

Ferro News

March 1997 Quarterly Newsletter for Ferrocement Boat Owners

Issue 2

Back Again

Well, we've made it to another edition of Ferro News. I thank all of you from which I received encouraging letters or phone calls. Our readership has now grown to around 50. While this is encouraging in itself, it brings me to that unpalatable subject of costs. I feel that to be able to continue producing this newsletter, some form of financial assistance is required to compensate for postage, envelopes, paper, toner, and copying. After discussing various possibilities, it was suggested that the solution was a quarterly newsletter and for each reader to contribute \$10 (\$13 outside Australia) to secure a 12 month subscription to Ferro News. This would also allow the Ferro News to grow in size. I hope that all of you feel that's this is a modest contribution and that Ferro News offers some value to you.

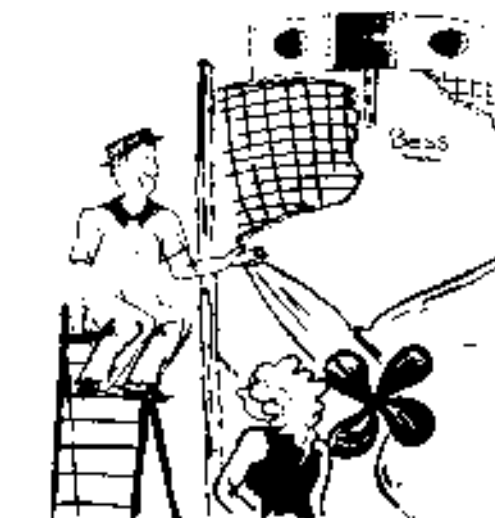
To ensure that Ferro News continues to have relevant content, I encourage everyone to participate.

New To Old

By Doug Wallace "S/V Mystery"

I have nothing but the highest praise for epoxy for repairing concrete. I did a test run on a slab of concrete. I mixed up a bucket of fresh concrete and made a row of 6" diameter by 1" thick test blocks.

- A - no surface preparation
- B- wire brushed and dusted
- C- acid etched, wire brushed and dusted
- D- painted with system 3 epoxy and cured
- E- painted with MEGAPOXY H, tacky



You can move in tomorrow honey!

I then put a towel on the blobs, sheet of plastic and cured for 2 weeks.

The results are as follows:

- A - Disc fell off as soon as I touched it
- B - Easily lifted off with a screwdriver
- C - Disc broke in half, but pop off with little effort
- D - Fell off
- E - Smashed screwdriver handle with hammer; got chisel and managed to chip off some pieces around the edge; got bigger chisel and sledgehammer and completely destroyed the disc, but could not break the bond. Finally I managed to remove a piece, but it had a chunk of the underlying concrete attached.

Now imagine the strength of the bond when the join is tied together with reinforcing rods and layers of mesh. I am now confident to glue bulkheads and furniture in (with fiberglass fillets) and no mechanical fastenings.

(Continued on page 7)

When joining new concrete to old its normal to use a tie coat of epoxy to ensure the new concrete is glued to the new.

inside...

The Yacht "Mystery"	2
Seminar Part II - Electrical Systems Seminar	4
Paint and Varnish	5
Your Say	6

YACHT SPOTLIGHT By Trudy Snowdon "S/V Lilly-Ann"

The one thing we have discovered as a result of starting Ferro-News is there are many dedicated ferro-yacht owners who would rebuild their yachts rather than parting with a valued friend. One such individual is Doug Wallace of Port Lincoln in South Australia.

Doug is the proud owner of "Mystery" a 26ft home designed and built ferro-cement yacht, purchased in Port Augusta in 1990. It was in Mystery that Doug, after sailing in his home waters of the South Australian Gulf for a year, circum-navigated Australia single handed in 1992-93.

Prior to sailing around Australia in Mystery, Doug had planned to do the trip in a friend's ferro-cement 32ft Hartley Ocean Racer. However the planned voyage was abandoned when it was discovered that the yacht was leaking in the fore foot area. Upon inspection, it was discovered that the mesh frame had disintegrated and the cement turned to mush. The damage was attributed to an incident several years earlier when the owner bounced the yacht heavily over a reef, causing stress fractures at the top of the fin keel. These fractures remained unnoticed for 8 years. The yacht in question however, remains

afloat in Adelaide after the hull was repaired by the owner.

As you can see from the accompanying pictures, Mystery is now also in a state of disrepair. The internal framework of the yacht was originally built with 1" water-pipe which, over the years has been exposed to water and rusted away. The expansion caused by the rusting pipe resulted concrete cracking around the edges of the deck and further exposing areas of the internal framework.

Doug is in the process of a complete hull restoration. He has removed all of the rusted water-pipe and has welded in 1"x1/4" flat bar. He then poured sump oil in the remaining sound pipe to prevent further rusting and then hammered in

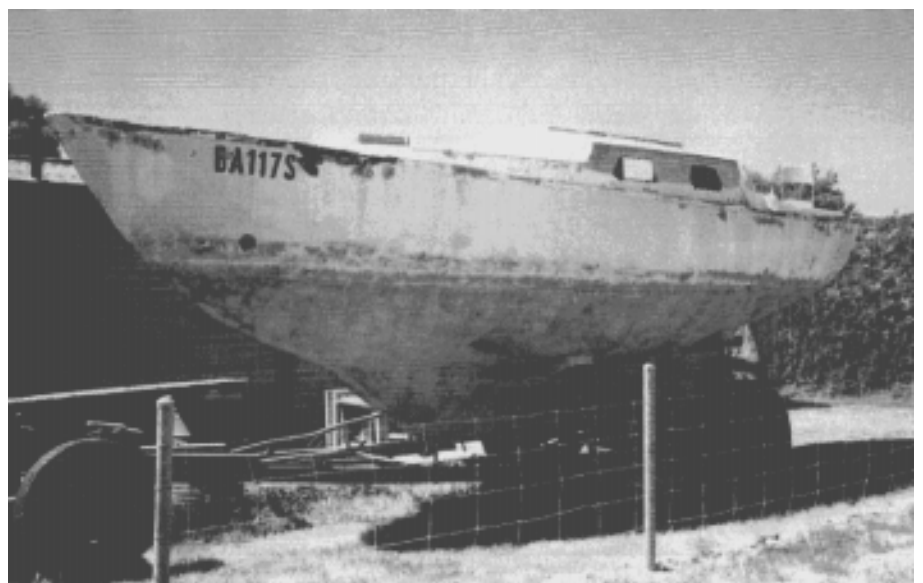
(Continued on page 3)



Doug with a fresh Mackerel, one of the delights of cruising.

and has welded in 1"x1/4" flat bar. He then poured sump oil in the remaining sound pipe to prevent further rusting and then hammered in

"Upon inspection, it was discovered that the mesh frame had disintegrated and the cement turned to mush."



Mystery waiting to undergo extensive repairs.

(Continued from page 2)

solid steel pins and finally welded the flat bar to the pipes. After restoring the internal framework Doug replastered the affected area near the deck and fibre glassed the deck for extra protection.

In the process of fixing Mystery's hull Doug ran a number of experiments on epoxies to test it's ability to bond to concrete. He found satisfactory results in using Megapoxy for bonding and repairing concrete and would be interested in hearing similar experiments or experiences of yacht owners who have repaired their hulls (see "New to Old" on Page 1).

Doug is now in the process of tackling a interior refit. Mystery's original interior was fitted out with chipboard, which did not stand up to the rigors of an Australian circumnavigation. After gutting what is left of the interior Doug intends to refit Mystery using veneered exterior grade ply.

Doug has promised to send more pictures and updates on his refit of Mystery. As well, we may soon see Doug's name on the bookstands. He has recently completed a book on his solo-circumnavigation in Mystery. Doug's book is currently under consideration by publishers.



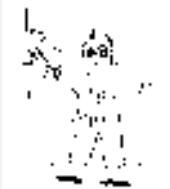
Extensive erosion along the deck joint

TIP:
Scrounge around in your galley for some Scotch Brite pads the next time you need to re-apply Deks-Olje or Sikkens Cetol to your timber work. With a good application of elbow grease and water, the pads will strip off any of the old coating. The Scotch Brite pads can also be soaked in the oil and used to rub the new coating into the timber.

R



..the same joint ready for re-plastering



Marine Electrical Systems

Part II - GROUNDS

By Cameron Clarke "S/V JUPITER"

Most cruising sailors recharge their house batteries at anchor by running their engine. Sometimes they run their mechanical refrigeration at the same time. Some sailors recharge once per day, some twice per day and others every second or third day. We will discuss ideal times to charge in Part 3, so wait for that. Typically an alternator is used to charge the batteries. How is the alternator connected to your battery? Well there is most likely a wire on the back that disappears into your wiring harness. This wire goes to an ammeter, through which all the charging current flows, then routed back to the engine and connected to the starter solenoid, where it connects to the battery via a heavier gauge wire, probably through a battery switch too. It is a long route with many connections. Oh "connections", do we remember about those in Part 1? Yes, we must check these connections too, but this is only half of the path. What about the ground? Remember our sample circuit for the bilge pump? We cannot have a complete circuit unless we connect to both the positive and negative of the battery. How does the negative side of the alternator connect to the battery? This is usually done via the case of the alternator. Yes the case of most alternators is part of the circuit which is usually the negative terminal. When the alternator is producing current and thereby charging the battery, electrons are flowing out the alternator's case, through the mounting bracket and bolts, the timing gear cover (on many engines this is an aluminum casting), the engine block (cast iron), the transmission bell housing (aluminum or cast iron?), the starter motor adapter (aluminum), many bolts, into a large gauge wire from the starter to the battery's negative post. Yes this is true! How many connections is that? How many dissimilar metals? How much voltage drop is created through all the connections? With just 35 amps of charge current, I have measured as much as 2.5 volts between the case of the alternator and the negative post of the battery. It is not uncommon to find 1.0 volts drop with 35 amps current. We are talking about just the negative side, the alternator "ground".

This is a good place for you to check your system. Carefully, so as not to damage any of your personal parts while the engine is running and the ammeter showing a good rate of charge, place the negative lead of your voltmeter on the

alternator case (because it is more negative than the battery during charging) and the positive lead on the negative post of the battery being charged. You may have to use a piece of wire to extend the length of your voltmeter leads. What you measure in volts times the charge current in amps is the loss in watts. Assume 35 amps charging current and you measure 1.2 volts drop. The power loss is 35 times 1.2, or 42 watts.

Now measure the positive lead loss. Again carefully place the positive voltmeter lead on the alternator's + output (be very careful not to short the lead to the case, OK? I place an insulated alligator clip lead on this terminal with engine off, then start), and negative lead on battery positive terminal (we are measuring the voltage drop in the positive side and the alternator is more positive than battery during charge). Due to the greater number of connections and wire length, you may find this value two or three times as great as the ground path loss. Let's assume you measure 2.4 volts at 35 amps charge. That is 84 watts loss.

Now the battery is probably about 13.5 volts at this point, so 472.5 watts (35 times 13.5) are applied to it. The alternator is producing 598.5 watts (42 plus 84 plus 472.5) of which only 472.5 watts (about 79%) charge the battery. That's a loss of 21%. Think now, if we did not have this loss, we could save some fuel and running time! For those who have installed large capacity alternators, 100 to 300 amp capable units, extra care must be taken to insure a low voltage drop through the mounting and positive output wiring. We will discuss this more in Part 4.

It is easy to reduce the loss in the ground path for the alternator, simply by attaching a large gauge wire (consult our wire table from part 1) directly between the alternator case (there is usually an unused threaded hole for this on the case) and the point the large negative battery cable attaches to the engine. I think a starter mounting bolt best, unless you have a starter (Lucas) with a designated negative post, use it. When cranking the engine, the starter will draw 200 to 600 amps. The fewer number and better quality of connections, the quicker the engine will start. The starter and its brushes will last longer.

(Continued on page 8)

"With just 35 amps of charge current, I have measured as much as 2.5 volts between the case of the alternator and the negative post of the battery."

Product Watch

By Len Brind "S/V Tava"

Last issue I looked at some ways to strip paint and varnish from timberwork. To finish off the theme I would now like to look at my experiences with applying clear finishes to exterior timber work. I found two products in particular to be useful, namely Deks Olje - #1 and #2, and Sikkens Cetol HLS and Supernatural 007.

The reason I have experimented with these two products is that I found that varnish on exterior timberwork did not stand up to the rigours of a harsh Queensland summer. Within a month of glaring sunshine that lovely glossy varnish was cracking and peeling, and I certainly had better things to do than strip it back and reapply every month! So began my search for a better timber finish.

Deks Olje is a two part system which is marketed by the Flood Company and widely available in ships chandleries. It's manufacturers claim that Deks Olje "penetrates right to the heart of the work, giving a rich natural glow that is long lasting..." Deks Olje #1 which is applied to the timber as a primer coat, is an oil based product. It penetrates into the wood requiring numerous coats to be applied until the timber cannot absorb any more. I have used this product by itself on a number of exterior fittings such as the toe-rail of my 40' yacht. I found that as a result of the amount of oil absorbed by the timber,



the toe-rails became quite impervious to scuffing. It appeared that #1 by itself had a life of about 3 months before it needed to be reapplied. There were a few disadvantages to the system however. One was the amount of #1 which needs to be applied (the port and starboard toe-rails took nearly 2 litres of #1 between them) and secondly, the amount of time it took to apply. The product must be continually applied

whilst the timber is wet, ie. as one coat is absorbed the next coat must be applied. This took me nearly eight hours to apply.

The manufacturer of Deks Olje recommends that exterior work is finished with #2, which will make the finish last longer and gives a rich gloss finish to your timber. Unless I can take the timber off the boat and work on it however, I rarely use the #2 laquer. I have applied it so far to my cabin doors, auxiliary tiller and cockpit seat surrounds. I usually apply about 8-10 coats of #2, sanding between each coat with successively fine grades of sand paper. When completed, the result are quite stunning.

I get about 12 months life out of my exterior timber finish if I use #2, after which the finish cracks and the timber fades. Despite what the manufacturer says, I find that I have to remove the old finish to bring out the colour of the wood before reapplying Deks Olje. Given the laborious task of applying Deks Olje, I again went on the search for something new.

Sikkens Cetol HLS and Supernatural are manufactured by AKZO and are products widely used in the building industry. It is available through some paint stores such as Taubmans. The coverage for Cetol HLS is approximately 12 - 16 sq.m/litre for a smooth surface and 4-8 sq.m/litre for a rough service. It comes in either clear or with a number of stains to match the timber you are working on. I used their teak stained product. It also contains a preservative that prevents fungus attack to the coating. Like Deks Olje, a number of coats must be applied and allowed to be absorbed into the timber. However only 1 to 3 coats are required, and a minimum of 24 hours drying time is to be allowed after each application. As Cetol HLS is not an oil based product such as Deks Olje it is not nearly as resistant to scuffing and I find it marks easier than Deks Olje.

Supernatural 007 is a clear water repellent wood finish which can be used over Cetol HLS, but is not necessary as Cetol HLS can be used on its own. It gives a coverage of 12 sq.m/litre for a smooth surface and 6-8 sq.m/litre for a rough surface. When dry, it gives a low lustre, satin finish. If you are keen on the high glossy look of varnish, this is not the product for you! Two coats of Supernatural are usually applied, allowing at least 24 hours drying time before applying over Cetol HLS and 24 hours drying time between coats of Supernatural.

I have applied Cetol HLS to my toe-rails (after trying Deks Olje), hand rails, hatches and window surrounds and have only used 750ml in applying 3 coats of the product. As well I gave the hatches, hand rails and window surrounds 2 coats of Supernatural and I quite like the satin finish that has resulted. After six months I have detected no fading, and except for a few scuff marks on some wooden cleats, it appears to be standing up very well to the elements. From this, it would appear that the Sikkens system wins hand down for longevity and ease of application. However Deks Olje whilst it does not appear at this stage to last as long, gives a glossy deep finish that looks superb on

Your Say - Q&A

It's good to see participation from some of you, keep it up! Keep the letters coming in. It's much easier for me to keep track of it all if it is in writing. Don't be afraid of your handwriting. I'm just glad you can't see mine. And then there's my spelling - well we won't say anymore about that!

How do other ferro boat owners go about getting their boats insured? ANKA has been insured with AMP for the past six years, without a claim, but this year they have declined to reinsure her as they are trying to get out of this particular market and I have been unable to get anyone to take a look at insuring her. Perhaps other others could share their experiences, or perhaps we could use our collective 'clout' to arrange our own source of insurance. My boat is a really terrific Adams 52 with a finish like fiberglass, and as a sea boat, I would put her up against anything on the water, but when one mentions ferro (sight unseen) insurers head for the hills. I'm sure we've all had these experiences but there must be someone out there that will look at well built ferro boats.

David, Vic "S/V ANKA"

A friend who has a 46' Hartley Tahitian, approached an insurance company who told him "Yes, they would insure, but NO if he was living aboard, which he was with his wife and two children. We still fail to understand this reasoning. If you live aboard, it's your home, most of your possessions are there. Surely there is less chance of the boat sinking if there is someone aboard most of the time as apposed to a boat left neglected on a mooring.

Thanks for the tip on the tungsten carbide hole saw, as I want a couple of holes in my hull, but what are your thoughts on actually sealing the concrete in the hole, prior to fixing the skin fitting or transducer?

Allan, Nrth Qld "S/V"

In response to Seans query on insurance: Having been insured for nearly two years by MarineSure, I was suddenly faced with a renewal premium nearly double the last - their way of dissuading me from further insurance. The same old excuses! After numerous 'phone calls, NRMA finally came to the party. They would have de-

manded a survey on the hard, but accepted a three-year old surveyor's report from the time I bought the boat. Maybe Sean can find some satisfaction from them.

P.S I shall have absolutely nothing more to do with your venture should you persist in misspelling "coming" - so be warned!

Robert, Qld "S/V L'Alouette"

Point taken Robert, on the count of spelling. I'll be calling on the electronic age to check my spelling from this issue on, so be on the lookout!

Ian, Qld "S/V Lilly-Ann"

In response to Allan's query on sealing new holes: To seal the new holes in your hull, I would suggest you seal the hole with first a thinned coat of say, EPIGLASS HT9000, to allow it to soak into the concrete. Follow this later with an unthinned coat. Then depending on your underwater paint system an epoxy primer feathered into the surrounding system. However make sure that all thru-hulls are properly grounded. This can be a bit tricky with the transducers that are not thru-bolted. But a small tap nut or a large copper washer is the usual method. If you don't own a multi-meter, buy one, it will be worth every bit of the \$50.00 you'll spend.

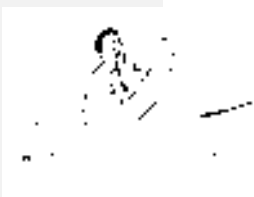
Ian, Qld "S/V Lilly-Ann"

We were insured with Anchorage in Sydney for several years, but the premiums were high. Recently we have swapped to NRMA, who seem to offer a good service and less restrictive conditions. I was particularly impressed by their personal inspection of our boat. An occurrence almost unheard of. They are to be commended. However I wonder for how long they will continue to offer such good coverage to ferrocement. Apparently the underwriters are most concerned with the cost of repairs to ferrocement yachts, and the lack of professional expertise in this area. This is where a group like this can build up the collective expertise.

Ian, Qld "S/V Lilly-Ann"

I am the proud owner of a 27 Ton 47' Bauquentine (?), constructed of concrete. I would be grateful for any information on the repair and maintenance of this material. I have only recently acquired this vessel and I am in the process of lifting out and overhauling her. I am par-

(Continued on page 7)



(Continued from page 6)

ticularly interested in what type of engine mounting to use for a 1.5 Ton Gardner 5KW diesel auxiliary engine, and how to attach them to the hull. It also has ferro tanks in the bilge keels, has anybody had experience of using them for water or diesel.

Barry J Scott, State of Bahrain.

Barry, an auxiliary engine must be mounted in a similar manner to the main engine. Engine beds must be solid and spread the load to the nearest frames. Mounts should never be attached directly to the hull skin. Unless the engine bed was built into the hull design, you will need to do a bit of thinking and planning. Using soft mounts to the bed will greatly reduce the vibration and noise. Many good brands are manufactured, but I found that the most helpful was PolyFlex in Brisbane. If the engine has to line up with a shaft or coupling, buy the mounts first, before you design the beds, it can save you a lot of time. Soft mounting on existing beds often requires new engine feet, to compensate for the additional height of the mount. A close look at many engines don't have much room in these areas, so some imagination is required.

Ian, Qld "S/V Lilly-Ann"

In response to "Rust Weeps" - Joseline Qld, Ferro News issue 1: The small spots are probably bits of mesh or wire close to the surface so the paint/cement is not thick/impervious enough to stop water getting in and rust bleeding out. Remedy is to grind a hole about 5mm deep and fill it with thickened Epoxy. This can be achieved with a masonry grinding disk in a 4" angle grinder. Rust weeps that dribble rusty water are more serious and indicate voids and porosity in the hull. If the weeps are in horizontal rows it could mean the cement sagged away under the horizontal reinforcing rods when the hull was plastered and these cavities are full of

(Continued from page 1)

Megapoxy H
VIVACITY ENGINEERING PTY LTD
Adelaide: (08) 234 5033
Brisbane: (07) 356 0000
Melbourne:(03) 576 0422
Sydney: (02) 875 3044
Perth: (09) 470 2121

Thanks Doug! Doug's yacht featured in this months Yacht Spot Light. He has undertaken some major repair work on his yacht "Mystery" and provided us with some information he gathered whilst testing some new-to-old cement bonding agents. I know many readers are interested in the process of repair in ferrocement and perhaps we could encourage Doug to write some follow up articles on his repair experiences and methods in ferrocement.

I have a question though Doug: Did you happen to test the bond between uncured System 3 and fresh plaster? What was the result?



To all those that have heard the call of the sea.

FERRO NEWS SUBSCRIPTION

4 Issues: 12 Months : \$10 (Australia) \$13 (Overseas)

Name: _____

Postal Address: _____

Vessel Name: _____

Design Name: _____ **Length:** _____

Mail To: Ian McFarlane, 69 Manly Road, Manly Q 4179, Australia

(Continued from page 4)

What other reasons are there to make a proper ground for the alternator?

When electrons move between dissimilar metals, they make little pits in the metal they leave from. This is known as electrolysis. When you allow current to flow through all those parts on your engine while charging your batteries, you are slowly damaging those parts. You might also find it difficult to remove some bolts too.

If you have an "internal" regulator, or even an "external" one that senses voltage at the alternator or if the regulator takes its ground reference from the alternator case, it will not charge the batteries properly, unless the alternator has a low loss "ground" connection. More on this in Part 5 on Regulators.

You can reduce or eliminate the alternator whine in your HAM or VHF radios and possibly eliminate the noise that affects some of your other navigation electronics by using a low loss ground from the alternator.

There are really many benefits for this simple, easy to install piece of wire, but mainly you will run your engine for less time, use less fuel at anchor, and keep your cabin cooler in tropical climates as well as prevent some electrolysis in the engine.

There are other types of "grounds" to talk about. In the U.S. our household wiring is 120 Volts AC and we use 3 conductor cords. The conductors are named "Hot", "Neutral", and "Protective Ground" (for those with my drawings, please note size and shape of outlet's conductors). Just like DC wiring on boats, AC also needs two wires to make a circuit. If you have ever gotten a shock from 120, then you became one of the wires, at least partially, to make the circuit. The circuit is made between "Hot" and "Neutral". All the current flowing through the load, the device consuming power, is supposed to flow through these two conductors. The "protective ground" is there to help prevent accidental electric shock. In power tools with metal cases, it connects the case of the tool to "earth", a term expressed as grounded, via a pipe driven into the earth near the electrical service panel (refer to next two drawings). Land based electrical code (which is carried into boats for the most part) states the "Neutral" shall be "earthed" via a wire to a metal pipe driven into the earth and that the "protective grounds" brought to the same point within the breaker or service panel. This also applies to dock wiring. How many salt water marinas do you know that don't have wiring problems? Perhaps many fresh water marinas have their problems too.

Let's go back to our discussion in Part 1. Recall our

bilge pump circuit and all its connections (refer to first drawing). With a battery voltage of 12.5 volts, the bilge pump received only 9.26 volts because of the voltage drop in the wiring network. Right? We can measure the voltage drop in any piece of wire or series of connections directly with a voltmeter. This is a handy way to identify problem areas. If you have not already done so, I urge you to measure a similar circuit on your boat. Take the time to understand this. It is important. We will refer to wiring losses, or voltage drop, many more times. By understanding this, you will be able to handle 95% or more of your wiring problems. You will save time, money, and aggravation.

The same applies to AC wiring. There will be a voltage drop in any conductors under load. What does this mean for boaters? I was discussing dock wiring and the electrical code regarding "Neutral" and "Protective ground". "Protective ground" is for safety and is not to be used as a current carrying conductor. "Neutral" on the other hand, is the compliment for "Hot". It is used to carry the load current. As such, over the course of wire length, a voltage drop will occur, increasing in direct proportion with length of run and current load. Follow that? Ok, now consider marina dock wiring. Power comes from the utility company to a breaker or service panel. A ground reference is established at that point via a pipe into the earth. "Neutral" and "Protective ground" are connected together and to the pipe. The power then runs to a series of dock boxes, and if each is wired to the code, new ground reference points are established in the dock boxes. You then run a cord from you vessel to the dock box and plug in. The "Protective ground" on your vessel is then connected to you bonding system if again done to code. Are all the grounds connected to the same reference point? Yes and no. When current is flowing, the "Neutral" conductor will produce a voltage drop, forcing the "Protective grounds" at your boat, the dock box, and shore, to be at differing voltage potentials (refer to dock electrical wiring). This produces a leakage current flowing between the dock and shore, resulting in some dock electrolysis. There will current flowing between your vessel's bonded parts, the dock and shore, causing a little more electrolysis. If any of the "Neutral" conductor's connections are a bit loose or corroded, the problem will become much more severe.

What can be done? No, do not disconnect your safety grounds! First make sure all connections are made to the proper places, are tight and free from corrosion. You could use an isolation transformer for your vessel's shore power. The Transformer's job is to isolate your "Hot", "Neutral" and grounds" from the sources. Done properly, this works very

(Continued on page 9)

“First make sure all connections are made to the proper places, are tight and free from corrosion.”

(Continued from page 8)

well. But beware, you can pick up the shore's ground from TV antenna wiring. You must connect the transformer case to shore "Protective ground", but could then connect the vessel's "protective ground" through your bonding system. You could also benefit from being able to step up or down the shore voltage to meet your needs in foreign ports, as many isolation transformers have multiple taps for this purpose. They are heavy. I used one that weighed some 80 pounds!

Could you use just the "Hot" and "Neutral" from shore and establish "Protective ground" within your vessel? This can be very risky. You must know what you are doing and therefore I cannot and will not recommend it. In fact all shore power wiring is dangerous around boats. If you do not feel competent in this area, please hire a qualified electrician to help you. I have known people who were electrocuted for swimming near a boat at dock that had severe electrical faults. Please be careful. Have any doubts? Place one voltmeter lead into the water near your vessel and the other lead on the dock. If you can measure anything, you have a problem to correct.

You might want to use a GFI (Ground Fault Interrupter) type circuit breaker for your vessel's shore power mains breaker. This would trip and disconnect power should it detect current flowing in the "Protective ground". Remember, the cause could be from a faulty dock box down the way, or even a neighbor's vessel. Should the GFI breaker detect current flowing through your vessel's ground, it would disconnect all circuits to your boat, protecting your boat from your's or neighbor's problems.

In any event, you can measure these problems by measuring voltage drop between "ground" points, but be careful! Shore power is very dangerous around water. Maybe you should leave this to a qualified electrician. Just be forewarned, shore power down island is much different than back home. You can find some very strange things!

Bonding is an attempt to bring all the vessel's submerged metallic objects to the same voltage potential, and thereby reduce electrolytic action between the parts when electrons leave into the water. There are three common methods, series connection, common point, and copper sheeting.

Series connection bonding is just what its name implies (please refer to bonding examples in the drawings). Think of a rudder post connected (by a wire) to the shaft strut. The shaft strut connected to a thru-hull, connected to the battery, connected to the engine, connected to a couple more thru-hulls,

and finally to the head stay. The wires are short and few, but a large voltage difference between the rudder post and forestay can exist due to the number of connections. This is considered poor bonding practice and provides little protection. In many cases it may even be more harmful than no bonding at all. It is the common technique of older Taiwan made boats. If you have this type, then I suggest you change it to common point method.

Common point bonding has one point that all the wires from metallic fittings, one wire per fitting, come to and is attached via one wire to the engine at the same point the battery negative cable is attached. Should current flow in any one object, it will not affect the others like the series connections will. You may find you have something like this, but a couple objects are tied in series, or the common point is not tied to the engine in the correct point. You can easily correct those errors. This method provides good bonding and is more than adequate for almost all boats. Any electrolysis problem can be easily offset with a sacrificial zinc anode, i.e. shaft zinc, or other zincs. This is common technique in U.S. built boats.

Copper sheeting, about 6" wide provides a very low resistance between any two points. The sheet is laid along the length of the hull and very short pieces of wire connect objects to the sheet. The sheet in turn is ideally connected to the engine at the same point the battery negative cable is attached. Although it looks more like a series connection, the inherently low resistance of the sheet provides the lowest possible voltage drop any where in the circuit. Some variations use copper screening which also makes a very effective ground plane for HAM radios. The drawback is that a little salt water on the copper sheet, will cause corrosion and possible electrical breaks in the sheet where the sheet is completely eroded away. If you have this type, make sure it stays dry. You can repair breaks by soldering in overlapping pieces. It is very difficult to make this type of bonding system after the boat is built. Keep all sheet out of the bilge. You can run it under the floorboards along the centerline.

By connecting your bonding system to your sacrificial zinc anodes, you can protect those metal objects from electrolysis. I will talk more about electrolysis and its causes in Part 6.

My vessel uses the common point method. It works well as long as I keep the connections to the objects clean and tight. Remember, CONNECTIONS! Keep 'em clean and tight!

What are the differences between alternator ground, protective ground, neutral conductor, and bonding?

(Continued on page 10)

“By connecting your bonding system to your sacrificial zinc anodes, you can protect those metal objects from electrolysis.”

(Continued from page 9)

What are the similarities? Proper uses? They are similar in that they all try to establish a stable voltage reference point within each system. They are different because they have different functions. Both the Alternator ground and neutral conductors carry the load current for their respective loads. The Bonding ground is to prevent current flow by eliminating possible voltage potential difference between objects. The effectiveness of any of these grounds be measured and simple improvements made to decrease charge time, add safety, and reduce electrolysis.

Copyright notice (C) 1995: This material has been reprinted with the kind permission of Cameron Clark. This seminar series will be continued over the coming months. cameron@unix.infoserv.net

FOR SALE

Below is a photo of my yacht, I am selling her, sick of sailing alone these past five years, having originally lived aboard for ten years, with what is now an ex-wife. So if you know anybody interested in my yacht please contact me.

Yacht "ROCK OF AGES"



"Rock of Ages" is a 38 foot ferro-cement Hartley designed "Golden Cowrie" built by the present owner about 17 years ago in Auckland, which has been lived aboard and extensively cruised in the pacific since launched. Her main particulars follow:

Length: 38' **LOAD Beam:** 11'6" **Draft:** 6' (4 Ton lead keel) **Sails:** 2 x mainsails, (1 x fully battened 3 yrs old) ,Staysail, spinnaker, no 1 genoa on furler, yankee, storm jib, trysail. **Winches:** 3 x halyard winches, 2 x sheet winches, manual anchor winch. **Cabin:** Open plan saloon with fore cabin and shower/toilet,six berths, interior fitted out in NZ rimu and kauri timber. **Engine:** Ford 4000 3 cylinder diesel, PRM 2:1 gearbox, 20x14 propeller. Steams at 6 knots burning 4 litres per hour. **Fuel:** 1818 Litres diesel **Fresh Water:** 454 Litres

Electronics: Autohelm 4000, and Aries windvane pilots, JRC GPS, JRC 8 mile radar, dept sounder, VHF radio, solar panel. **Safety Gear:** 4 Man RFD liferaft, Flares, bouys, lifejackets and EPIRB.

Galley: 4-ring gas stove/oven/grill, double sink, fridge/freezer, ice box. **Anchors:** 2 x CQR type, 2 x Danforth, puls 210' 3/8 gal chain, 100' rope

Bildge Pumps: 1 Manual, 1 Electric. **Dinghy:** 7'6"F/G sailing + 2 hp Johnson. **Hull:** Vessel slipped & painted August 1996 with Devoe antifouling over tar epoxy substrate. **Price:** \$55,000 cash only

Contact: Bob Cooke 20 Moffatt Street The Port Bundaberg 4670 Phone: 014 051 288

CONTACTS

Ian McFarlane
Trudy Snowdon

"S/V Lilly-Ann"
69 Manly Road, Manly Q 4179
Ph: (07) 3348 6567
e-mail: mcfarli@citec.qld.gov.au

Len Brind
"S/V Tava"
Ph: 018 159 925