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Issue 1  
Revision A

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**Welcome!**

If you have made it this far, congratulations! You have taken another step in obtaining some piece of mind during the next power failure! In these next pages, I've tried to outline the basic steps in building, buying, and operating the emergency backup power system that I use at home. As stated in the "about" page, this is a hybrid system that uses either solar panels or a gasoline generator to recharge the batteries (based on the weather conditions at hand). Fitting the entire system (solar panels, rolling toolbox, generator, and charger) in the back of my truck was one of the basic system design requirements. It is very HEAVY so, use ramps or a friend to help you lift it. I can power my essential items at home or take it to someone else's house and power their essential items in a pinch. You can easily modify the design based on your budget and power needs.

You may notice, I do not discuss the specific mounting of my solar panels—that is because I am still toying with a couple of options. I actually have 4 panels that are "free floating". I set them up as stand alone units so I can adjust or move them quickly if need be. In the future, I am thinking about mounting them on a small trailer but, that is a project for another day—(possibly in the next Grid Ridder Gazette issue?) You may also notice that I use "standard" electrical outlets (both male and female) on the rolling toolbox—the reason for this design feature is so that I could use *any* heavy duty extension cord to get electricity from any common brand of solar panel to the battery box (I have 4-270 watt panels wired in series for a "low amperage high voltage" arrangement as to not overload the electrical cord). I made a custom MC4 connector to get this job done—you do not have to use this approach. You can connect to the charge controller with traditional MC4 connectors and solar wire if you prefer. Drop me a line if you have any questions, comments or suggestions for improvement.

Enjoy and good luck!

JW





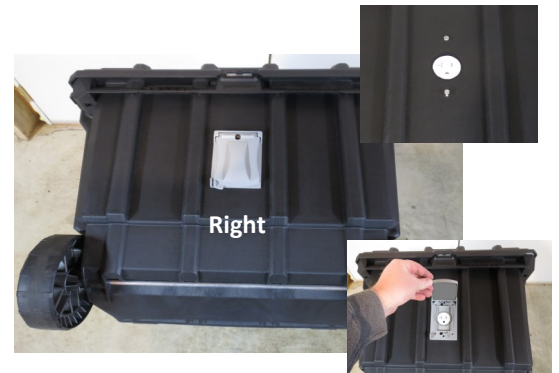
1. Rotozip or Dremmel tool (to cut rectangular hole for RJ45 jack)
2. Drill with bit sizes (5/32", 3/8", 1-1/8", 1-1/2", 2")
3. Misc. tools—Hack saw, Phillips head screwdriver, Socket set, Hammer
4. Handheld wire stripper/crimper, Vice crimper, Various terminals (see wire descriptions)
5. 1- 15 amp outdoor male outlet
6. 1- 20 amp outdoor female outlet
7. 1- 12 volt marine power outlet
8. 1- RJ45 dual jack outlet with RJ45 inserts
9. 2- Shoreline Marine Battery Terminals
10. 1- Tracer 4210 40 Amp Charge Controller
11. 1- Samlex America 2000 Watt Pure Sinewave Inverter
12. 4- Walmart 27DC 12 Volt Deep Cycle Marine Batteries
13. 2- 15" RJ45 patch cables
14. 12- #6-32 x 3/4" machine screws
15. 12- #6 flat washers
16. 12- 5/16" hex nuts
17. 2- 3/8" x 20" threaded rods (cut to length with hacksaw)
18. 4- 3/8" flat washers for threaded rods
19. 4- 9/16" nuts for threaded rods
20. 1- 12"x 16"x 3/4" piece of shelving board
21. 4- 1/2" two hole straps
22. 4- #10 flat washers
23. 12- #8 x 1/2" wood screws
24. 6- 8" lengths of 2 AWG wire with 5/16" ring terminals on **both ends** for battery to battery connections
25. 1- 27" length of 2 AWG wire with 5/16" ring terminals on **both ends** for positive battery to positive inverter connection
26. 1- 37" length of 2 AWG wire with 5/16" ring terminals on **both ends** for negative battery to negative inverter connection
27. 1- 10" length of 8 AWG wire with 5/16" ring terminal on **one end** for charge controller to positive battery connection (strip 1/2" insulation from opposite end)
28. 1- 60" length of 8 AWG wire with 5/16" ring terminal on **one end** for charge controller to negative battery connection (strip 1/2" insulation from opposite end)
29. 2- 18" lengths of 10 AWG wire with #10 spade terminal on **one end** for charge controller to PV connection (strip 1/2" insulation from opposite end)
30. 2- 48" lengths of 10 AWG wire with #10 female terminal on **one end** for charge controller to 12 volt accessory connection (strip 1/2" insulation from opposite end)
31. 1- 36" length of heavy duty electrical cord with #10 spade terminals on **one end** for inverter to female outlet connections. (Keep male end in tact and strip wires at opposite end to make a "pigtail")

*“Measure twice, cut once” — a wise man*

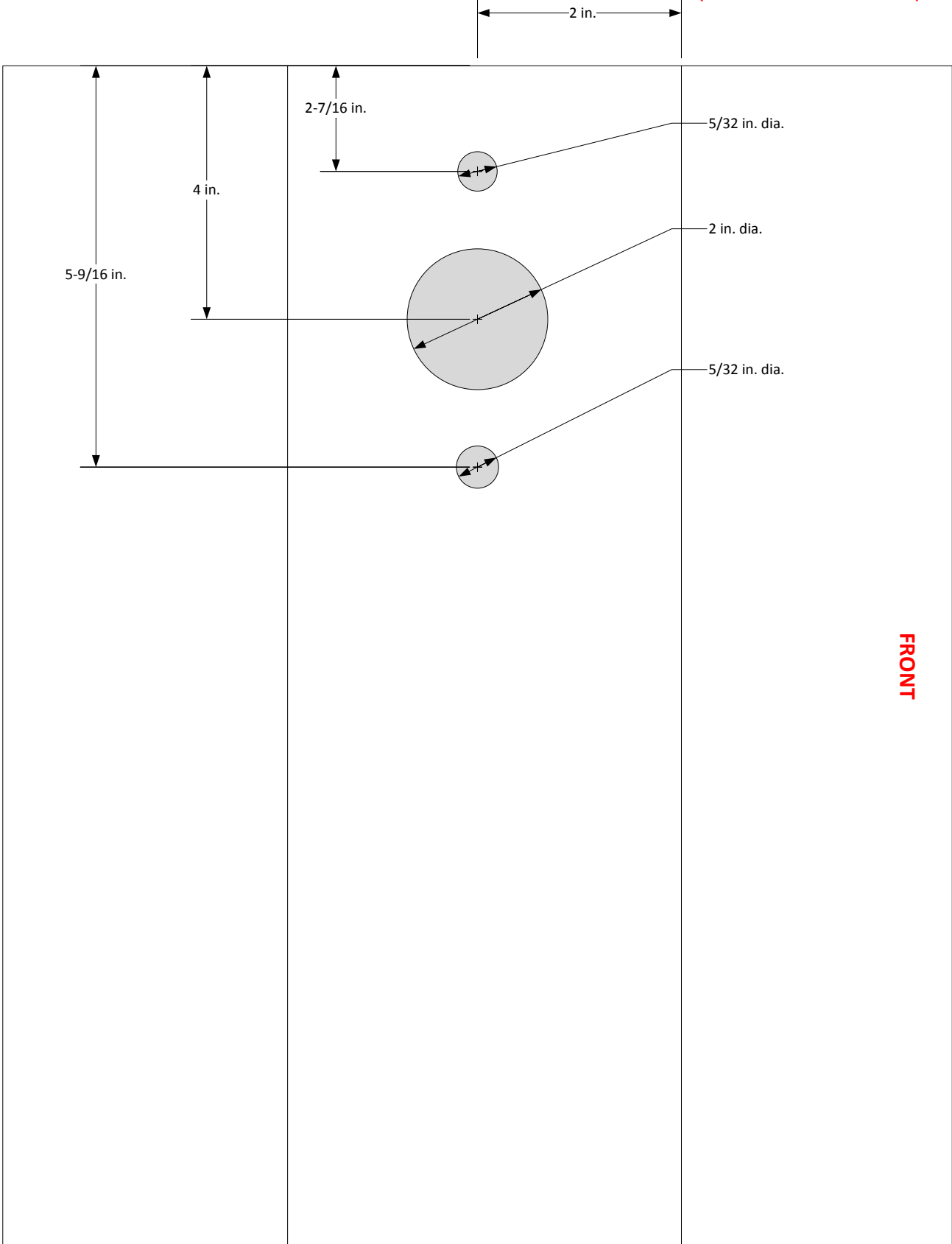
**Preparing the Power Pack (SEE DETAILED SCHEMATIC ON FOLLOWING PAGES)**

I used a drill/bit combo for all holes except the RJ45 jack (I used the Rotozip there)

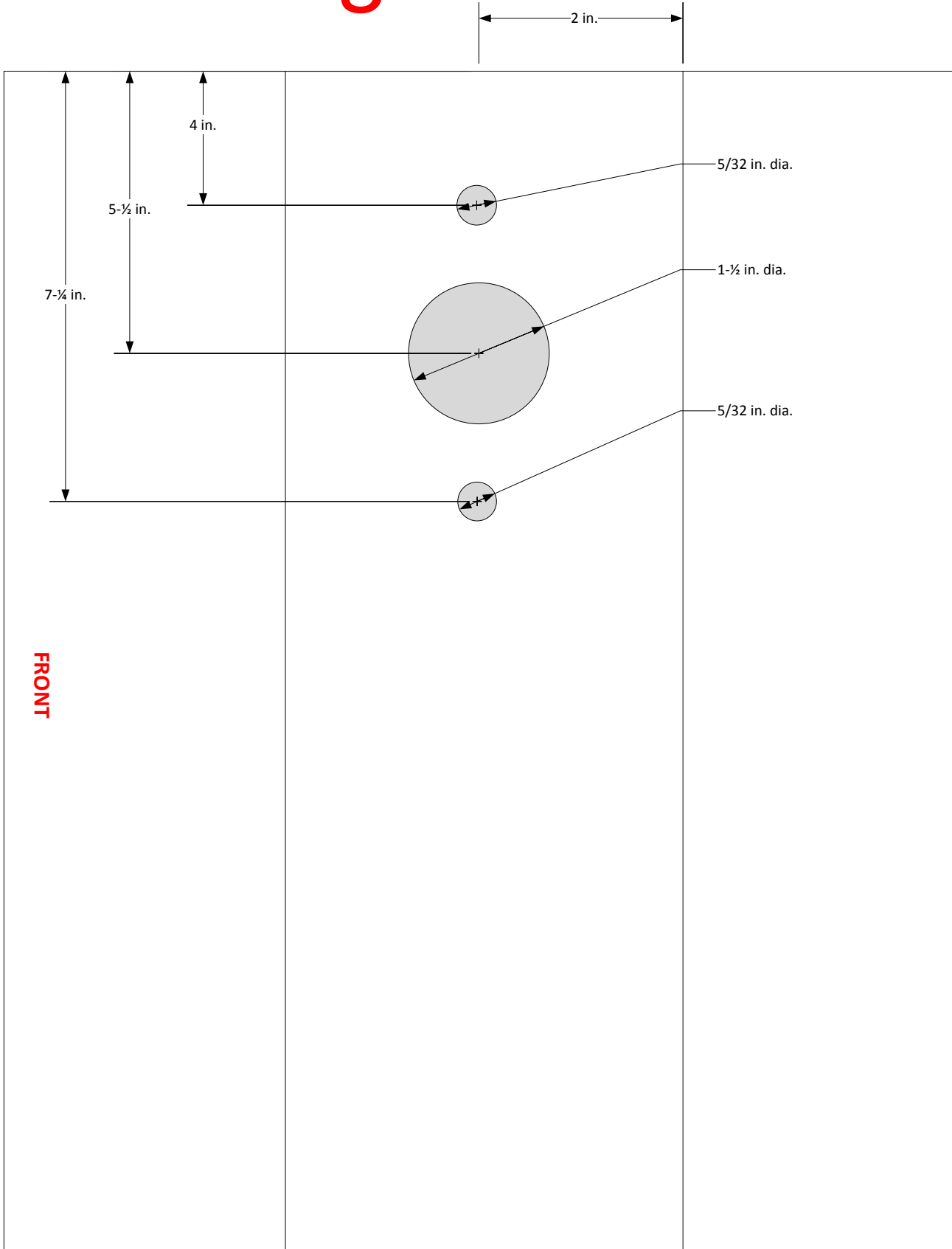
1. On left side of the box, cut holes for male 15 amp outlet. Mount outlet with 2- #6-32 x 3/4" machine screws, 4- #6 flat washers and 2- 5/16" hex nuts.
2. On the right side of the box, cut holes for 20 amp female outlet. Mount outlet with 2- #6-32 x 3/4" machine screws, 4- #6 flat washers and 2- 5/16" hex nuts.
3. On the front of the box, cut holes for 12 volt power outlet . Mount outlet with 2- #6-32 x 3/4" machine screws, 4- #6 flat washers and 2- 5/16" hex nuts.
4. On the front of the box, cut holes and rectangular opening for RJ45 jack. Mount jack with 2- #6-32 x 3/4" machine screws, 4- #6 flat washers and 2- 5/16" hex nuts.
5. On the front of the box, cut 2 holes for the threaded rods. Leave vacant for now. (See schematic)
6. On the back of the box, cut 2 holes for the threaded rods. Leave vacant for now. (See schematic)
7. On the back of box, drill 4 holes for the charge controller. Leave vacant for now. (See schematic)

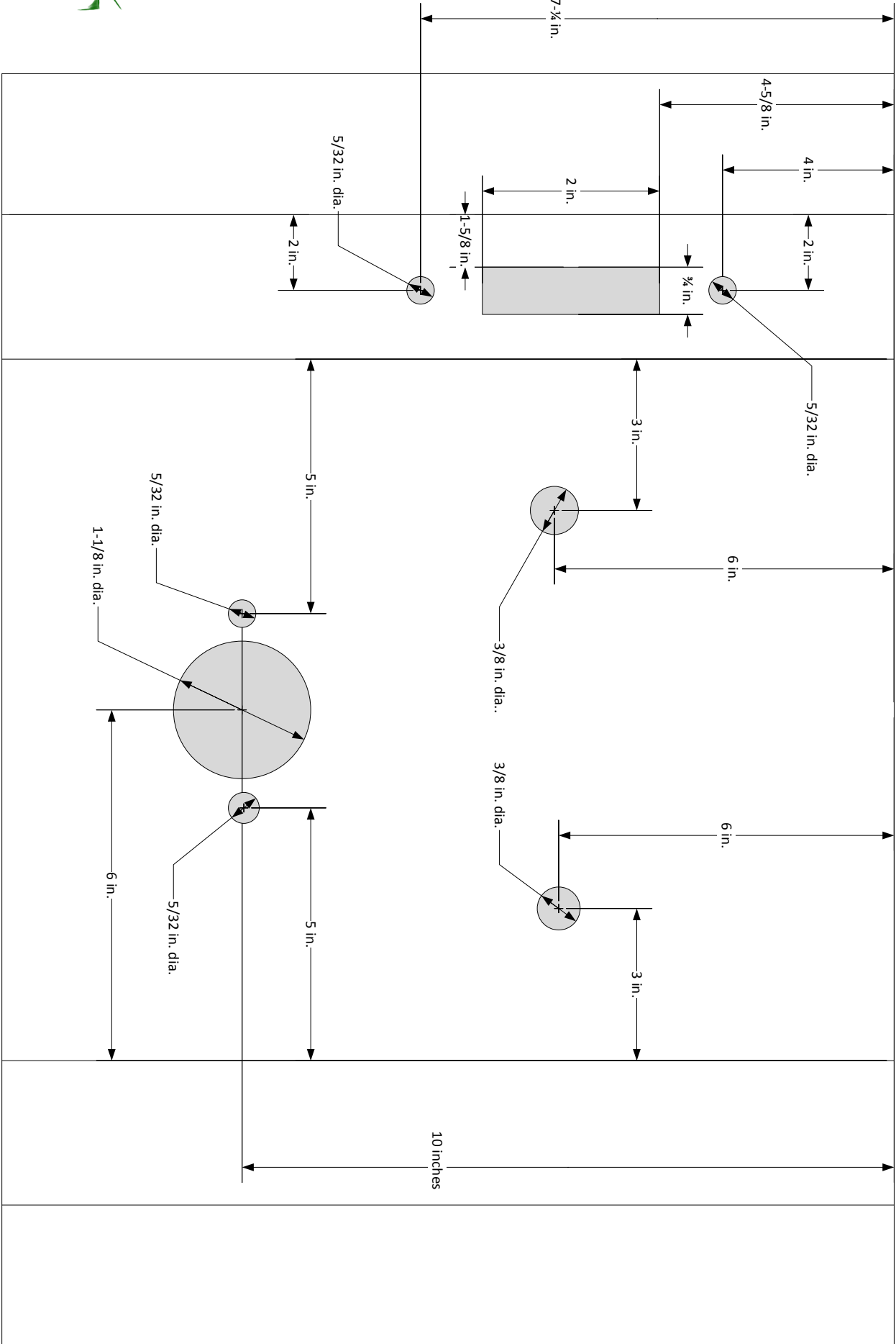


# Left Side (cut shaded areas)



# Right Side (cut shaded areas)

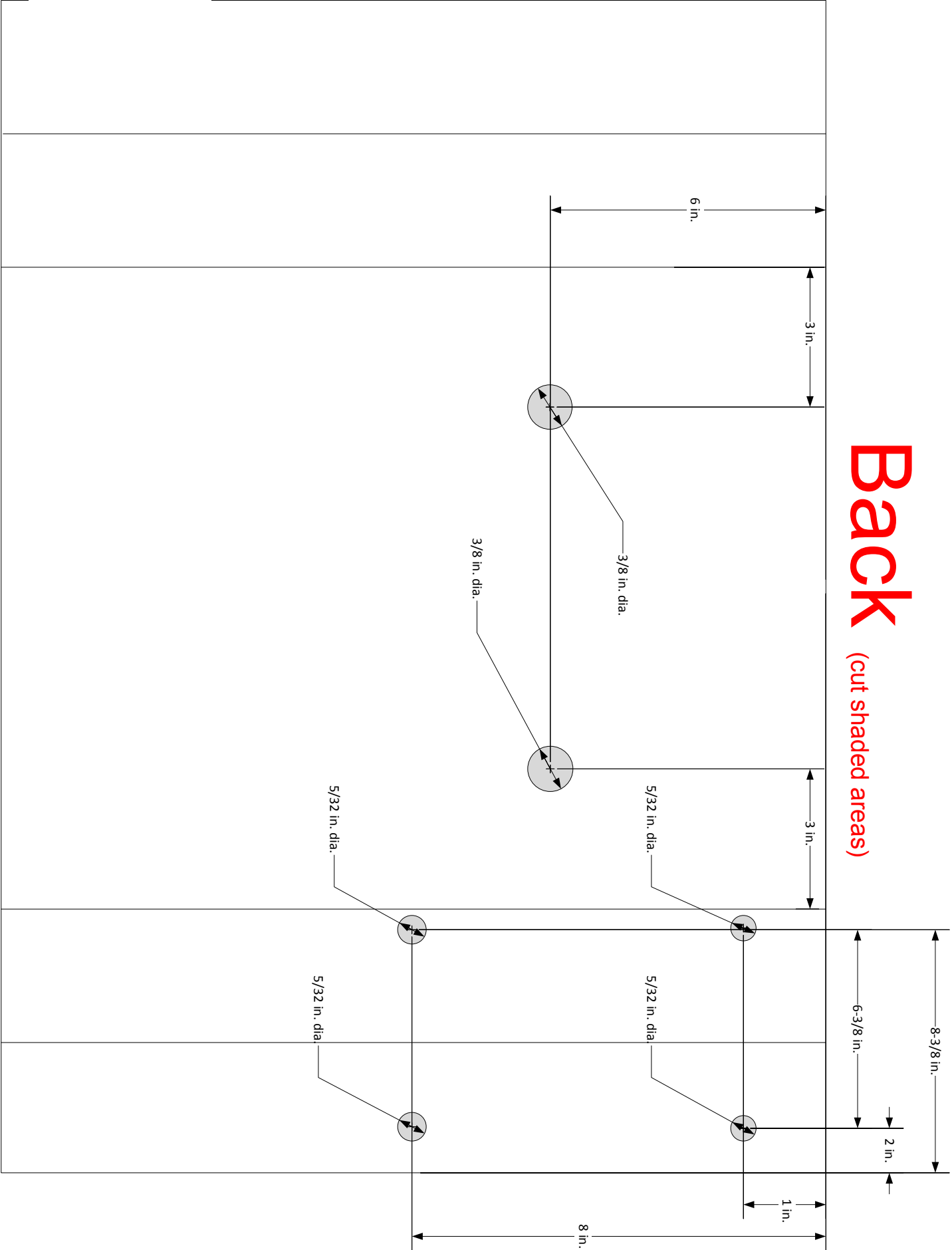




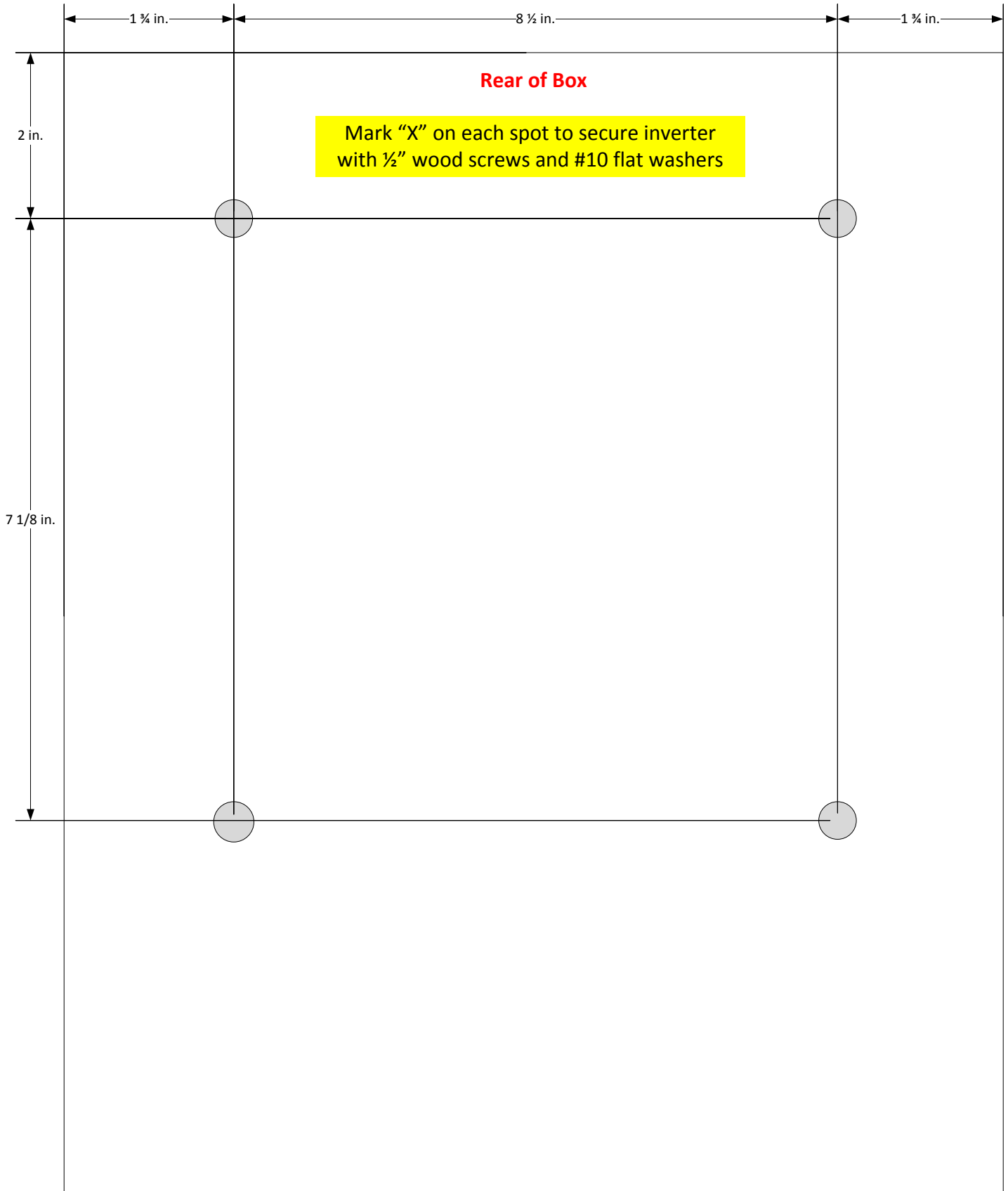
**Front**  
(cut shaded areas)

# Back

(cut shaded areas)

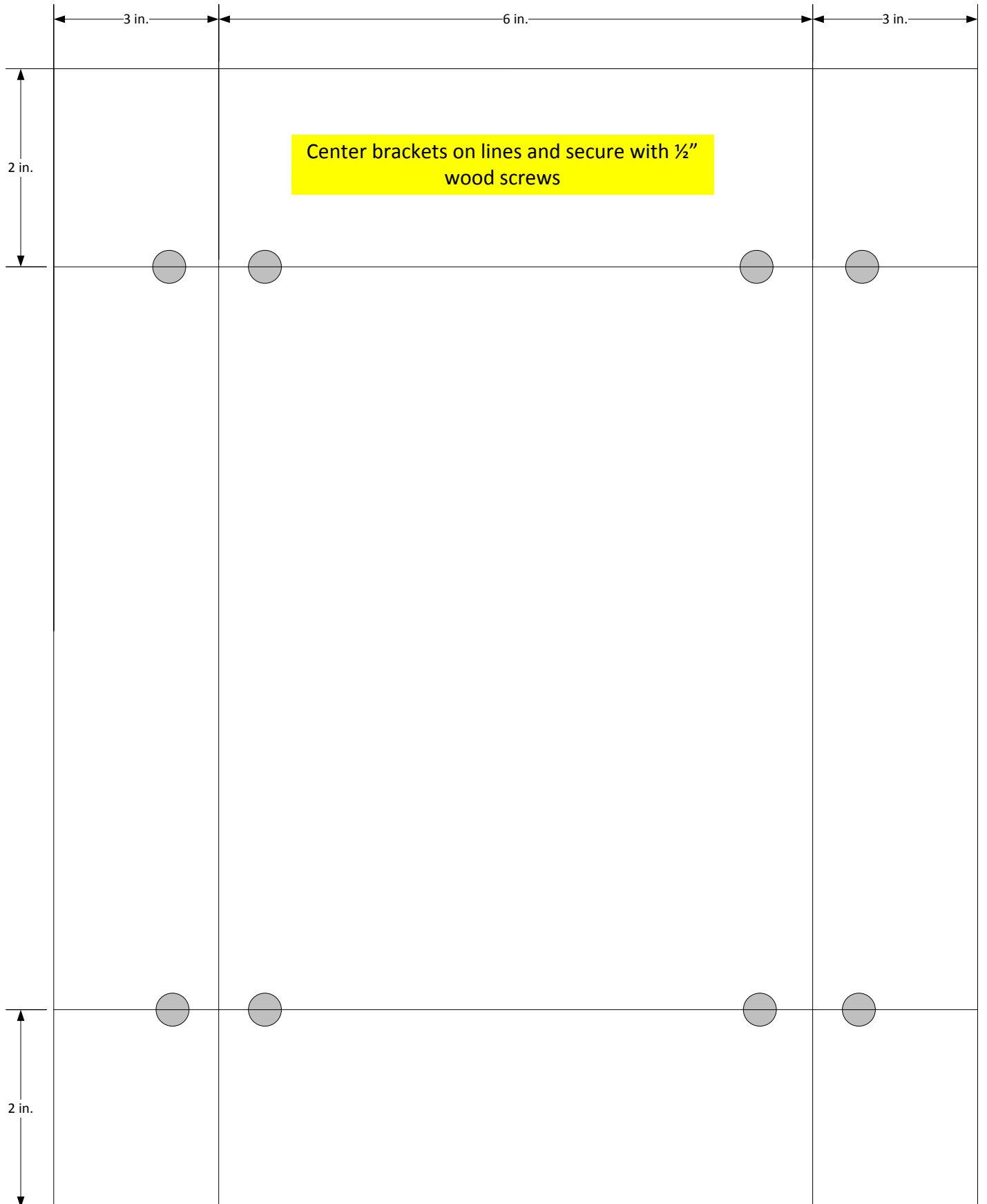


# 12"x16" Shelf Insert Topside





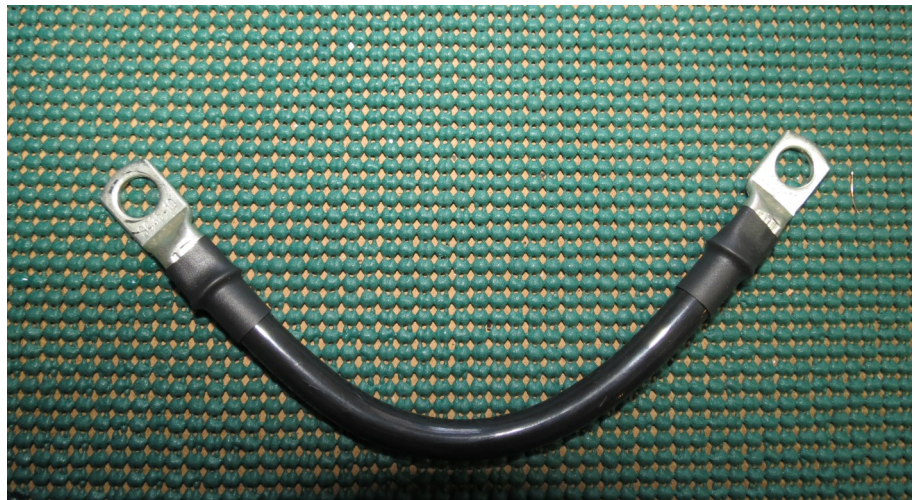
# 12"x16" Shelf Insert Underside





### Making Your Own Custom Wiring (Optional)

1. Cut appropriate wire size to length
2. Strip about 3/4" of insulation from each end of the wire
3. If using bare terminals, place pre-cut sleeve of heat shrink tubing over wire (let float in the middle of the wire temporarily)
4. Place appropriate terminal over end of wire
5. Lay wire/terminal into crimping tool (or use hand held crimper for smaller terminals)
6. Strike with hammer 3-4 times (or squeeze crimper handles)
7. Slide heat shrink tubing over connection if applicable
8. Use small flame to shrink tubing and complete joint if applicable. Repeat on other end if necessary





### Pre-wire Charge Controller

1. Attach 2-18" 10 AWG wires (with spade terminals) to **PV input** of charge controller
2. Attach 1-10" 8 AWG wire (with a ring terminal) to **positive battery charge terminal** of charge controller
3. Attach 1-60" 8 AWG wire (with a ring terminal) to **negative battery charge terminal** of charge controller
4. Attach 2-48" 10 AWG wires (with female terminals) to the **load output** of the charge controller



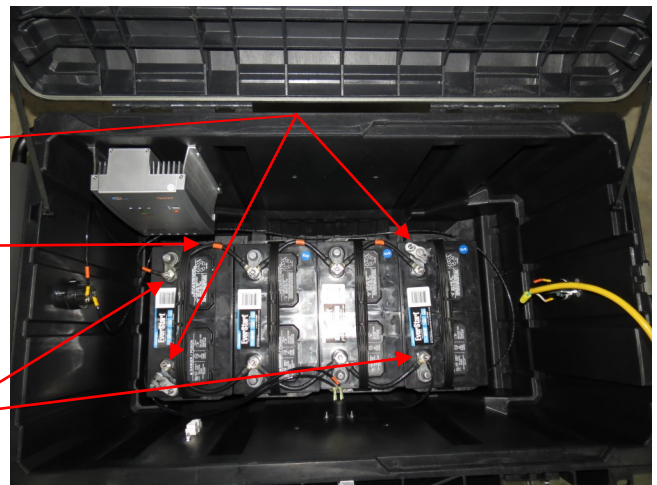
### Mount/Connect Charge Controller and Female Outlet Pigtail

1. Using 4- #6 3/4" machine bolts, 8- #6 flat washers and 4- 5/16" hex nuts, attach charge controller to back right side of box.
2. Attach PV input wires to the male outlet (brass screw is positive)
3. Attach load output wires to the appropriate 12 volt receptacle terminals on front of the box
4. Attach female outlet pigtail
5. (Battery charging wires are unattached at this point)



### Install/Connect Batteries

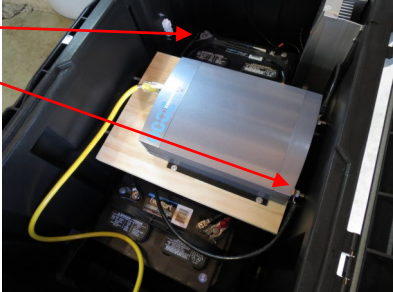
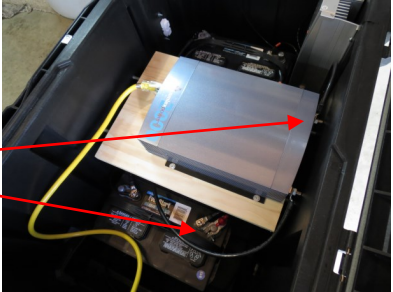
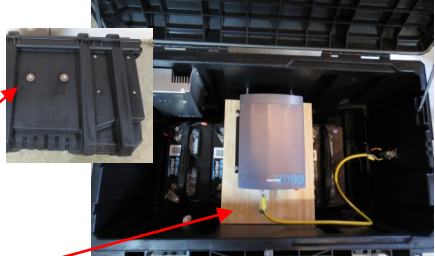
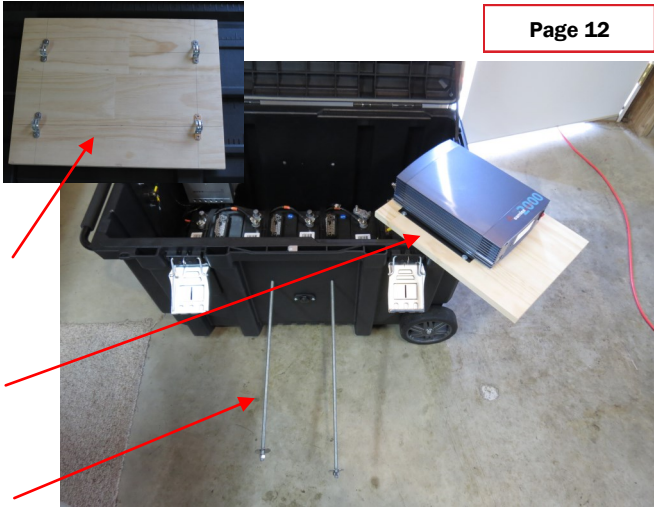
1. Place the batteries side by side in the box
2. Attach the 2 marine battery terminals as shown
3. Using 8" cables, daisy chain positive to positive (x3) and negative to negative (x3). (connection hardware supplied with batteries)
4. Attach battery charging wires from charge controller





**Mount/Connect Inverter**

1. Attach clamps to underside of platform with 8- #8 wood screws
2. Attach inverter to platform with 4- #8 wood screws and 4- #10 flat washers
3. While holding inverter platform in place with one hand, Thread rods through front of box and then through the two hole straps on the bottom of the platform and then through the back of the box
4. Secure threaded rods to the tool box with 4- 3/8" washers and 4- 9/16" nuts
5. Plug the pigtail you made earlier into the inverter
6. Attach 1-27" 2 AWG wire to the positive side of the inverter and right most positive battery terminal
6. Attach 1-37" 2 AWG wire to the negative side of the inverter and left most negative battery terminal



**Connect RJ45 Data cables**

1. Connect RJ45 cables from charge controller and inverter to the rear of the RJ45 jack you installed earlier





**Using the System**

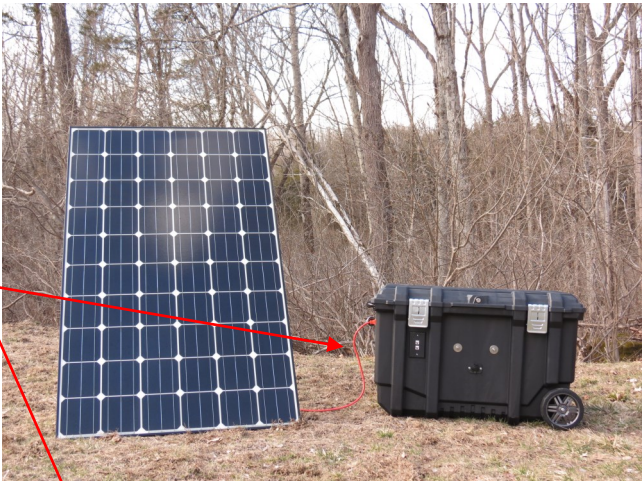
1. For 120 volt AC equipment, plug power strip into outlet on right side of the box (or hard-wire into house via transfer switch)
2. Plug items you wish to use into power strip (or enable breakers on your subpanel)
3. Plug inverter and charge controller remote displays into RJ45 jack on the front of the box. Control and monitor inverter and charge controller functions from remote location if desired. (I used a plastic project box to mount the included charge controller and inverter displays)
4. Turn on the inverter either by its front panel switch or with the remote panel provided
5. Turn on items one at a time
6. For 12 volt DC equipment (LED voltmeter and USB port shown) Plug items into jack on front of box (Power to outlet is controlled via a switch on the MT-5 remote panel)



**Recharging the System**

**To recharge system using solar panel(s):**

1. Set solar panel(s) in sunny location
2. Use the **Grid Ridder MC-4 Adapter Plug** and any heavy duty extension cord to connect solar panel(s) to charge controller input on left side of the box
3. Batteries will recharge automatically based on the sun conditions and panel size you have chosen for your system
4. Monitor charging with remote display if desired



**To recharge system using a generator/battery charger combination:**

1. Start generator
2. Plug battery charger into 120 volt outlet on the generator
3. Attach red charger cable to any positive battery terminal and black charger cable to any negative battery terminal. (I use opposite end terminals to draw energy more evenly through the system.)
4. Set charger for Auto mode and maximum amperage (60 amps for example)



**To maintain system: (grid power available)**

1. Daily- connect trickle charger to 120 volt outlet and then to opposite end positive and negative terminals
2. Yearly- use **Grid Ridder Code Blue Battery Saver** to de-sulfate and condition the cells



# Grid Ridder

**Cut the Cord**



[Http://gridridder.com](http://gridridder.com)  
Email: [jim@gridridder.com](mailto:jim@gridridder.com)

