

GORDON WEST ON GROUND PLANES ABOARD BOATS

These are personal instructions from “Gordo”, along with free unlimited phone help with questions. He is happy to help at (714) 549-5000 Monday through Thursday 10A-4P Pacific Time.

Good news – you no longer need to lay down hundreds of feet of copper foil to achieve an adequate ground plane for marine and ham single-sideband equipment for your boat. The fully automatic antenna tuner, placed at the antenna feedpoint, will offer terrific performance with as little as 2 or 3 bonded underwater through-hulls as your ground plane system. The modern high frequency ham or marine SSB system will operate on frequencies between 2 MHz and 29 MHz. The lower the frequency, the greater the need for a large-sized ground system.

The reason we use copper ground foil as opposed to #8 green bonding wire is because wire has an adverse effect on ground currents. Wire develops inductive reactance, and this actually opposes the flow of AC ground current. We want very low X_L , so we use copper foil. The .003” x 3” copper foil is your best conductor. It’s thin, tough to tear, and works as a ground plane as well as a grounding interconnect between your bonded underwater through-hulls.

The modern microprocessor-based antenna coupler can now choose hundreds of selections of X_L and X_C to develop a good match with good efficiency to your selected bonded metals below the water line. The greater your ground plane below the water line, the higher your radiation resistance.

For sailboats with bonded underwater through-hulls, you will notice a green wire running from one through-hull to another and daisy chain all the way up and down on the inside of your hull. This is part of your corrosion system, and also may be part of your lightning system. Bonded underwater through-hulls with a green wire is part of the A.B.Y.C. recommendations for controlling galvanic corrosion and a nearby lightning strike. If all of your underwater metallic through-hulls are bonded, you can parallel these same through-hulls with copper ground foil to both your automatic antenna tuner and to your SSB transceiver. Wire brush the bonded through-hulls for a good clean connection to the copper foil. Foil is simply wrapped around the through-hull and tightened down with a stainless steel hose clamp. No soldering, brazing, or welding. The stainless steel hose clamp and copper foil make for an easy connection to your bonded underwater through-hulls. Pick as many through-hulls as you can. I usually pick up a minimum of 2 or 3 through-hulls back aft interconnected to my automatic antenna coupler. Sometimes the rudder post is a good spot to add additional ground foil.

If your underwater metals are not connected by a green bond wire, you may wish to use a single through-hull that is isolated by a non-conductive hose as your first point of establishing an underwater ground connection. While a single through-hull might work as a tuner ground, you would probably want to add additional strips of copper foil inside the hull to add additional capacity to this lone ground point. Even a ground plate made of porous bronze might be in order here where all of your underwater fittings have been specifically left unbonded.

For the transceiver at the NAV station, you would run the copper foil directly off the back of the transceiver and down to a single ground point. This could be a single through-hull, your keel bolt, or a bronze water intake valve. And as long as you adhere to good red and black voltage techniques, you will not be troubled by the scary word “electrolysis” – stray current corrosion. Electrolysis occurs when you do not run adequate red and black wires, and current gets pulled through the ground system. Not good! But, if you use good red and black wiring techniques to your voltage distribution panel, and that panel has good red and black runs down to your positive and negative posts on the battery, you should not experience electrolysis with your new ground system. Remember that your ship’s ground is considered a separate entity to any black wire that goes to the battery negative terminal. Although the negative battery terminal ultimately gets hooked into your ship’s ground system, you should NEVER use the ground system as the return side to the black battery negative lead. In fact, most ham and marine transceivers specifically fuse the black power lead in case refrigeration or anchor windless equipment tries to find another return path for the black battery return lead. If you ever pop your black lead fuse, chances are that something else is causing stray current electrolysis.

On power boats, the tuner goes up to the flying bridge, and there may or may not be a ground screen already laid on the top roof of the bridge. If there is, interconnect to this artificial ground plane, and then go to the big job of interconnecting your bridge SSB radio and tuner to a ground plane that goes all the way down and contacts the sea water below. Again, green wire bonded through-hulls are one great way to achieve an adequate ground plane. No longer are one-quarter wavelength “radials” required in most installations. Your fully automatic antenna tuner will resonate your seawater ground system without the need of a tuned radial system.

No longer is 100 square feet of copper foil required to be laid down on the inside of your hull.

No longer is interconnecting every last piece of underwater metal required – or even recommended. If you haphazardly start interconnecting everything together, you could accidentally hook up aluminum trim tabs to the rest of your underwater metal, and the aluminum will begin to behave like an underwater zinc. And you know what an underwater zinc does when it’s doing its thing best – it deteriorates. So don’t be attaching your copper ground foil to any and every underwater metal before you check it out and make sure it’s part of your original bond system.

Remember, don’t be attaching this copper foil to through-hulls that have been purposely left unbonded. If you’ve not experienced any type of underwater corrosion, don’t change the profile of your underwater metals at this point by grounding to them, or taking them off of a bond system.

Once you are satisfied that you have bonded to a minimum of 2 or 2 underwater through-hulls, it’s time to go on the air. When you transmit, it’s perfectly normal to see your anemometer and speedo jump around on voice peaks. This is because they act like field strength meters, and pick up your powerful transmitter output. You might even see your instrument panel flicker as you modulate. This is normal.

A simple way to check whether or not you have achieved adequate ground on lower SSB channels (2 MHz, 4MHz, and 6MHz), or lower ham frequencies (160m, 75m, and 40m), is to use the old “Gordo overboard foil trick”. Establish communications with the high seas marine operator, another ship, or another ham on high frequency. As you’re communicating with this station, have someone take the free end of the foil (where the other end is at least 20 feet in the drink) and touch it to the tuner’s ground foil connection. If the tuner begins to retune, or if the other station indicates that you have abruptly increased in signal strength, this is proof that additional grounding is necessary. But I doubt if there will be any change. If you touch the foil to the existing ground foil, chances are that the tuner will not change its setting (it won’t go click, click, click), nor will the other station hear any difference. You have just proved that an additional 20 or 30 feet of terrific sea water ground makes no additional improvement in your communications range, so no additional grounding is necessary inside your hull. Do this test at the tuner – this is where there is maximum capability of seeing any change in your underwater ground performance.

Experts will disagree on how much ground is necessary for marine SSB and ham SSB. In repeated tests aboard power boat and sail boats, a few well chosen sea water contacts with a bonded through-hull may be all that is necessary to achieve a terrific ground plane for the modern microprocessor-based antenna tuner. However, if you are using a manual antenna tuner, they need copious amounts of ground plane.

If you are using a whip, it should be placed over a horizontal stainless steel rail, and it should work well down to 40 meter ham and 8MHz marine bands. If you want performance lower in frequency than this, interconnect the inside stanchion through-hull. This will add more ground plane to the circuit.

Finally, ham radio type “built-in automatic antenna tuners” are not designed for marine single-wire installations. Only the fully remote automatic microprocessor-controlled antenna tuner is designed for this type of long wire application. As long as the tuner is at least 15 feet away from the transceiver, you should not have any problems of RF feedback associated with manual tuners. As long as your transceiver is fed with 8 gauge or larger wire to a healthy 12-volt source, you will not be troubled with garbled modulation.

IMPORTANT

- 1) Check these instructions with your boat’s electrical installer to verify that your SSB ground system will be compatible with other grounds onboard
- 2) Make sure all ground work complies with American Boat and Yacht Council guidelines.
- 3) Always consult with your ship builder before running ground foil to bonded underwater through-hulls.
- 4) Since every boat is unique below the waterline, consult with an electrical specialist who can inspect the proposed foil run to insure it’s compatible with the rest of your underwater metals.
- 5) For more information about installation, please call Gordon West at (714) 549-5000 Monday through Thursday from 10AM to 4PM Pacific Time. These grounding instructions are suggestions only. Metal & Cable Corp., Inc. is not responsible for ground installation and results.