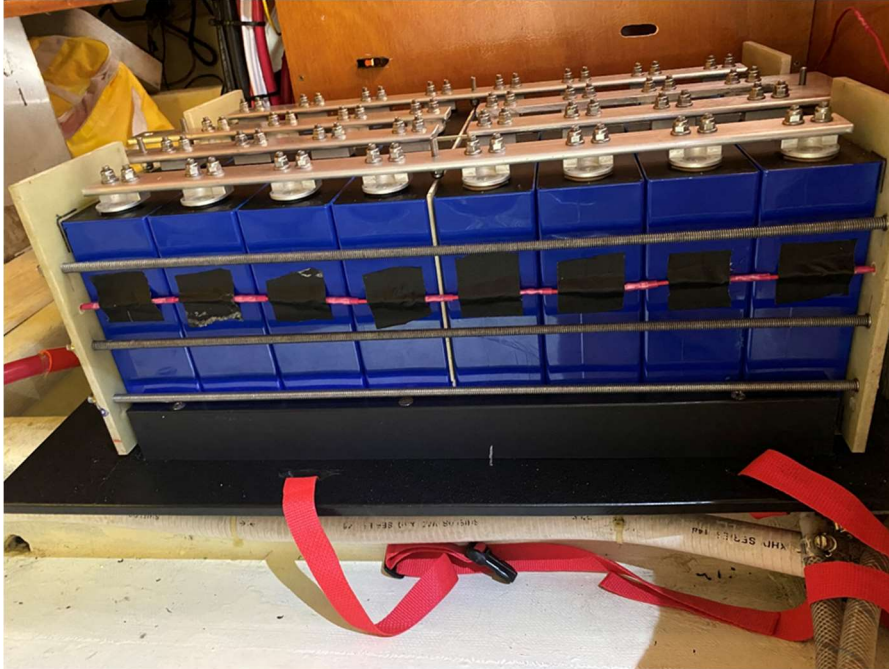
- Terminals
 - M6 SS allen set screw flat point studs installed in cell terminals
 - set screws installed once, permanently, with primer and red Loctite
 - this needs to be carefully done to avoid traces of Loctite ending up on the tops of the battery terminals which would prevent a perfect mating of the battery terminals and the busbars.
 - Nuts on busbars are SS M6 Nylock flange nuts with serrations.
 - bit of belt & suspenders with nuts being both Nylock and serrated-flange.
 - Busbar nuts torqued to 50 in-lbs per EVE specs.

- Cell Compression
 - ½" G10 endplates with epoxied ½" G10 stiffening beams.
 - Six 5/16" aluminum threaded rods. Given that the EVE cell cases and the busbars are aluminum, the compression rods are also aluminum to match the thermal coefficient of expansion of the cells and of the busbars.
 - Torqued to 6 in-lbs to achieve the EVE specified cell compression.



- BMS Rec-Active
 - Controlling BlueSea 7712 remote battery switch
 - Wifi module
 - Pre-charge module
- Alternators
 - Two, Balmar XT-250 on J10 serpentine belts, one on each Yanmar 4LHA-HTP engine
 - Limited to 65% field current, with temperature sensors limiting alternator temperature to 85C
- Regulators
 - Two, Wakespeed WS500, controlled by Rec-Active BMS via Canbus
- Independent monitoring
 - Victron BMV-712 with external relay-output alarm for bank HV and LV
- Independent temperature fuses
 - SDF DF077S thermal fuses, one on each cell, in series with control wire to BlueSea7712 remote battery switch
 - These are the non-resettable thermal fuses that are sometimes used in hairdryers, portable electric heaters, toasters, and other heating appliances.
 - If any cell heats up, the battery is disconnected, independent of the BMS.
 - Note that the series resistance of LFP is very low, so there is essentially no self-heating in normal use.





- Load dump protection
 - Two Victron Argofet battery isolators, one for each alternator, to split each alternator's output between the "house" LFP and the AGM engine start battery.
 - Regulator sense wires on output of battery isolator, before the BS7712 remote battery switch, so that the regulator always senses alternator output voltage.
 - Alternator current can always flow to AGM start battery, absorbing load dump if the LFP battery becomes disconnected.
 - Battery isolators also serve as alternator service disconnects, preventing battery voltage from appearing on the alternators when the engines are being serviced.
 - Battery isolator protects battery from alternator diodes that fail shorted (albeit unlikely).
 - AGM charge voltages are compatible with LFP charge voltages.
 - ABYC requirements are met prohibiting interconnection of different chemistry batteries.

