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The Committee and I
Wish you all fair winds and pleasant seas for the coming year.

Hi Members,
This month's newsletter contains an article that could be of interest to any member wishing to upgrade his boat wiring.

As we rush towards another year, it's time to reflect on this last sailing season.
I must confess to having been fortunate to have reasonably good season. The unusual, dare one say 'hot' week in March, was followed by a cool, wet and windy April, May, and even June. Most of the earlier part of our season being spent, (dodging the many strong winds that seem to be becoming more commonplace during our summer season) by coast hoping in the shelter of the Solent and Poole. To enable quick, safe and comfortable cruising for us required sensible passage planning of no more than four to six hour stints preferably being helped by the tide. This said, we and many others were pleasantly caught out with only cold weather gear on board when the temperatures suddenly rose during this year's Gaffer's rally held at Yarmouth I.o.W. For our (Summer) cruise plan (a) we wanted a window of twenty-four to forty eight hours to enable us to head west past the beautiful Jurassic Coast of Dorset and on to Devon and Cornwall. The exclusion zone by Portland during the Olympics made it easier for us to take our plan (b) option, to cross the ditch to France and the Channel Islands. We finally managed this in July having been delayed by all manner of expected and unexpected problems.

Peter & Sue

Cl.8.220 ME-AND-ER

Before I met Toni, the nearest I got to a boat was watching *Howard's having it away* (Howard's Way) on a Sunday night from the comfort of my living room and that, at that time, was as close as I was prepared to go.
I had never considered sailing or boating as a hobby or pastime. I, like so many others had a preconceived idea that yachts were large, expensive and only for the rich and idle. On meeting Toni, my views and opinions were up ended, for he was not rich and not (too) idle but he did own a yacht, a Leisure 23 to be precise.

I remember the first time I went aboard. Inside was bijou and compact, but outside looking from the blunt end to the pointy end seemed an awful long way away.
We spent a great deal of time on the 23, sailing around Essex but I can count on two fingers the precise amount of times I actually took the helm. Toni would try all manner of things to try to get me interested in his 'Waggle Stick', but I'd have none of it. I was too conscious that our relationship was still in the early stages, too early to survive his pride and joy being bent or, worse still, broken by me, a complete novice.

My contribution to our time onboard was more meal-time than maritime. I love cooking and the challenge of two rings, small oven and half-hearted grill was one I couldn't pass on. The art of cooking, according to my dear old Dad (a baker), is having the talent and imagination to conceal the disasters, present them as masterpieces and all with the air of 'I meant it to look and taste like that'. Over the years I have had many occasions in which to perfect this 'art'. I, like so many who share my interest, have shelves upon shelves of cookbooks, filled with exotic and mouth watering concoctions. But when you read down the recipes you soon realize how incompatible the majority of them are with the cooking facilities on board. I believe that Dads adage should also include the ability to change and adapt to the conditions prevalent at the time of cooking.

As we're now living aboard, as opposed to weekends or the odd two weeks, the galley is stocked accordingly. Cakes, scones, bread, biscuits, pies and sweets are all now within my repertoire. Mind you I still have disasters that I blame on the non-regulative oven! I don't know what excuse I'll be able to use once the new oven is installed, suggestions please?

Round Essex, we often sailed in the company of others and I noticed something that appeared to be a common occurrence on all the boats within the flotilla. Nearing a Marina or mooring for the night, you would see a lonely figure carefully picking her way forward, distributing fenders and attaching lines with precision. Look back towards the cockpit and you would see illuminated against the lowering sun, her partner/husband, gin and tonic in one hand, helm in the other, bellowing orders and shouting instructions.

Since then I have seen this scenario many times, but why? I know that due to superstition, many years ago back in the dark ages, before the days of Claire Francis, women were not allowed within fifty feet of a ship and that boats and all they entailed were the province of men, whether for war or profit. But surely we have moved on from there? In these days of equality and girl power is it too much to ask for an even division, for both parties to 'take their turn'? Even the Royal Navy has allowed women within their hallowed ranks. Of course some may want and prefer to take a back seat, to remain a Mooring Line Moll and a Saucepan Susie and let their male partner take the lead. If this is the case then so be it, good for you, enjoy.
But what happens in a crisis, when your hubby/skipper has gone overboard or becomes incapacitated and you are required to take command? Can you? Do you have the confidence? More importantly do you have the knowledge and skills to bring yourself, the crew and the boat back to safety?
Think about it.
I did, which is why I looked around for a sailing school which would teach and equip me with the necessary skills and confidence. I am proud to say that I hold the RYA Day Skipper certificate, both theory and practical, and that I am able to helm and navigate Pipers Dream with or without Toni's assistance.
The Day Skipper can be studied at night school but as this is over quite a few weeks, I opted for the more intense option, two full weeks, the theory in January and the practical a few weeks later in March. The advantages in doing it this way were; the classes were much smaller, only three

including myself, which meant that if you found yourself floundering the lecturer had plenty of time to assist; you didn't forget from one lesson to the next what you had learnt, easier to remember as there is no break between. The main disadvantage could be the cost even though some schools offer a discount if both the theory and practical are booked at the same time, the price is steep. But what price you or your loved one's life?

Until next time.

Fender Floozy.

This Electricity Stuff

You know how it happens, usually when you are young, and at school, you suddenly find something that just grabs your attention and becomes a burning interest that dictates your future career, or your lifelong hobby, or both. For some folks it could be a sport (Football, Rugby, Angling), for others cars, or whatever. For me, it was electricity. 'Ahh! Poor lad! How sad' I hear you saying. Don't be deceived. I had a healthy interest in the usual young man's things (girls, pop stars, etc.), and I found that I wasn't alone in the world. The newsagents were stuffed (at that time) with electronics hobbyist magazines: but in those times the subject matter wasn't called electronics, it was Ham Radio, or Electrical Projects, or some such title.

(Well? What was your 'thing'?)

Eventually, my interest led me to become an Engineer in electronics and telecommunications, then to lecturing at a further education college.

Now if, by any chance, you are one of the folk who just don't have a passion for pop music, or football, (or sailing), there must have been a time, when talking to an aficionado of the topic, that you felt completely at a loss. Then, to compound your embarrassment, you realized that they couldn't understand why you couldn't understand them, because they assumed that everyone must know what they know. It happens to me every time that I have to visit my doctor. Of course, it's just as bad the other way round, when the 'expert' suddenly realizes that a glazed expression has formed on their listener's countenance. The problem for them is how to continue without either making things worse, or sounding patronizing.

<u>Where is all this waffle leading</u>?

Well, I'm coming to that.

In my (relatively) newfound world of yotty friends, I keep coming across folks who want, or need, to mess about with their boat electrics. This is evidenced by the number of articles that are published in the mags, and letters asking for help.

However, those articles are usually written by the 'expert', who always appears to assume that everyone knows what they are talking about, (and no doubt many folks do), and then sometimes going into their subject so deeply that Fermats Last Theorem seems suddenly to have become a walkover. I suppose that you can't blame them really, after all they do have to sell the magazine.

So, with the approval of our Editor, I am going to attempt to write a few articles with the objective of de-mystifying electrics from your point of view as a fellow yotty.

You are also welcome to contribute.

1 - From Little Acorns

'Let's start from the very beginning, a very good place to start'.
That piece of plagiarism probably won't be my last, but at least it is good advice.

When considering the process of installing an electrical system into a small boat, then it is helpful to think things through from the beginning, even for a relatively simple system.

In the first instance, my guess is that we, (as yotties), probably concentrate on what we want to fit on board in the way of electrical gadgets. VHF radio, GPS, depth sounder, a few cabin lights etc,. Then we think about where to put all the gadgets and what is needed for wiring them to an electric supply.

This is not an unreasonable approach, and not to be poo-poo'd at. However, it is very easy to concentrate on the undoubted advantages offered by an onboard electrical system, and just as easy to ignore the monster that we propose to invite aboard.

HUH? What do you mean? MONSTER! I can be cagey about the 240 volt mains supply at home, but a 12 volt 'monster'?

See what I mean! We are taught that the domestic 240 volt mains supply is a hazard, and not to be treated lightly because it can deliver a fatal electric shock, so we take reasonable precautions.

The 12 volt supply as used on most boats, and most road vehicles, does not offer a shock hazard, but what it does do is to

INCREASE THE RISK OF STARTING A FIRE

Oh that! Aren't you being a bit of a scaremonger?

Yes, I am, because it can so easily happen, especially on a boat with its potentially wet environment, and a fire on a boat is one of the worst things that you can experience.

Come off it! How often do you hear about a boat fire? They must be as rare as ice cubes in hell.

Thankfully they are rare because most installations comply with the suggested guidelines, and are built into the boat during manufacture. However, the Department of Transport is worried enough to issue a Merchant Shipping Notice about it, and as you may know, small pleasure craft come into the category of Merchant shipping. If you have access to the Internet, go to:
www.mcga.gov.uk/msn/msn1557.pdf

(if you don't have Internet access, get in touch a friend who has and ask them to send you a copy).

So, before launching into a DIY project, your FIRST thought should be:

'HOW CAN YOU ARRANGE YOUR INSTALLATION SO AS TO REDUCE THE RISK OF FIRE TO A MINIMUM'

2 – Cause and Effect

OK then. What does cause an electrical fire?

The simple answer to this is that one of the effects of an electric current is to produce heat. Whenever an electric current flows through an electrical resistance then its energy will be

converted (transformed) into heat. The higher the current, and the higher the electrical resistance, then the greater the amount of heat produced.
Under the 'wrong' conditions, an electric wire can glow red-hot, then it becomes a hazard. Under the 'right' conditions, the effect becomes useful, as in a light bulb, or a heater.

I suppose I knew that already. So, what can we do about it?

Well, we can't stop the heat from being produced; after all it is a natural effect. What we can do is to design the installation so that:-

1. The resistance of all circuits is as low as practical.
2. We guard against excessive current.
3. Any part of an installation is not against, or close to, anything that could easily catch fire.
4. All parts of the installation are protected from physical damage.

That all sounds rather vague and technical. What exactly does it mean?

It's not as bad as it sounds, and there's lots of help an Engineers) have sorted most of the problems, all that is except for the hard bit, which is actually putting the kit into the boat.

Anyway, there's another advantage to all of this, you will finish up with an efficient system, so your battery will last longer and your gadgets will perform properly.

Tell you what, we'll take a closer look at that list, and sort out exactly what each item means in practice.

Is that OK for you? Good.

3 – Go with the Flow

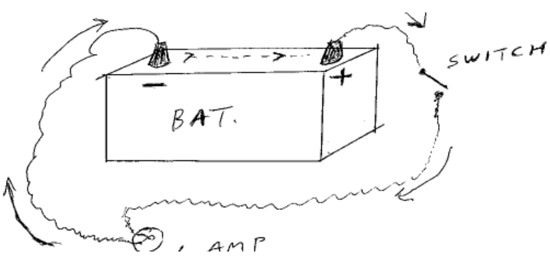
Remind me why they are call 'circuits' when it's clear to me that the cable goes from one place to another, and not round in a circle?

Well, there are usually two wires in a cable. One wire is for carrying the current from the supply to the appliance, (e.g., from a battery to a lamp), while the other wire is for taking the current back to the supply. We name the two terminals of the supply the Positive (+), and the Negative (-). Positive is the 'go', Negative is the 'return'.

Ah! I remember now. That's why the wires are usually coloured! Red is for the Positive, and Black is for the Negative.

You've got it! However, what most folks forget is that the current not only flows through the wires and the lamp, but it also flows through the supply to complete the 'circuit', otherwise the flow won't be continuous.

Let me make a sketch showing a battery, switch, and a lamp. When the switch is closed it will complete the circuit so that the lamp lights.



I've drawn in some arrows to show the path of the current.

<u>Yes, we did that sort of thing when I was at school. The positive volts flow through to the negative volts.</u>

Ah! That's another misconception. Volts don't flow; they simply push. It's the current that flows, and we measure current in Amperes or Amps for short.

<u>But what puzzles me is why doesn't a current flow inside the battery from its Positive to its Negative?</u>

Yes, it does seem odd, but the battery does what it does by 'forcing' its (+) terminal go to a higher Electric Potential than its (-) terminal. When current flows in the external part of the circuit, the (+) side looses energy to the lamp, so the battery has to keep 'pumping up' the (+) side in order to maintain the Potential Difference (Voltage) between the (+) and the (-) sides. The current carries the energy away from the battery to the rest of the circuit. This process carries on until the battery runs out of energy, and that's why the battery discharges while it's in use.

<u>OK. I'll believe you.</u>

Well members, that's the easy bit, the more advanced will be continued next month. ED.

4 – Powerful Stuff

<u>So then. If the wire filament inside a lamp gets hot enough to glow, why doesn't the circuit wire do the same?</u>

Good point. The simple answer is that the lamp is designed to have a higher electrical resistance, whereas the circuit wire is designed to have a lower resistance.

Then there's the matter of Power.

<u>Ah! I've heard of that, it's in Watts isn't it?</u>

That's right, or another way of looking at it is: Watts = Volts x Amps.

<u>I thought there'd be some maths in here somewhere!</u>

'Fraid so. Let's take an example. Suppose that we want to fit a simple 12-volt battery, and a cabin lamp. The lamp will probably be rated at something like 12 Volts, 20 Watts.

So, the lamp needs: $\frac{\text{Watts}}{\text{Volts}} = \frac{20}{12} = 1.67$ Amps.

From Ohms Law, the lamps resistance will be: $\frac{\text{Volts}}{\text{Amps}} = \frac{12}{1.67} = \mathbf{7.19}$ **Ohms**.

Now, let's suppose that the two feeder wires have a resistance of 1 Ohm each, and the battery has a resistance of 1/100 (0.01) Ohm.

For a series circuit, as in the example, we find the total circuit resistance by adding all of the individual resistances together, which gives us 9.2 Ohms.

To find the actual current flow, we use $\frac{\text{Volts}}{\text{Ohms}} = \frac{12}{9.2} = \mathbf{1.3}$ **Amps**.

Notice that the circuit current is now 0.37A less than the current needed for the lamp. The lamp won't be as bright as you'd hoped for.

<u>So where's the missing current gone?</u>

Actually, there isn't any missing current, but there is some missing voltage!

The resistance of the wires is limiting the current, and at the same time causing a Volts Drop along their length. It's this voltage that's missing from the lamp.

The voltage across the lamp becomes:

Volts = Amps x Ohms = 1.3 x 7.19 = **9.35V**, instead of 12V

The actual power of the lamp is now 9.35 x 1.1.3 = **12.2W** instead of the expected 20W.

The power lost in the wires due to the volts drop will be: Amps(2)xOhms=1.3(2)x2=**3.38W**

So the wires are warming up a bit.

5 – Irresistible Force, Immovable Object

<u>It seems to me that this 'electrical resistance' in the wires is a bit of a nuisance. Can't we get rid of it?</u>

'Fraid not old chum. From a practical point of view every wire, termination, switch contact, connection point, fuse, and gadget will have some resistance. Why, even so-called insulation is really a very high resistance material, and when we open a switch contact all that we are doing is inserting a high resistance air gap. So you see, resistance has its uses as well.

<u>Its name seems to be self-explanatory, but what exactly is it?</u>

The property that we call Electrical Resistance was first 'discovered' by a Mr Ohm, hence the name of the unit. He gave us the much quoted 'Ohms Law', which basically says that when an electric current flows round a given circuit, the higher the applied voltage is then the higher the current will be. The ratio of Volts to Amps **is** the resistance of the circuit.

Ohms Law is often shown as an equation:

$\text{Ohms} = \frac{\text{Volts}}{\text{Amps}}$ which we can re-arrange to give:

$\text{Amps} = \frac{\text{Volts}}{\text{Ohms}}$ or Volts = Amps x Ohms

<u>I see! So, if I remember my maths, if we decrease the Volts, or increase the Amps, then we can make the Ohms smaller. Problem solved!</u>

Ah, no. This is a non-commutative equation; it works one way but not the other. Years of research have shown that Resistance is not dependent on voltage or current, but upon the circuits material, length, and cross –section area. So, you see, all that we can do is to arrange so that the wires are made of very good conductive material, are kept short, and have a large cross-section.

The best conductive wires that we could use are Gold, Silver, or Platinum, need I say more? So, as a reasonable affordable alternative we use Copper. Wires are made of other materials, (e.g. Aluminium), but although they are a tad cheaper, they're not as good as copper.

Similarly, we could use an enormously thick wire, but could we handle it? (Or afford it?) So, we use the thickest wire that does the job.

As for the length involved, we only have a limited choice here, but careful consideration can make the run as short as possible.

6 – The Thick and the Thin of it

So why do they make cables that have two, or more, wires inside a common covering, when separate wires will do the trick just as well?

Of course, you can use separate wires, and they are available in a variety of colours, as well as red and black. Having two, or more, wires enclosed in a common cable sheath simply makes installation less work.

The cable sheath does three jobs. It is made of a fire-resistant material, protects the wires and insulation against physical damage, and keeps the wires of a circuit together. However, the manufacturer has no control over the environment where the cable is installed, that's why they put a sheath over the insulation of single wires, as well as over multi-wires.

That makes sense.
Now. I know that wires are made in different thicknesses, and that some are solid-cored, some are stranded, and some are tinned. Some are even made out of metal other than copper. How is a chap supposed to make a simple choice from what's available?

Horses for courses, old chum. All those different wire types are make available by the manufacturers to cater for a wide variety of applications, that's why electrical engineers are paid. For our purposes though, we can considerably narrow the choice down. On most boats, you won't be installing any long lengths of wire, and by long, I mean several hundred yards. You probably won't require specially armoured cable, neither will you be using a high voltage supply. All that we need to concern ourselves with is finding wires that have a fire resistant covering, a fairly low electrical resistance, and are not too difficult to install.

The first point is already catered for, just about every wire made for carrying a fairly high current will have a fire resistant sheath.

The second point means that you should choose copp0er wire that is as thick as you can handle in order to keep its electrical resistance low, which brings us to the third point.

Ease of installation. That includes things like pulling it through narrow spaces, getting it to bend around corners, and will it be relatively easy to terminate. Don't forget that the equipment terminations will have to be able to accept the wires thickness. In most cases, you'll find that a multi-stranded wire will be better than a solid core wire, with the added advantage that it will 'give' as the boat flexes whilst sailing, or withstand vibration when motoring. Mind you, multi-strand wire will be somewhat thicker than an equivalent solid wire, but that shouldn't be too much of a problem.

To be continued. ED.