2010 Round Britain and Ireland Yacht Race.

Start 6th June, Plymouth Sound.

Richard Lett and Sharon McMichael are entering the 2010 RBI as a personal challenge and to raise money for the 'Richard House Children's Hospice'. If you enjoy or learn something from this article, please consider visiting our 'justgiving' website to learn more about the 'Richard House' and the Round Britain Yacht Race.

http://www.justgiving.com/roundbritain-velocitygirl

Some thoughts on boat batteries and more efficient charging on the VQ32 'Richard House'.

Lots of work to do and so little time, Sharon and I are focusing on simplicity and safety; efficient charging and use of power could fall into either category and will pay dividends. Less engine running hours may mean more and better sleep if we are lucky.

Some of the RBI legs last up to 6 days so power for navigation, lights and autopilot systems becomes an important consideration. Power concern is one of a number of areas where cruising and offshore race boats have lots in common; 'buoy racers' or 'day sailors' pay very little concern to power matters and along with a small battery capacity, often have ruined batteries due to poor charging and maintenance protocols. This article reflects what I understand to be good battery management; aspects may be wrong, but hopefully one or more ideas may help you understand some of the issues with charging and maintaining batteries on a charter or your own boat.

Power requirement.

'Richard House' has a Power-gauge Battery monitor, which provides me with detailed information on:- Amps being drawn, percentage battery charge, total amps used (since charge), and, when charging displays the charge, rate in volts and Amps. I know that on average my autopilot draws between 2 – 8 amps (big difference whether upwind or downwind in a following sea), Tricolour LED 0.5 amps, Laptop (Navigation) between 1.8 – 3.5 (reduced draw when screen closed), internal lights 0.5 amps, VHF, Navtex, SeaMe total 0.3 amps (VHF on standby). So our total draw per 24 hours is between 122 and 307 amps. The average is probably more like 200amps.

Charging system.

We currently have installed 3 x 105 Amp, Absorbent Gas Mat (AGM) deep cycle batteries, we feel these are a good choice and won't change these. Deep cycle batteries are excellent for a service supply; cheaper starter batteries will not provide the amps you require and will break down quickly if used as a service battery. The benefits of AGM batteries are that they cannot spill, the plates are held firmly in place so cannot deform (both useful in a bouncing boat); and particularly useful is that they can absorb as much charge as you can throw at them. Standard batteries normally accept less than 25% of your batteries capacity as a charge rate, so in our case of 315amps this would mean a maximum charge rate of 80amps, if a standard Alternator could provide it, more on that later. So we have a potential of 315 amps, but see next paragraph as not all is useable!

A battery can only provide 50% of its charge before it is effectively flat. If you take your batteries below 50%, firstly 12v items will start to fail as the battery voltage when capacity falls below 50% is also below 12v; secondly and more important is that the battery plates will distort and if you do this regularly the whole battery will fail and need replacement. So we really only have just over 150 amps, which is enough battery power to run all our systems for between 24 – 12 hours. We don't have a fridge or similar mod cons which would use an awful lot more.

The other matter to consider is how much of a full battery charge you can provide using an alternator alone. When we leave the dock our batteries are fully charged having been plugged into a 4-stage shore powered charger. Because an alternator can only provide power at stage 1 (bulk charge) it can only charge your batteries up until about 80% of their full charge before the internal resistance of the battery get so much the alternator shuts down, everything is still running but if you have a monitor like the power-gauge you would see that the output of the alternator has reduced to just a couple of amps and is effectively useless when the battery charge reaches 80%.

Smart chargers.

Some people get around this by fitting a smart charger to the alternator. This works to some extent, the alternator with or without the smart charger will still get your batteries to 80% charge. The smart charger controls the rate of charge to push in the final 20% against the increasing battery resistance; but this can take hours. The final 20% can take another 4 – 6 hours of continuous engine running with a smart charger; but at least the charge will get into the battery, rather than the engine running and the alternator doing nothing. The engine bay smart charger replicates the 3 or 4 stage charging provided by a modern shore powered charging unit, but is only effective if you don't mind running your engines for long periods.

Boat Alternators.

Most marine engines are provided with an alternator from the automotive industry. These alternators are designed to run at full power for a short time after the engine has been started to top up the starter battery; and then to provide instant power for the all the systems running whilst you drive along. In effect the alternator on a car provides the power and the starter battery does what it says it does and no more. On a yacht most of the power is provided through the batteries and the alternator re-charges the batteries (or should do). Totally different requirements, so why does the marine industry use car alternators? Because they are cheap and readily available. The main problem with automotive alternators is that their voltage is regulated close to 12 volts because that is what is required to run the lights and stereo etc; whereas a marine alternator should be regulated to above 14 volts because that is the power output required to charge a battery .

On tick-over most of these alternators will barely be providing any amps at all, they will need to be running at around 3000 rpm to generate anywhere near their full power. Most pulleys (crank and alternator) are close to a ratio of 2:1, which means that your engine would need to be running at 1500 rpm to produce 3000 rpm on the alternator. You can waste an awful lot of time trying to charge your batteries with the engine on tick-over or just above, at these speeds you may only be charging at a rate of around 7 amps per hour.

The alternator on 'Richard House' was an 80 amp automotive unit; even at 3000 rpm I have never seen the charge above 40 amps, and this would drop off rapidly after less than 20 minutes to between 10 and 20 amps per hour. This charge rate isn't much better than the rate at which we may be using the power.

The new alternator.

We have fitted a purpose built marine alternator rated to 120 amps and it is regulated to provide that charge at above 14 volts. Another feature of a purpose built alternator is that it is designed to provide their power at much slower rpm, which suits a small marine diesel. Watching this alternator on the power gauge, I can see it outputting 100 amps at 2000 rpm (engine running at 1000 rpm, which is just above tick-over). And the alternator keeps providing 100 amps all the way up to an 80% charge, which it does very quickly. Even a very good alternator cannot get around basic physics; at sea you have to recognise that you are running your batteries between 50% and 80% capacity and manage

them between these levels. However, it does mean we now only need to run the engine for less than 2 hours a day. This pays great dividends when you are very tired and want to sleep; before the engine would be required every few hours, with short-handed racing or cruising quality, sleep is a very valuable commodity.

A Smart charger as well.
We have also decided to fit a smart charger. Not to keep the batteries up to 100% at sea, but to enable us to fully charge the batteries between legs, where we can leave the engine running for a few hours whilst cleaning and prepping the boat for the next leg so that we start again with fully charged and conditioned batteries.

Summary.
If you only ever charge your batteries using the engine alternator, your batteries will only ever be charged to 80% of their designed capacity. The chances are that, without a battery monitor; and using an automotive alternator you may find your batteries only get to 60% or less and if a battery is not fully charged it will permanently lose the capacity it was built with.

You may find that without knowing it you are regularly running your batteries close to or below 50%, which will significantly reduce their life.

If you have a shore powered charger you should use it after every sail to maintain your battery's full capacity.

Whilst sailing, racing or cruising, you should only expect to reach 80% of charge using your engine alternator. An engine mounted smart charger will do the job of a shore powered unit when in a 'foreign' harbour, but you must be prepared to run your engine for several hours.

The factors to consider are high Amp rating, regulated above 14 volts for battery charging and high power at lower rpm. To maintain battery capacity and longevity fully charge when shore side. Without a multi stage charger you will never get the final 20%. A battery monitor can be a very valuable tool. If you run your engine to charge the battery make sure you have it between 1200 and 1500 rpm. On a long distance cruise or race, good quality charging equipment and monitoring can mean many more hours of restful sleep.

My next project to fill these winter evening will be make up a storm drogue. On the last RBI we got caught by a force 10 storm, one yacht was rolled and lost their mast, two dragged anchors and went onto rocks, Pete Goss's trimaran started to break up (like Team Philips) and had to find a safe harbour. Even the Barra lifeboat, the biggest type in the UK, was rolled over for the first time ever, causing injuries to the crew including a broken leg and leading to a Bronze Medal being awarded to the crew. The storm and associated stories can easily be found on the internet. We had a drogue then, but it was prepared as much for pre-race scrutineering than use in anger. This year we will have a proper set up drogue, ready and easily deployed. I will report on the design and construction when completed.

The Children on Richard House will be following their boat around the UK and updating the justgiving website, if you do make a donation please say if you are a police officer and where you are from.

Richard and Sharon.