Starting Battery and Alternator upgrade project
A BOA VIDA, Catalina 320 Hull 972
Danny Jensen

The project was broken down into 9 phases

1. Design and ordering parts
2. Starting Battery installation
3. House battery and Starting Battery Wiring with Xantrex Shunt and Blue Seas ACR
4. Xantrex Link Lite Battery Monitor Installation
5. Conduit and Wire Pulling needed for Alternator
6. Voltage Regulator Installation
7. Alternator Installation
8. Main Panel Wiring
9. System Test Under Load

I am grateful for all the on-line articles on this subject. It is my hope that this article will save you time. If you find this article valuable, please take the time and document some the projects you have been working on so others can benefit from your experience.

DESIGN PHASE

I spent about 2 months studying articles, schematics and photos from the following really smart people:

- Myron Welch (schematic) – My primary Source
- Chris Ashley (schematic)
- Karl Mielenhausen
- Jeff Hare
- David Swanson
- Roy Kraft
- Warren Updike

Thanks to these people, I got the courage to tackle this project and I was able to "stand on the shoulders of giants". Thank you again for your contributions!

Next, here is a list of recommended reading before you do any ordering:

Recommended Reading:

- http://www.catalina320.com/
- http://www.pbase.com/mainecruising/battery_cables
- http://www.pbase.com/mainecruising/wire_termination
- http://www.pbase.com/mainecruising/flooded_battery_orientation
- http://www.pbase.com/mainecruising/terminating_small_wires
- https://groups.google.com/forum/#!forum/c320-list

- http://www.pbase.com/mainecruising/wire_labeling
- http://www.pbase.com/mainecruising/battery_fusing
- http://www.amazon.com/Boatowners-Mechanical-Electrical-Manual-Essential/dp/0071432388
- http://www.yanmarmarine.co.uk/pdfs/service_manual/EPB5494.pdf
- http://fairwind.org/boats/C320/Catalina320Manual.pdf

Design Considerations:

1. Parallel 2 existing house batteries to get more amp hours per Jeff Hare's design
2. Install battery monitor to monitor house loads and assess available capacity
3. Install multimeter to measure alternator output and replace existing volt meters on main panel
4. Install group 27 starting battery orient battery long ways port starboard
5. Install charging relay (ACR) to isolate starting battery. Isolated start battery will be useful in the likely event I kill off my house batteries at anchor.
6. Provide protection for batteries using low cost MRBF fuses. Protect against dead short.
7. When possible, eliminate the use of in line fuses in favor of centralized fuse boxes using low cost blade fuses. This will make troubleshooting easier and eliminate fuse clutter.
8. Run conduits to consolidate wire distribution in battery area, port side where bilge pump is located and aft port side where water pump is. Conduits will have pull strings and will have extra wire in them for future projects/emergency wiring
9. Install 100A Balmar Alternator with MC-614 regulator. Max recommended alternator for ½" belt is 110 amps. Voltage regulator should have longer life if located outside of engine room. Balmar harness is 53 inches. Take advantage of MC-614 feature to run alternator in small engine mode at reduced output to conserve engine horse power and reduce bearing wear on engine components.
10. Provide circuit protection for Balmar alternator.
11. Extend status leds to panels
12. Label each wire when practical so wiring is self documenting
13. Cost? Wow I'm guessing the project cost including tools was about $2,500. Way more than I expected at the start of the project. I've got extra parts left over.
14. Time? At least 80 hours including ordering parts etc. This is not a project for the summer. You will be a slave.

Upgraded Electrical Components
Balmar 6 Series Alternator 100A
Balmar MC-614 Voltage Regulator
Xantrex Link Lite battery monitor
Xantrex True Charge 40 Charger
Blue seas 7610 SI ACR
Blue seas mrbf battery fuse
Blue Seas 8236 multi meter Amps and VDC
Marine Starting Battery Group 27

Thanks for posted design
from these very smart guys
(google their articles):
Myron Welch (schematic)
Chris Ashley (schematic)
Karl Mielenhausen
Jeff Hare
David Swanson
Roy Kraft
Warren Updike

Recommended Reading:
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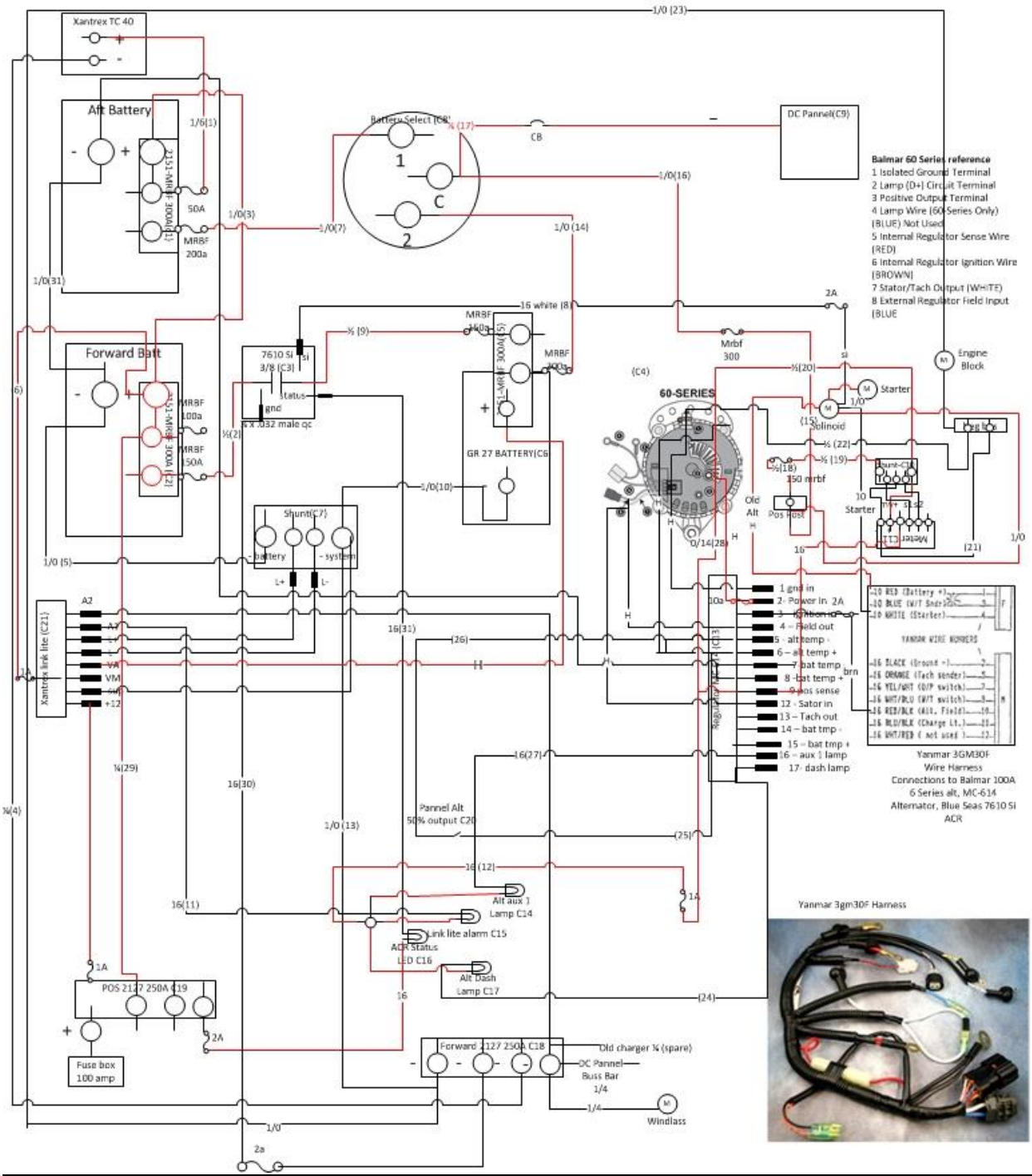
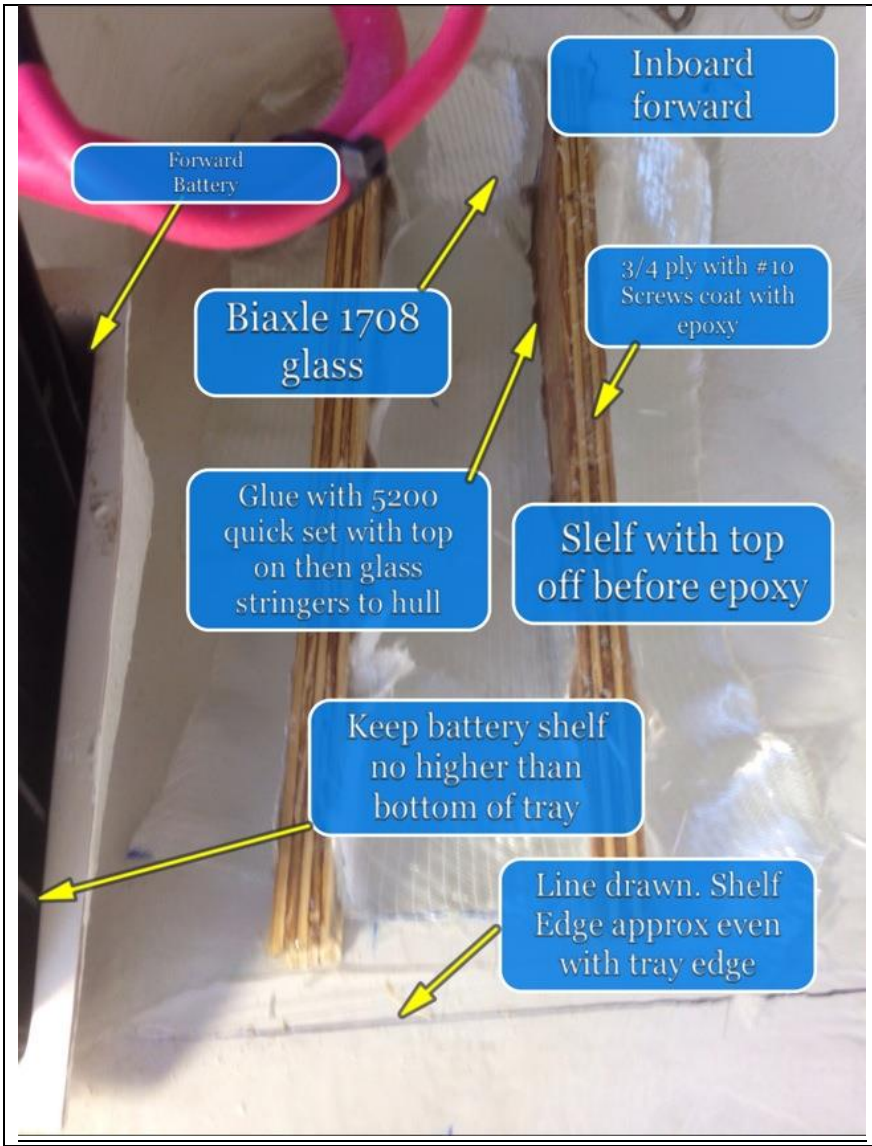
http://www.pbase.com/mainecruising/wire_termination
http://www.pbase.com/mainecruising/flooded_battery_orientation
http://www.pbase.com/mainecruising/terminating_small_wires
https://groups.google.com/forum/#!forum/c320-list
http://www.pbase.com/mainecruising/wire_labeling
http://www.pbase.com/mainecruising/battery_fusing
http://www.amazon.com/Boatowners-Mechanical-Electrical-Manual-Essential/dp/0071432388
http://www.yanmarmarine.co.uk/pdfs/service_manual/EPB5494.pdf
http://fairwind.org/boats/C320/Catalina320Manual.pdf

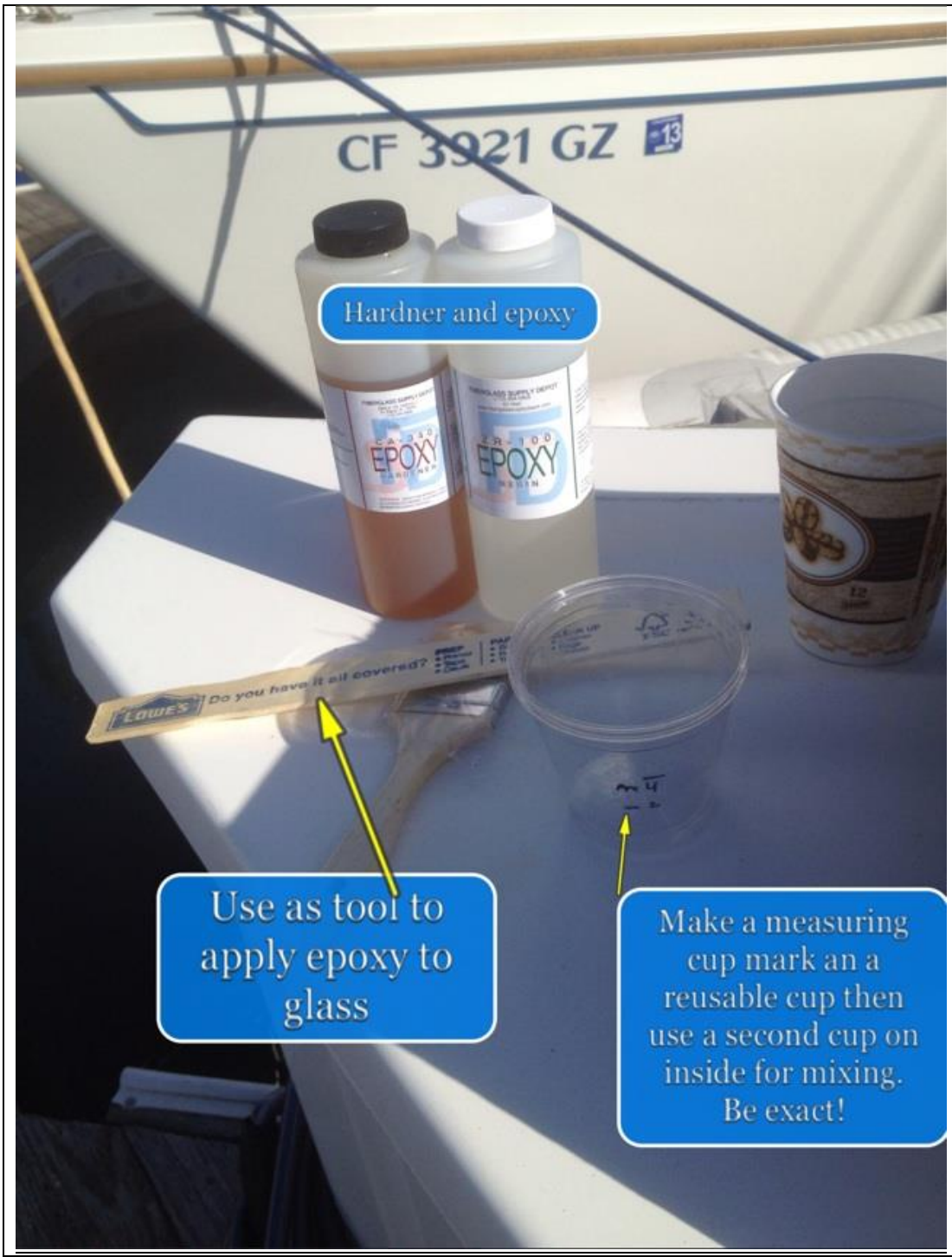
Revision 5 11/22/2013
A Boa Vida Hull #972 Electrical Schematic
Catalina 320 2004
Yanmar 3GM30F-YEU
AUTHOR: Danny Jensen 11/22/2013
Redondo Beach, CA



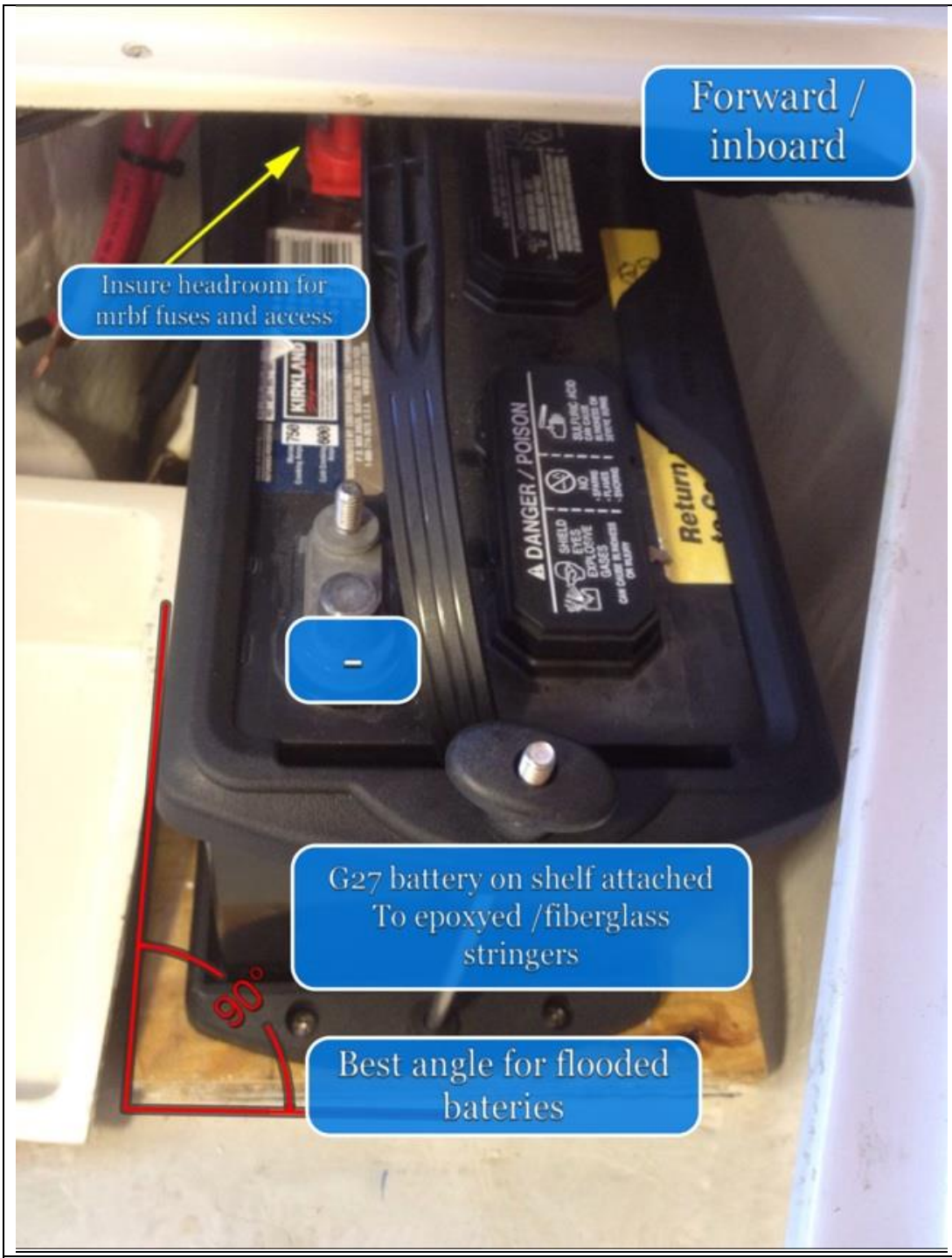
STARTING BATTERY INSTALLATION



I purchased a half sheet of ¾ inch sanded plywood at lowes then I used cardboard and duct tape to make a model of the stringers that I placed the shelf on. Once the model was complete I cut the stringers with a jig saw and cut a shelf to match the foot print of the battery hold down purchased from West Marine. The shelf would not be glassed in. Only the stringers are glassed to the null and I screwed the self to the stringers. All plywood needs to be painted with epoxy before installation. The tricky part is to have the stringers in place to be glassed in. First I assembled the shelf on the stringers, sanded the surface were the stringers would go, then I applied a large amount of 5200 quick set to the bottom of the stringers. Once the 5200 was dry, I unscrewed the shelf and glassed the stringers to the hull with epoxy and biaxle 1708 fiberglass. After epoxy is dry then screw down shelf and battery tray. Shelf placement and height is critical. If I were to do it again I'd like to get more room. Jeff Hare recommends a Group 27 optima battery. I think I spend the extra money on a smaller optima battery next time. It was really tight once I put the MRBF fuses on the battery; I had almost no extra space.

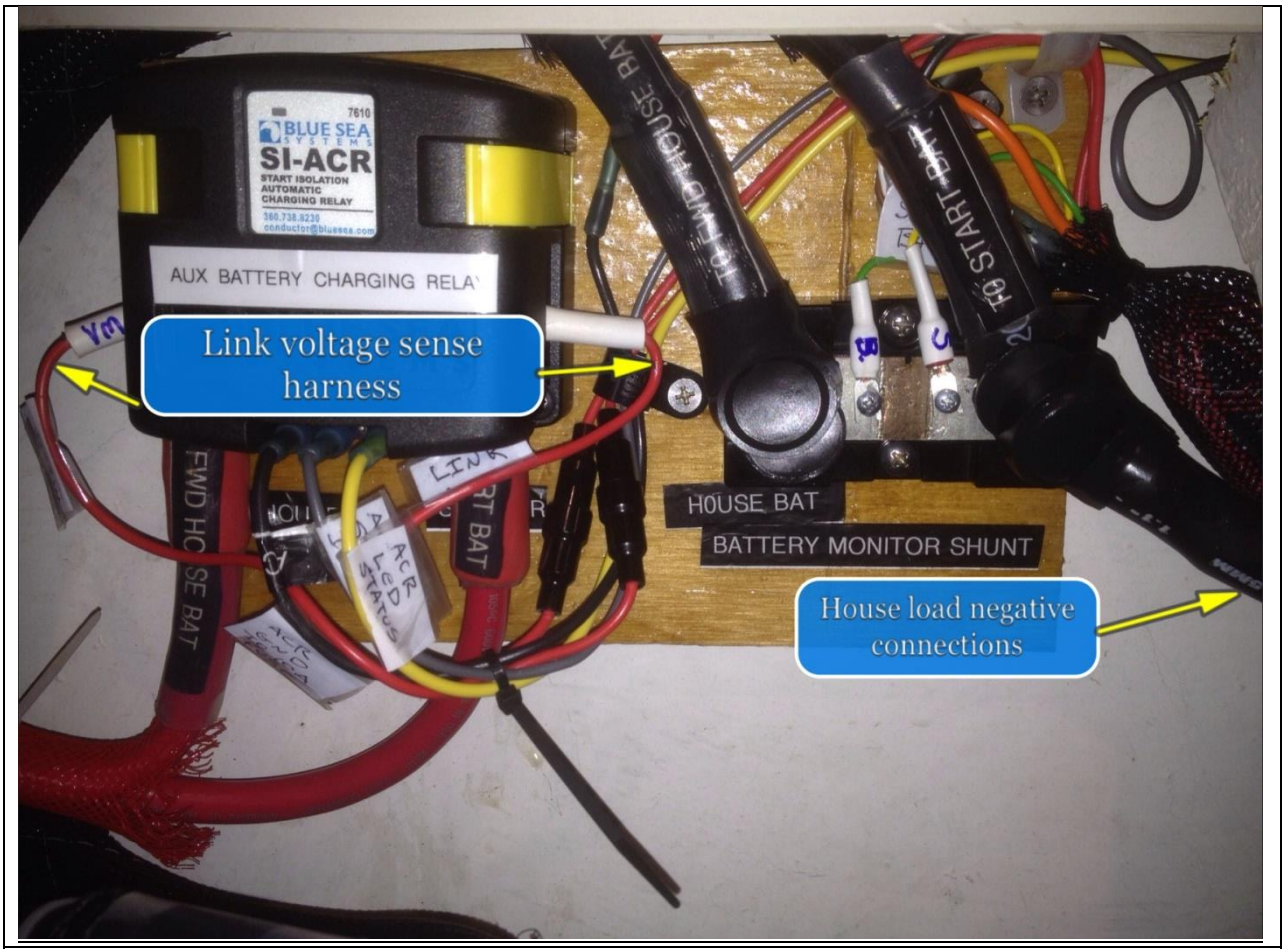


Glass and epoxy were purchased from http://fiberglasssupplydepot.com . Screws are inexpensive here. Here is a trick I found to make a reusable measuring cup sleeve. Epoxy needs to be stirred well and make sure your hardener to resin ratio is exact otherwise you will have a big mess on your hands. Use latex gloves. Epoxy is thick use the stirring stick to spread on the stringers. A chip brush is okay for painting the wood with epoxy. I mixed the epoxy in that coffee cup.



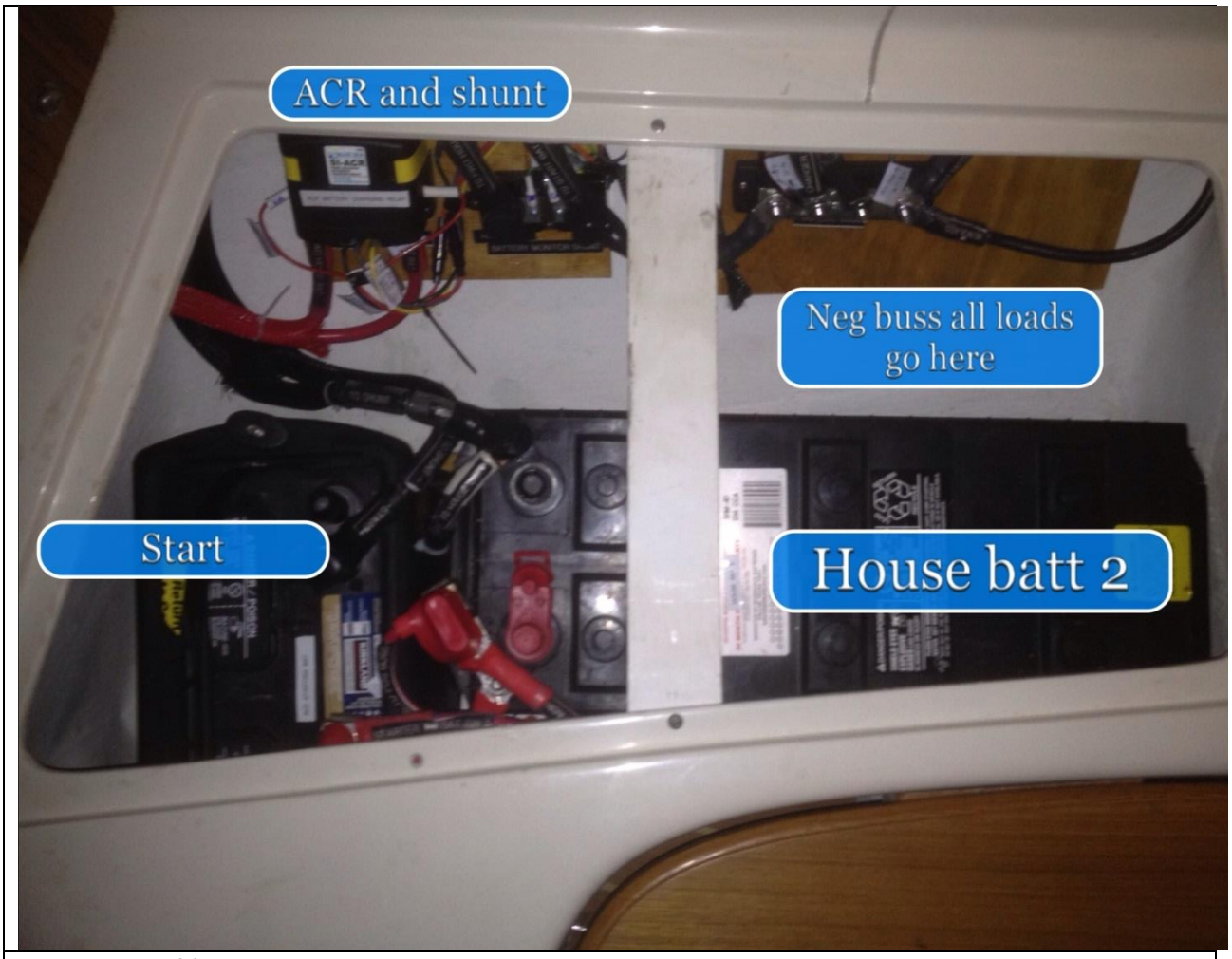
The shelf you see is removable and is screwed to stringers with 2 inch #10 screws. I don't think the battery is going anywhere. The battery hold down was really hard to secure on the inboard side. Notice the battery is going under the settee. I've got just enough head room here. I needed to take the 4D forward battery out to get the G27 Battery in. Either use a smaller size battery G24 or optima G27 and avoid this issue?

Needed to glue on epoxy painted ¾ backboards with 5200 quick set (24 hr dry time). Use scuba weighs and line to press to the side of hull.

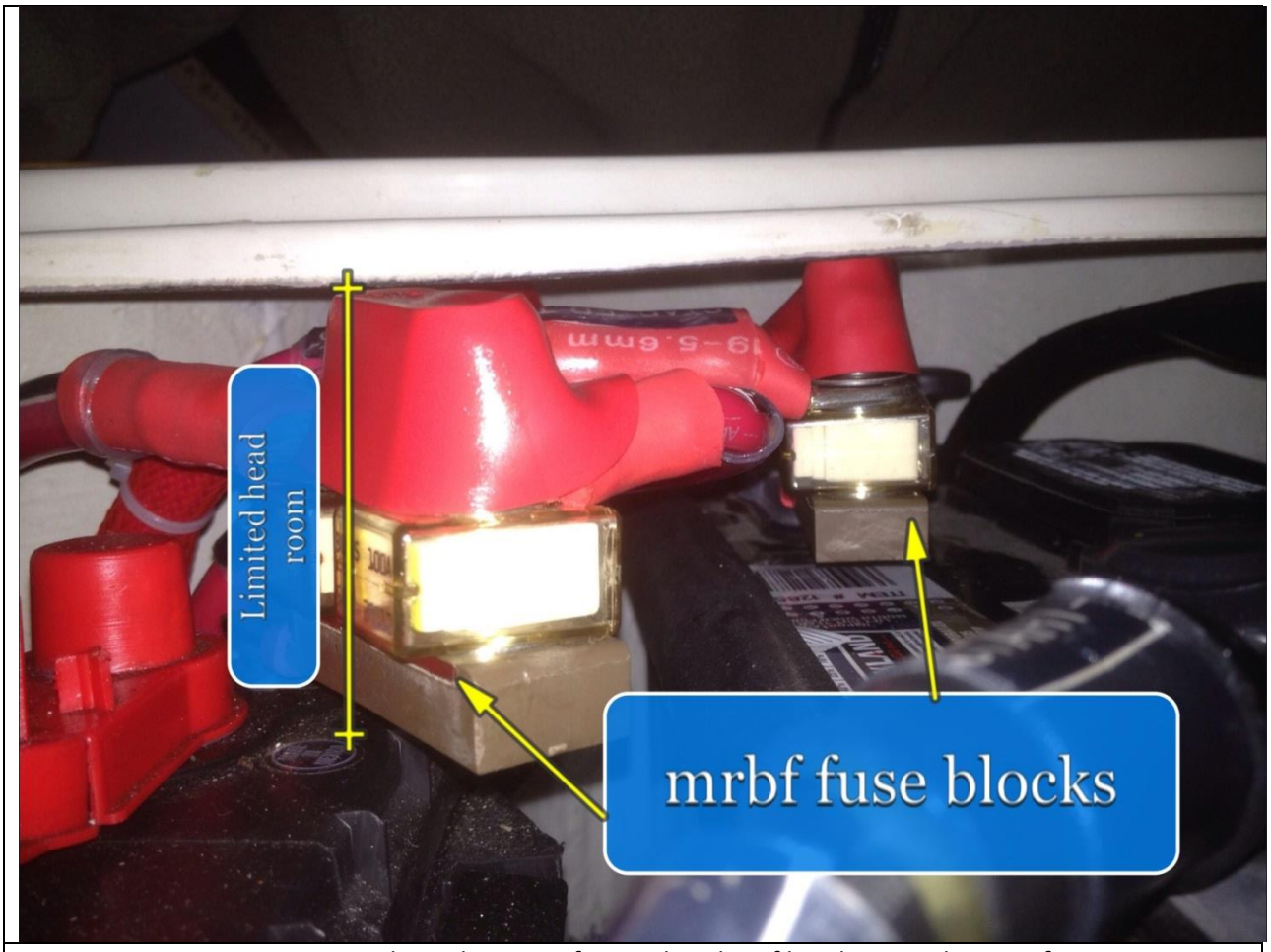


Shot of ACR and Link Lite Shunt. Notice Link is just monitoring amps from/to house bank only. Voltage is being monitored via voltage sense I terminated on ACR. I wanted to keep the battery terminals free of clutter.

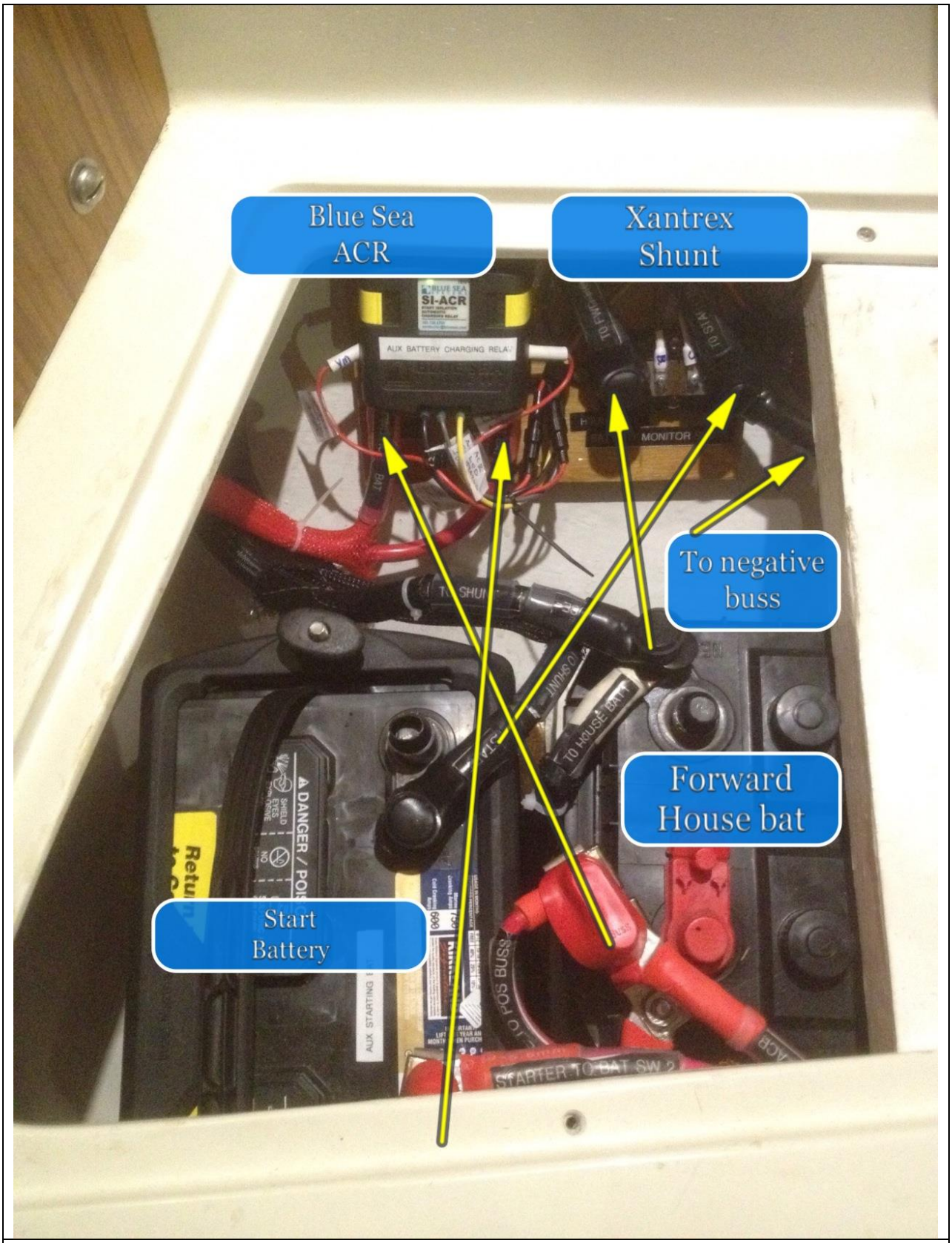
All loads go here notice I needed to terminate the ground from motor to his buss or my battery meter would not give the correct reading.



Macro View of forward battery compartment

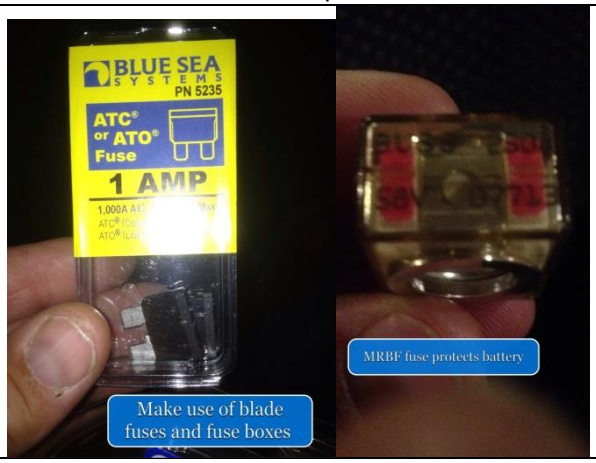


You can see here the MRBF fuses take a bit of head room. They just fit.

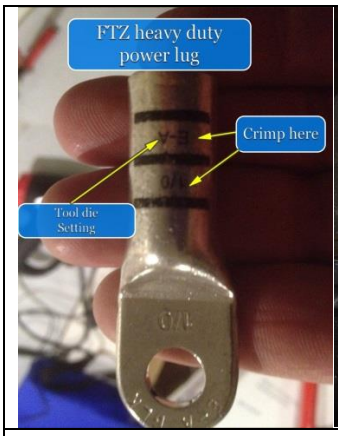


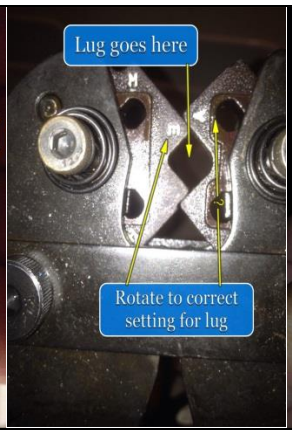
The schematic attached has all the wiring but you can get an idea here as to the physical layout.

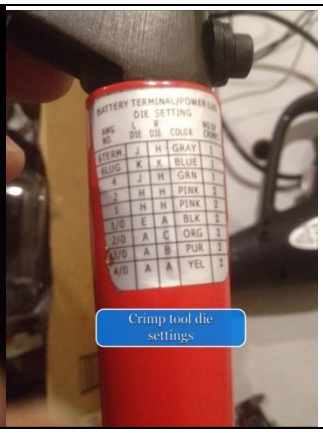
Positive buss bar for future and also this runs a small 24 hr sub panel for link monitor and acr status led. It is easy to power cycle the link monitor with this setup.



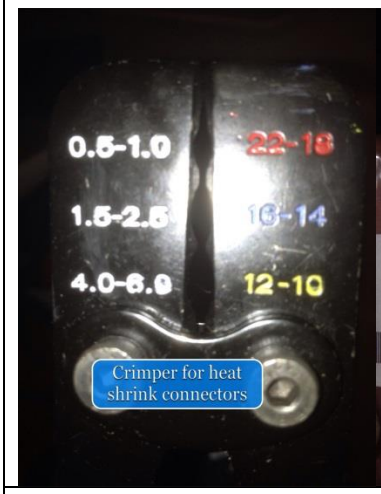
Blade fusing and fuse boxes are used instead of inline fuses when possible. MRBF fuses are used for high amp applications.

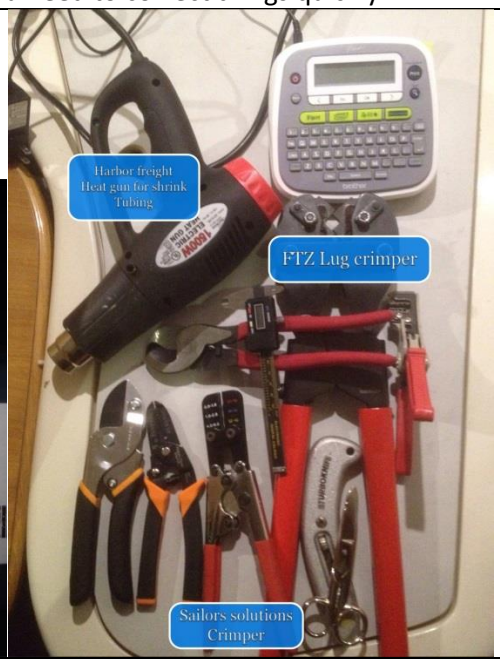






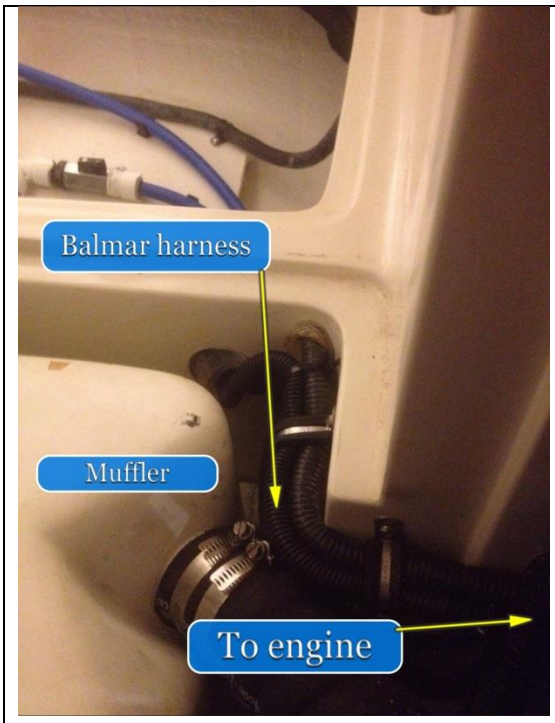
Use FTZ power lugs. Better than Ancor lugs. Here is the FTZ tool. Read the Compass article referenced for directions on how to crimp. Making your own cables is necessary. It is really hard to estimate the lengths you will need and it is easy to make mistakes and you need to correct things quickly.



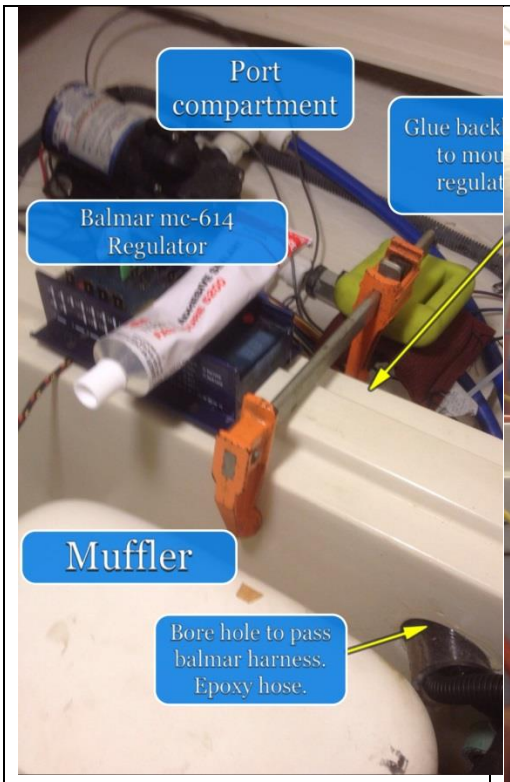


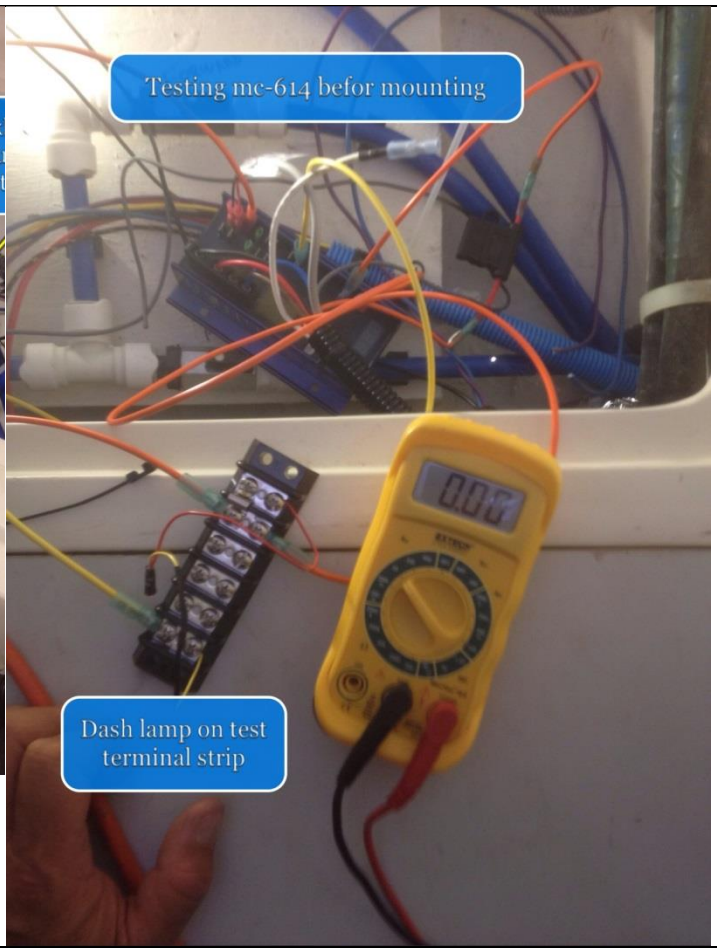
Use adhesive lined shrink connectors. Read Compass article I referenced. Here is some tools needed for the job. See Compass marine articles for more details.

New battery select panel before I found out that my start battery was actually on Switch Position 1 and House was on Switch Position 2. Notice I drilled a hole for and installed an led to let me know if the ACR is combined. I ordered the Xantrex link cable for about $50. It came with crimp terminals and about 3 times the cable I needed but I did use about 20 feet of the Xantrex cable to run wire from the regulator to the main panel.

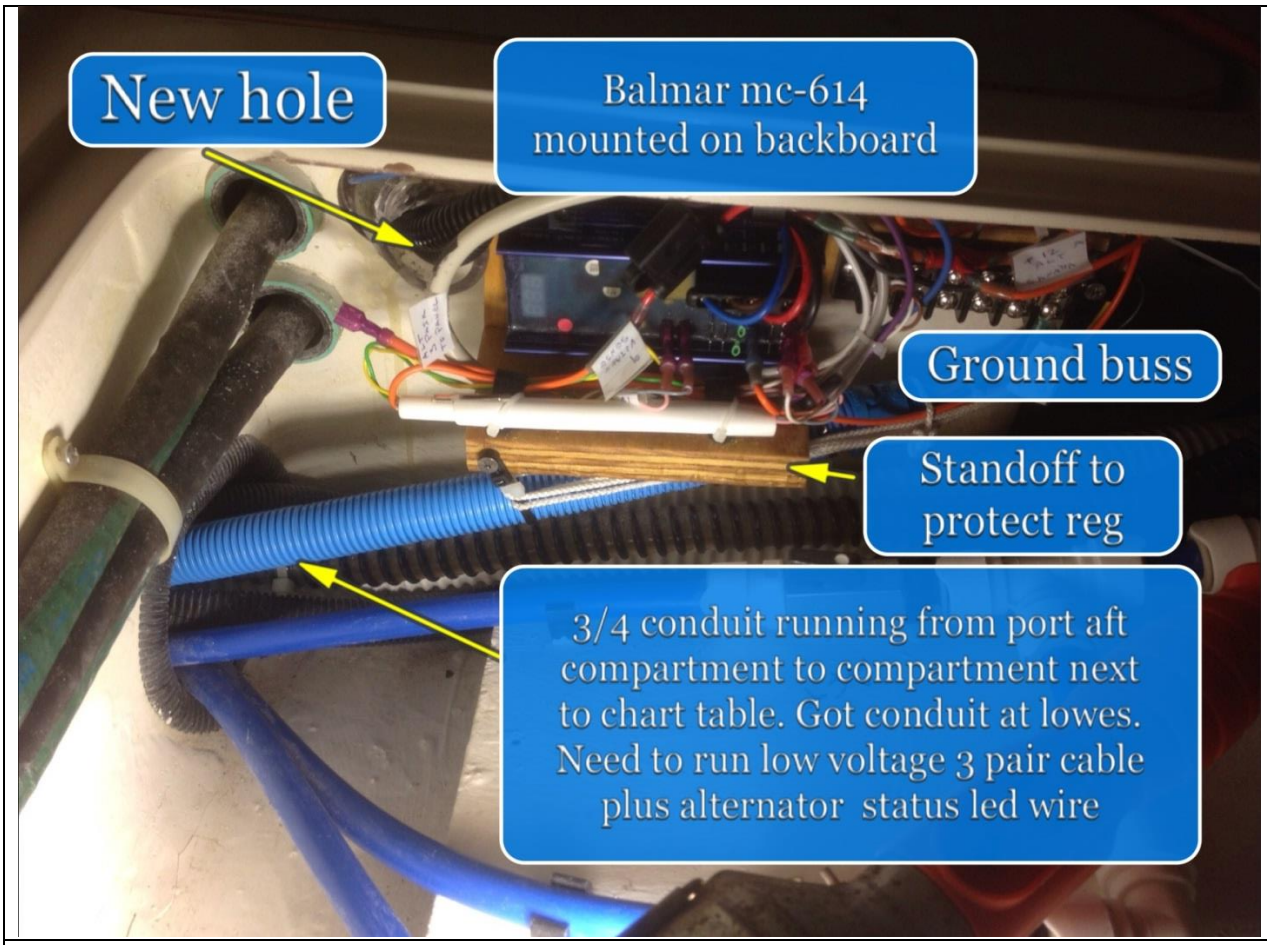


Needed to locate the balmar regulator outside of engine area in port compartment and run harness back to engine. I read on line where Balmar ARS regulators were failing then when they moved them outside the engine room, failures stopped. Warren Updike used this mounting place and it works well. Harness wires were added for positive alternator shunt. Plastic clamps were replaced with metal clamps. Blue Sea multi-meter 8248 comes with a shunt for the negative buss but I had to use a shunt shifter circuit shown on top of shunt to be able to use the meter on the +12 line between the alternator and the common battery select line. Notice the MRBF fuse on the alternator side of the shunt. The black ground wire here is coming from the main DC Panel. Try to leave enough room to remove the muffler. I needed to move the overflow tank about ½ inch to fit the shunt in. The balmar harness follows the Yanmar harness to the alternator.

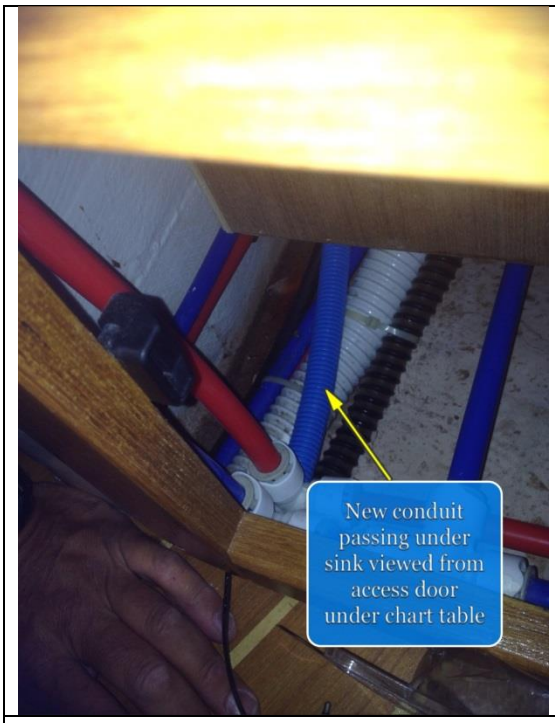


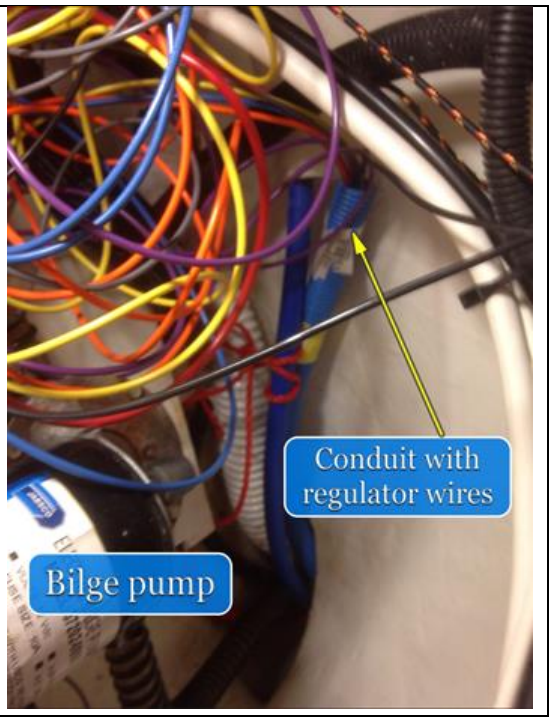


Gluing backboard to compartment so I can mount the regulator after I made a hole for the hose. To the right, you can see my preflight test with regulator unmounted and wiring loose. Follow the Balmar preflight testing protocol. Here are some programing / wiring details. **Wiring** Pin 3 brown run to horizontal plug in old alternator (see pictures later), Pin 4 and 5 alt temp run switch back to main panel for small engine mode and also piggy back alternator temp sensor. See Balmar manual. I purchased a kit for that included battery and alternator temp sensors. Pin 7 and 8 run back to aft battery via conduit channels. Pin 16 aux lamp used to indicate small engine mode/alternator over temp. Pin 17 Dash lamp low charging voltage run to mail panel LED with buzzer. You can also run this to the engine console. Pin 12 sator in – do terminate the white wire but you won't need this for the yanmar 3gm30 because we use a mechanical tac. Pin 13 tach out again not needed for yanmar but you electronic tach people will need this to run to your tach. **Programming** – Program your battery type. Mine is fdc (flooded). For my 100A alternator I skipped the belt manager because I have a small engine mode switch configured. Next I disabled the bDL alternator failure advisory mode and turned sator output monitoring off. Monitoring on was default and caused my dash lamp to flash at low RPM.



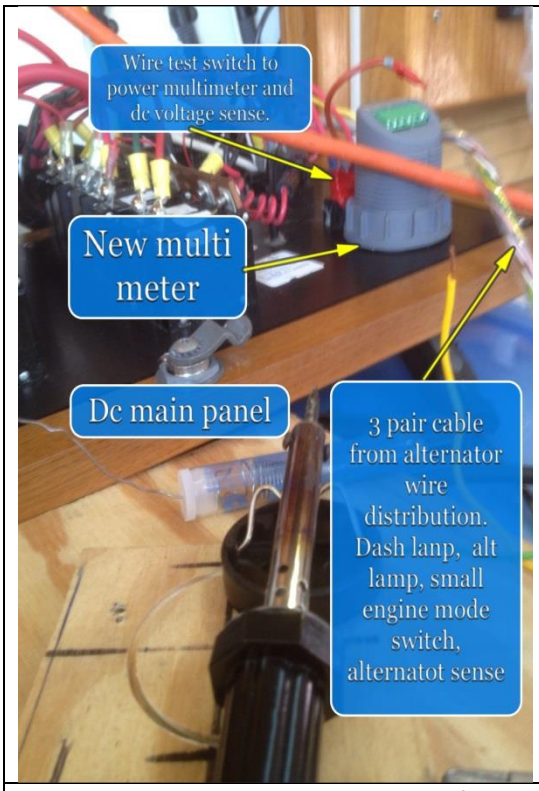
Port side of aft cabin where balmar mc-614 is mounted. I'm running the shunt wires in from the engine room along with the balmar harness wires. Then I run a 3 pair STP communication cable from the balmar mc-614 and shunt to the main panel.

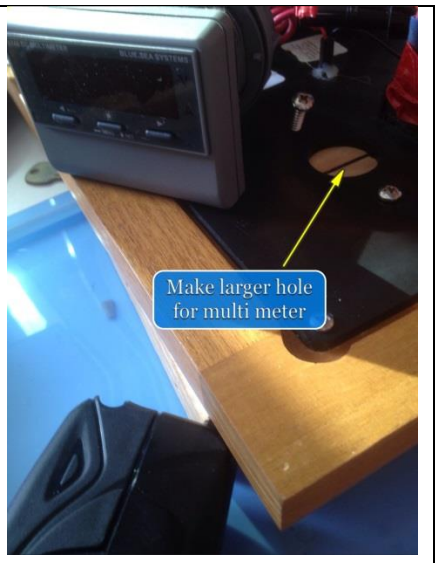




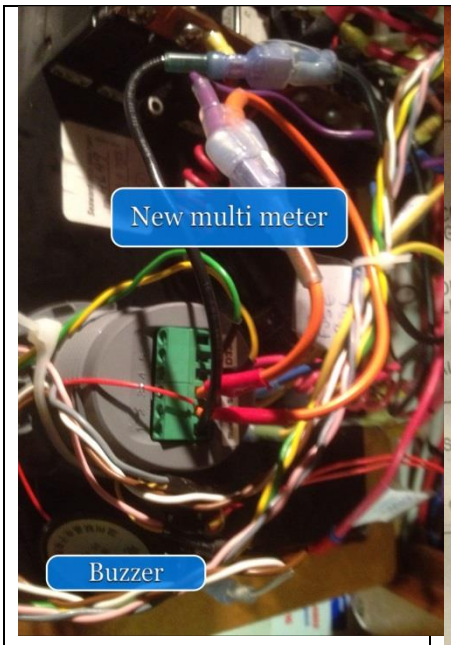
The conduit from the aft cabin port side needed to be run down on the port side under the sink then I could fish it from the compartment where the bulge pump is. The conduit is called flex-plus blue ENT. They sell it at lowes in 10 ft. sections. Just enough to make the run. I did need to couple on an extra foot. Jeff Hare used this I believe it is really cheap and rigid perfect for this application. It was really hard to get the end of the conduit here. I needed to run a fish tape down the conduit then grab the fish wire and then I finally got the conduit here. It took about 3 hrs. I first ran ½ inch conduit then I needed more wire so I ending up pulling a ¾ in conduit to get all the wires I needed to the regulator plus I'm got a few spares. I'm running battery temp, small engine mode, dash lamp, alt lamp and alternator shunt wires plus a ground from the dc panel. ¾ will give me the room I need for more upgrades.

A shot of the cross connect are in the bilge compartment where wires run up to the dc panel, run to the starboard battery area and run aft to the compartment in the aft cabin to the regulator. I have pull strings and conduits run to each area. Notice the starter wire run through this fuse box to the ACR on the starboard side. Led lamps and the multi meter are run from the +12 Alternator lead in the engine. This +12 is voltage sense on the Balmar MC-614 pin 9. I'm using a leftover segment of shielded twisted pair cable from the Xantrex link lite to make the run to the Main Panel from the Regulator.

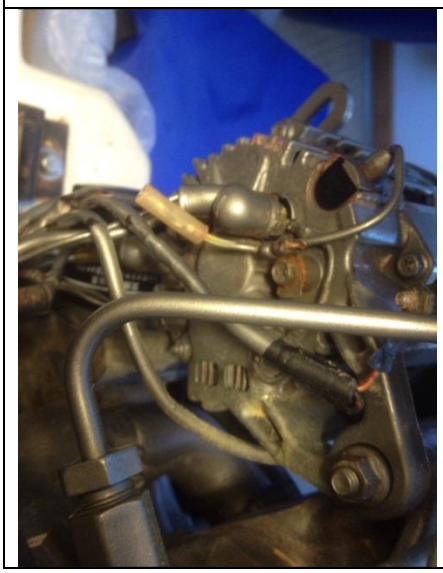




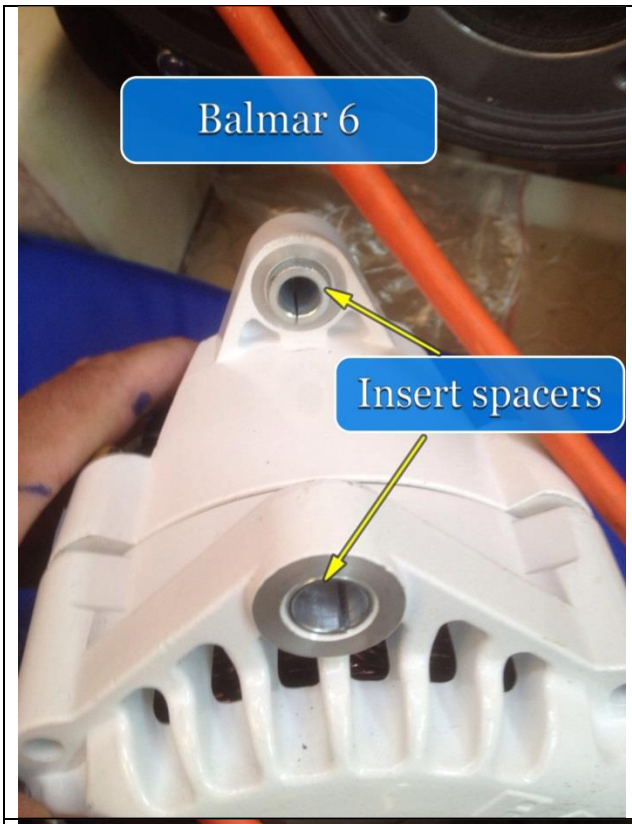
The multi meter always shows amps from the alternator. The voltage sense and power to the meter is switched by the 3 position battery test switch and can be turned off like the old volt meter. Here is the STP 3 pair cable I'm running from the Balmar regulator via the bulge pump distribution area. Here I screwed some backing plywood on the panel to be a guide for my hole saw to make the opening bigger for the Blue Sea multi meter. Next I needed to drill holes for the leds and also wire the switch for small engine mode where I can run the alternator at 50% output unless I'm at anchor and really need to charge in a hurry. You will also notice the soldering iron in the foreground. The Xantrex multi wire shielded twisted pair wire is not tined. I had great problems getting this 22awg wire to stay in the screw terminals in the link lite and blue sea multi meter. I needed to tin the ends of the 22 awg wire and then I used heat shrink to reinforce the wire otherwise everything was crimped or screwed down. 22 awg is hard to work with. Make sure you get good stripping tools!



Voltage from the house or the alternator positive terminal is read. Also note the alternator output switch. An amber led indicates the alternator is in 50% output mode. The multi meter can be shown in the amp mode where it read amps from the alternator shunt. A buzzer alarm is attached to alternator sense power and the negative lead can run be crimped on the red led. I read LED can also be put on the dash at the wheel and wired to the buzzer with the oil pressure sensor.

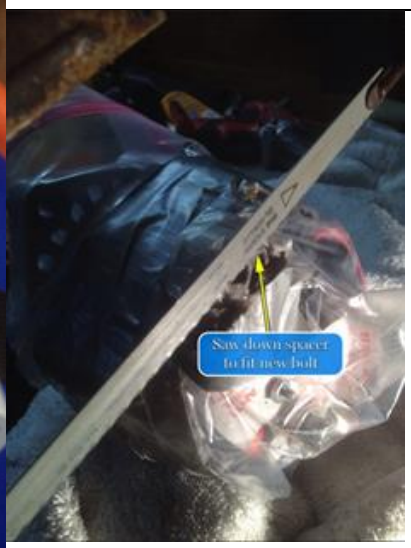


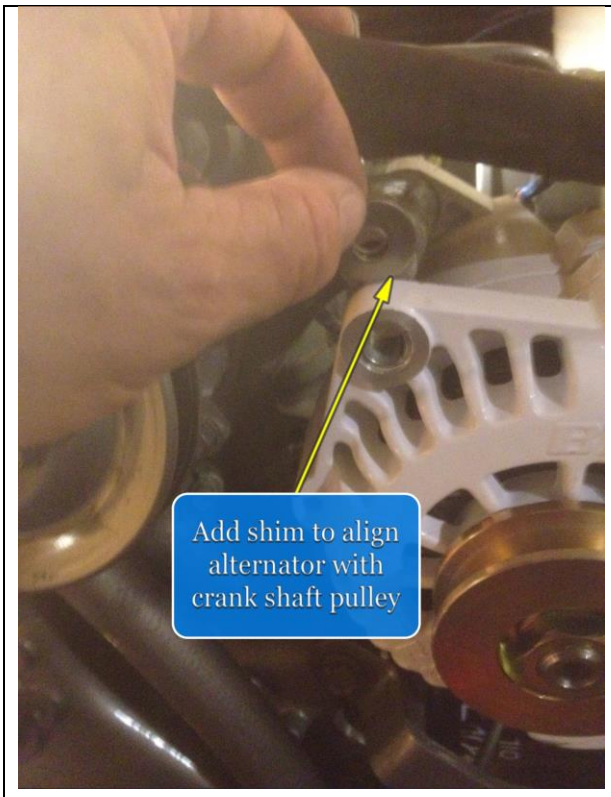
yanmar 129772-77200 55AMP alternator. Hitachi LR155. You only need to worry about positive and negative terminal plus the ignition plug. The saddle bolt here is not long enough for the new saddle on the balmar 6 series so you need to buy a bolt metric bolt about ½ to 1 inch longer. Plan for this. Don't worry about a tach connection for yanmar's. Make sure you read everything below before you disconnect.



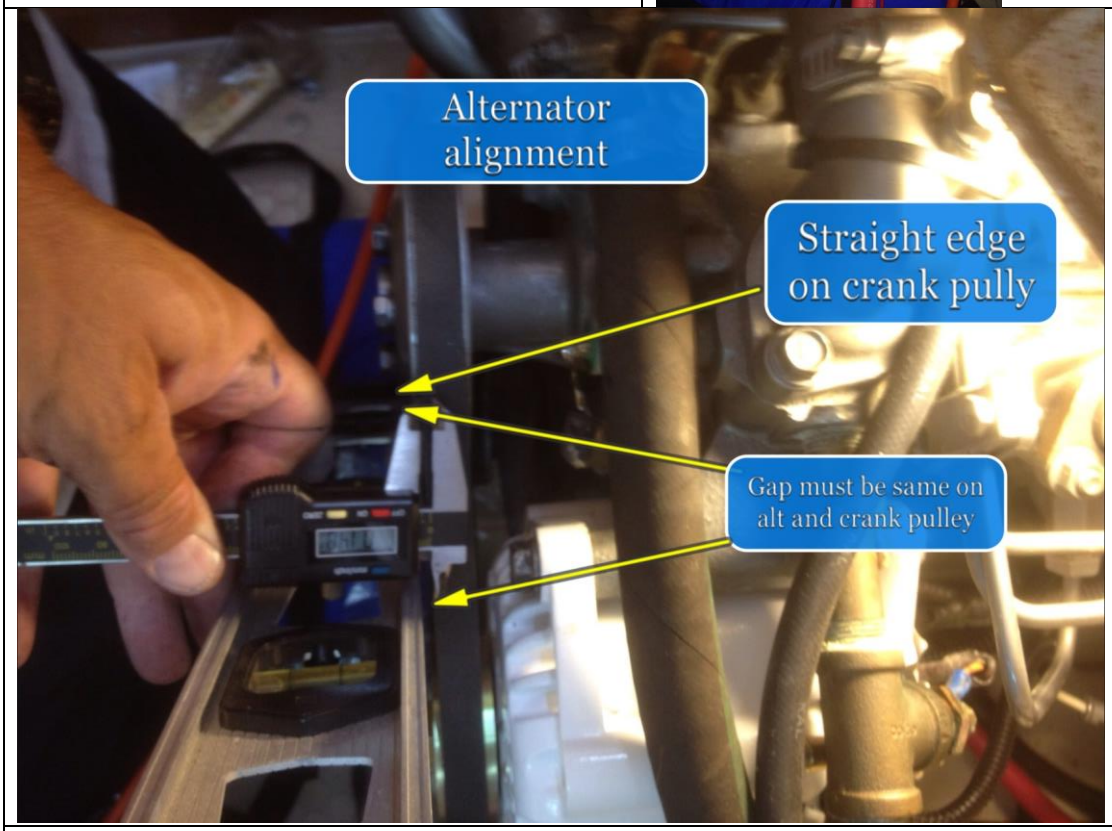
Insert spacers from Balmar Kit. You may need vise grips for aft hole.

Insert copper bushing through spacer and 8M nut should be snug but you will need a new bolt approx ½ to 1 inch longer. This was hard to find. Approx size you need is 5 inches x 8 M X 1.25 thread. You may need to saw down the spacer to get your new bolt to fit.





Get some thick steel 5/16 washers and some thin washers. Some of the washers should be larger if possible the start by shiming the alternator forward by 2 washer thickness as shown here. Get your gates 25-9380HD belt you special ordered from Napa auto parts for $21.00 after testing the old Yanmar belt to make sure the old belt and new belt are the same size. Don't even think about using that old Yanmar belt unless you want black dust all over your motor and new alternator.

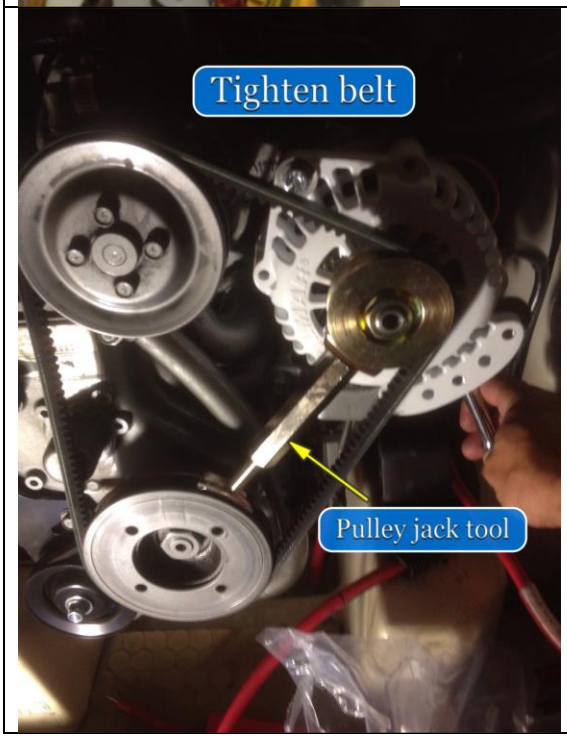


Alternator alignment - Get out your Harbor freight calipers and straight edge to span between the crank

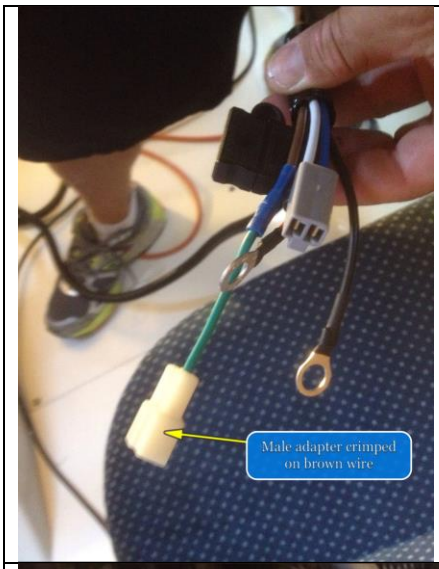
pulley and the alternator pully (I used a level) and make sure the distance from the crank edge to the v belt on the crank matches the distance between the alternator pulley v belt and the straight edge resting on the surface of the crank pulley. Measure this on both sides of the alternator pulley, top and bottom. You may need to add more shims on the bottom alternator bolt than you did on the saddle bolt. A good trick is to just take a few washers and stick them in the gap instead of measuring. Don't skip this step.

Order this belt jack from MSC Industrial Supply. http://www.mscdirect.com/product/35438209?rItem=35438209

It is really handy for sticking on backboards with 5200 too. This will make your life easier. The cost is $20.54 plus shipping. I couldn't find one at Harbor Freight.



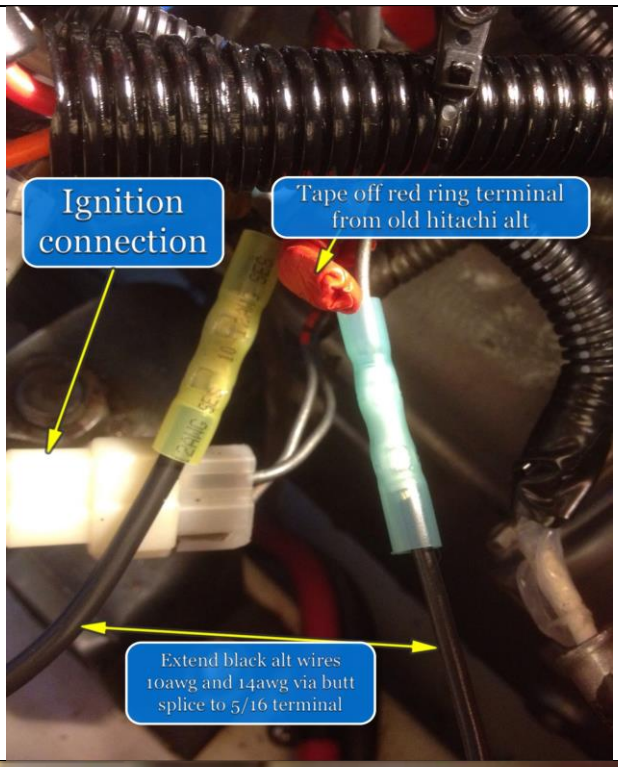
You see here I'm tightening the alternator adjustment bolt after tightening the one bolt on the alternator arm and inserting about 3 wasters on the bottom between the arm and the alternator and I have 2 washers in the saddle indexing the alternator toward us. I used the Balmar adjustment bolt that came with the kit. The bolt stripped out! The threads were still attached to the bolt. All that shimming limits the amount of threads that the adjustment bolt has available. I recommend that you trough bolt the alternator to the adjustment arm on the second hole from the top. Make the bolt long enough so you can put a 1" stainless clamp on the other side with another nut. You will feed positive and negative 2 awg alternator cable through the clamp.

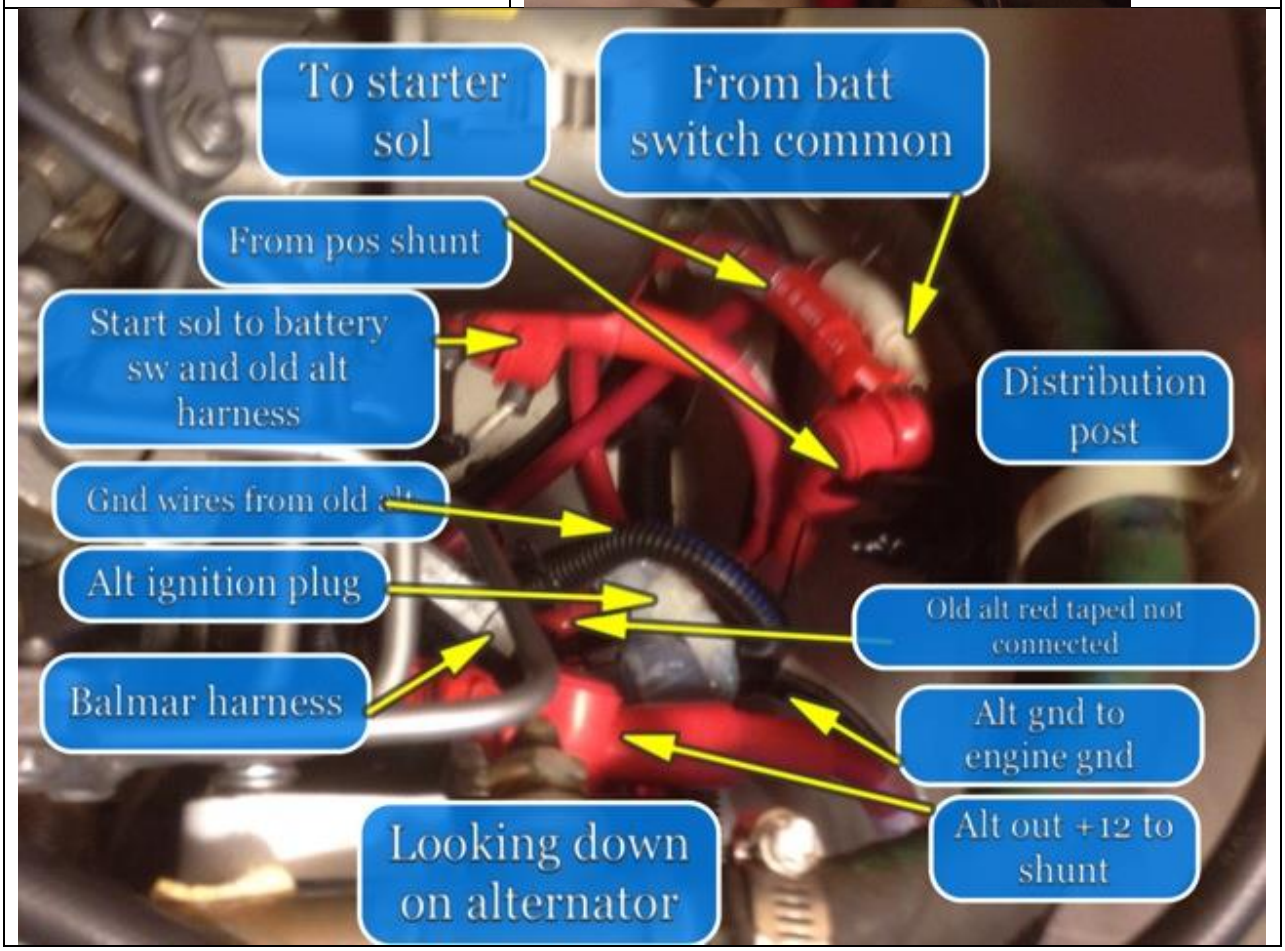


Here is the MC-614 alternator side of the harness. You may want to go to an auto parts store and get a male pin mate to the existing Yanmar harness to run the ignition wire to the brown wire. The other wires just terminate on the 5/16 positive and negative posts on the alternator. Only one wire needs to be run the other can be disconnected. The other quick connector is has a mate on the Balmar alternator. The fused wire you see powers the unit. One other wire is voltage sense for battery. Since I'm charging the batteries via the battery select switch I just run voltage sense to the alternator positive post. The voltage sense fuse is on the alternator side of the harness.

You need to get a mating connector from the auto parts store or just butt splice the connection to the brown wire. Next you can just tape off the connection to the red as the other end of the cable connects to the starter post and we leave it connected to provide power to ignition and other motor functions. The black wire terminal ring here is too short for the new alternator so you will need to extend it and put a 5/16 ring on the end. Notice we don't have tach wires because we have a mechanical tach on the 3GM30.

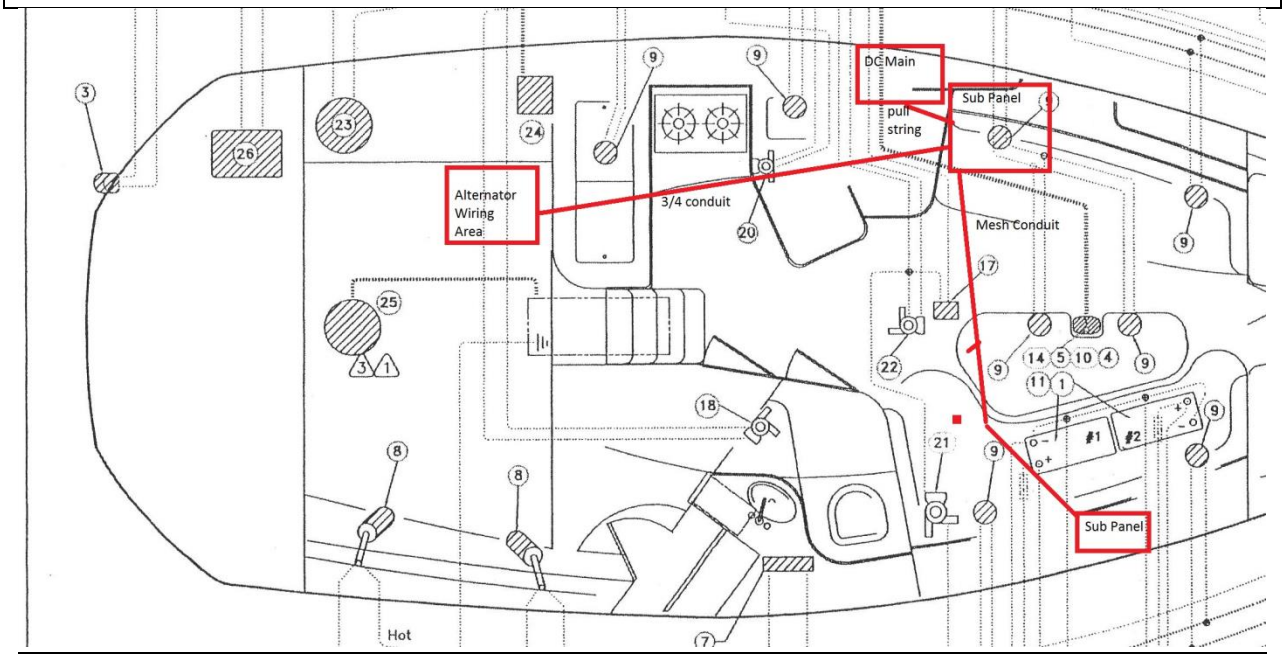
Here is a shot where you can see the butt spliced the negative wires and taped the hot lead. Also the ignition is mated with the Balmar Harness.

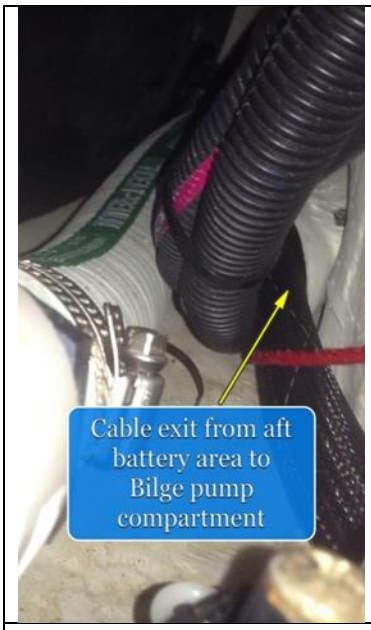




We needed to use a distribution post because the starter solinoid post was copper and did not have enough capacity to hold heavy gage wires. The starter post was also a bit stripped. We have a Blue Sea positive and negative post. We are terminating battery switch, starter and alternator shunt wire. On the starter post we only have the ring for the Yanmar harness and the Starter Wire. This simplifies things. Notice split loom is used to protect the old ground wires. You are now ready to to the pre flight test for the regulator.

See below for the wire distribution locations.



	Here you see a shot taken of a cable run just forward of the holding tank where the positive cable routes from here across the bilge and to the compartment

Appendix

https://www.genuinedealz.com/

Best place to purchase Blue Sea Products , wire and connectors

Heavy Duty Cable Lug Tinned Copper 1/0 AWG Gauge Stud Size 3/8 Inch	91757	$2.71	Ordered: **3** Shipped: **3**	$8.13
Heavy Duty Cable Lug Tinned Copper 1/0 AWG Gauge Stud Size 5/16 Inch	91756	$2.71	Ordered: 15 Shipped: 15	$54.20
Heavy Duty Cable Lug Tinned Copper 2 AWG Gauge Stud Size 5/16 Inch	91766	$2.88	Ordered: **6** Shipped: **6**	$17.28
1/0 AWG Butt Splice Heavy Duty Tinned Copper	91850	$2.46	Ordered: **3** Shipped: **3**	$7.38
6 AWG Butt Splice Heavy Duty Tinned Copper	91810	$1.58	Ordered: **2** Shipped: **2**	$3.16
4 AWG Butt Splice Heavy Duty Tinned Copper	91820	$1.70	Ordered: **2** Shipped: **2**	$3.40
1/0 AWG Gauge Battery Cable Tinned Copper Marine Wire Red /ft	BC1/0RD	$5.24	Ordered: **12** Shipped:	$62.88

			12	
1/0 AWG Gauge Battery Cable Tinned Copper Marine Wire Black /ft	BC1/0BK	$5.24	Ordered: **11** Shipped: **11**	$57.64
2 AWG Gauge Battery Cable Tinned Copper Marine Wire Red by the foot	BC2RD	$3.25	Ordered: **15** Shipped: **15**	$48.75
1/0 AWG Gauge Battery Cable Tinned Copper Marine Wire Black by the foot	BC2/0BK	$6.33	Ordered: **6** Shipped: **6**	$37.98
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Black 25 ft	BC16BK-XXV	$7.86	Ordered: **2** Shipped: **2**	$15.72
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Orange 100 ft	BC16OR-C	$16.73	Ordered: **1** Shipped: **1**	$16.73
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Blue 100 ft	BC16BL-C	$16.73	Ordered: **1** Shipped: **1**	$16.73
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Gray 100 ft	BC16GY-C	$16.73	Ordered: **1** Shipped: **1**	$16.73
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Yellow 100 ft	BC16YL-C	$16.73	Ordered: **1** Shipped: **1**	$16.73
16 AWG Gauge Primary Wire Tinned Copper Marine Grade Violet 100 ft	BC16VI-C	$16.73	Ordered: **1** Shipped: **1**	$16.73
6 AWG Gauge Battery Cable Tinned Copper Marine Wire Red by the foot	BC6RD	$1.24	Ordered: **6** Shipped: **6**	$7.44
Heavy Duty Cable Lug Tinned Copper 4 AWG Gauge Stud Size 5/16 Inch	91726	$1.33	Ordered: **3** Shipped: **3**	$3.99
2 AWG Butt Splice Heavy Duty Tinned Copper	91860	$2.76	Ordered: **2** Shipped: **2**	$5.52
Nylon C-Clamp for Cable/Hose 3/8 Inch Black - 10 pack	BCCH06-C0-X	$2.20	Ordered: **1** Shipped: **1**	$2.20
Nylon C-Clamp for Cable/Hose 3/4 Inch Black - 10 pack	BCCH12-C0-X	$2.48	Ordered: **2** Shipped: **2**	$4.96
Nylon C-Clamp for Cable/Hose 1 Inch Black - 10 pack	BCCH16-C0-X	$2.84	Ordered: **2** Shipped: **2**	$5.68
Nylon C-Clamp for Cable/Hose 1/2 Inch Black - 10 pack	BCCH08-C0-X	$2.29	Ordered: **1** Shipped: **1**	$2.29
Heat Shrink Tubing Heavy Wall Adhesive Lined 3/4 Inch Diameter				

Heat Shrink Tubing Heavy Wall Adhesive Lined 3/4 Inch Diameter 1 ft Black	21212	$4.24	Ordered: **3** Shipped: **3**	$12.72
Heat Shrink Tubing Heavy Wall Adhesive Lined 1.1 Inch Diameter 1 ft Black	21412	$4.57	Ordered: **2** Shipped: **2**	$9.14
Heat Shrink Tubing Heavy Wall Adhesive Lined 3/4 Inch Diameter 1 ft Red	21312	$4.24	Ordered: **3** Shipped: **3**	$12.72
Heat Shrink Tubing Heavy Wall Adhesive Lined 1.1 Inch Diameter 1 ft Red	21512	$4.57	Ordered: **2** Shipped: **2**	$9.14
Heat Shrink Tubing Adhesive Lined 1/4 Inch Diameter 1 ft Clear	HS3A-025-CL	$1.56	Ordered: **3** Shipped: **3**	$4.68
Heat Shrink Tubing Adhesive Lined 1/2 Inch Diameter 1 ft Clear	HS3A-050-CL	$1.95	Ordered: **2** Shipped: **2**	$3.90
Heat Shrink Tubing Adhesive Lined 3/4 Inch Diameter 1 ft Clear	HS3A-075-CL	$2.43	Ordered: **3** Shipped: **3**	$7.29
Heat Shrink Tubing Adhesive Lined 1 Inch Diameter 1 ft Clear	HS3A-100-CL	$3.48	Ordered: **3** Shipped: **3**	$10.44
Heat Shrink Tubing Adhesive Lined 1/4 Inch Diameter 1 ft White	HS3A-025-WT	$1.56	Ordered: **2** Shipped: **2**	$3.12
Heat Shrink Tubing Adhesive Lined 1/2 Inch Diameter 1 ft White	HS3A-050-WT	$1.95	Ordered: **2** Shipped: **2**	$3.90
Heat Shrink Tubing Adhesive Lined 3/4 Inch Diameter 1 ft White	HS3A-075-WT	$2.43	Ordered: **3**	$7.29

			Shipped: **3**	
Heat Shrink Tubing Adhesive Lined 1 Inch Diameter 1 ft White	HS3A-100-WT	$3.48	Ordered: **3** Shipped: **3**	$10.44
Self Fusing Silicone Tape Red 20 ft roll	99201	$11.03	Ordered: **1** Shipped: **1**	$11.03
Flame Retardant (FR) PET Expandable Braided Sleeving 1.25" 10 ft Roll	BSFR125-BK-X	$9.83	Ordered: **3** Shipped: **3**	$29.49
Blue Sea Systems 5028 ST Blade Fuse Block With Cover - 6 Circuit	5028	$26.10	Ordered: **1** Shipped: **1**	$26.10
Blue Sea Systems 2151 Fuse Block for Battery Terminal Fuse Dual	2151	$28.57	Ordered: **3** Shipped: **3**	$85.71
Heavy Duty Cable Lug Tinned Copper 2/0 AWG Gauge Stud Size 3/8 Inch	91767	$2.88	Ordered: **1** Shipped: **1**	$2.88
Lug or Ring Terminal Boot for Single Stud fits 2 AWG to 2/0 AWG - Red	222E3V02	$2.00	Ordered: **1** Shipped: **1**	$2.00
Lug or Ring Terminal Boot for Single Stud fits 2 AWG to 2/0 AWG - Black	222E3V14	$1.99	Ordered: **1** Shipped: **1**	$1.99
Lug or Ring Terminal Boot for Single Stud fits 8 AWG to 2 AWG - Red	222E2V02	$2.00	Ordered: **1** Shipped: **1**	$2.00
Blue Sea Systems 5191 Fuse Block for Battery Terminal Fuse	5191	$16.75	Ordered: **1** Shipped: **1**	$16.75
Blue Sea Systems 5177 Battery Terminal Fuse 50 Amp	5177	$11.43	Ordered: **2**	$22.86

			Shipped: **2**	
Blue Sea Systems 5190 Battery Terminal Fuse 300 Amp	5190	$11.43	Ordered: **4** Shipped: **4**	$45.72
Blue Sea Systems 5183 Battery Terminal Fuse 100 Amp	5183	$11.43	Ordered: **1** Shipped: **1**	$11.43
3 Way Wire Splice Butt Connector w Adhesive Heat Shrink 22-18 AWG	KS53-16	$1.20	Ordered: **2** Shipped: **2**	$2.40
Metal Bat Toggle Switch SPST On-Off with Tabs	2FA53-73/TABS	$4.54	Ordered: **1** Shipped: **1**	$4.54
16-14 AWG Heat Shrink Quick Disconnect Wire Terminal Female - 5 pack	KS66-14-250F	$2.83	Ordered: **4** Shipped: **4**	$11.32
16-14 AWG Heat Shrink Quick Disconnect Wire Terminal Male - 5 pack	KS66-14-250M	$2.83	Ordered: **1** Shipped: **1**	$2.83
22-18 AWG Heat Shrink Quick Disconnect Wire Terminal Male - 5 pack	KS66-18-250M	$2.83	Ordered: **1** Shipped: **1**	$2.83
Wire Splice Butt Connector w Adhesive Heat Shrink Terminal 22-18 AWG - 10 pack	KS5-16-X	$4.51	Ordered: **1** Shipped: **1**	$4.51
Wire Splice Butt Connector w Adhesive Heat Shrink Terminal 16-14 AWG - 10 pack	KS5-14-X	$4.70	Ordered: **1** Shipped: **1**	$4.70
Cable Lug Tinned Copper Ring 2 AWG Gauge Stud Size 1/4 Inch	91035	$1.15	Ordered: **3** Shipped: **3**	$3.45
3 Way Wire Splice Butt Connector w Adhesive Heat Shrink 12-10 AWG	KS53-10	$1.45	Ordered: **1**	$1.45

			Shipped: **1**	
4 Way Wire Splice Butt Connector w Adhesive Heat Shrink 16-14 AWG	KS54-14	$1.45	Ordered: **1** Shipped: **1**	$1.45
Wire Splice Butt Connector w Adhesive Heat Shrink Terminal 12-10 AWG - 10 pack	KS5-10-X	$5.88	Ordered: **1** Shipped: **1**	$5.88
10 AWG Gauge Primary Wire Tinned Copper Marine Grade Red 25 ft	BC10RD-XXV	$17.00	Ordered: **1** Shipped: **1**	$17.00
22-18 AWG Heat Shrink Quick Disconnect Wire Terminal Female - 5 pack	KS66-18-250F	$2.83	Ordered: **1** Shipped: **1**	$2.83
12-10 AWG Heat Shrink Quick Disconnect Wire Terminal Male - 5 pack	KS66-10-250M	$3.39	Ordered: **1** Shipped: **1**	$3.39
12-10 AWG Heat Shrink Quick Disconnect Wire Terminal Female - 5 pack	KS66-10-250F	$3.39	Ordered: **1** Shipped: **1**	$3.39
16-14 AWG Heat Shrink Ring Terminal #8 Hole - 25 pack	KS114-08	$8.86	Ordered: **1** Shipped: **1**	$8.86
16-14 AWG Heat Shrink Ring Terminal 5/16 Hole - 25 pack	KS114-516	$10.58	Ordered: **1** Shipped: **1**	$10.58
Braided Expandable Wire Sleeving 3/4" 10 ft Roll Red	BS075-RD-X	$7.80	Ordered: **1** Shipped: **1**	$7.80
16-14 AWG Heat Shrink Ring Terminal #10 Hole - 25 pack	KS114-10	$8.86	Ordered: **1** Shipped: **1**	$8.86
Cable Lug Tinned Copper Ring 6 AWG Gauge Stud Size #10	91014			

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• 2 of : Blue Sea 2127 Maxibus 4 X 5&Frasl;16-18 Stud Common	$54.96	Shipped
• 1 of : Blue Sea 5004 Anl 300 Fuse Block W/Out Cover	$15.78	Shipped
1 of : Blue Sea 7610 120 Amp Si-Series Automatic Charging Relay	$69.34	Shipped
1 of : Blue Sea 8242 Shunt Adapter For Dc Digital Ammeter	$57.62	Shipped
• 1 of : Blue Sea 8248 Dc Digital Multimeter W/ Alarm	$191.15	Shipped
• 1 of : Xantrex Connection Kit F/Linklite & Linkpro	$91.35	Shipped
• 1 of : Xantrex Linklite Battery Monitor	$209.29	Shipped

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