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Over the last few years, our on-board equipment has developed brilliantly, but consumes much more energy. For semi-offshore cruising or a long-term voyage, energy needs must therefore be redefined so as to use the new means of recharging and storage suited to this new consumption and the environment.

# UNLIMITED ENERGY

Let's admit it, for a very long time now we have abandoned complicated calculations of our amperes, and our ecological conscience has not convinced us to do without a level of domestic comfort which resembles that of our home. Aboard a modern catamaran, in addition to the autopilot, the instruments and the navigation lights, the minimum allowed by the rules of the new 'Well-Being Federation' represents a sizeable list of equipment in areas which are as varied as they are essential. For cold: air conditioning, fridge, freezer, ice machine; for hot: heating, water heater; for domestic appliances: pressurized water, microwave, coffee machine, washing machine, hair dryer and food processor; for multimedia: various chargers (telephone, PC, etc.), flat screens and iPods; for tools: drill, jig saw, are all devices for which no compromise at all can be envisaged. So even though led bulbs give us the impression of behaving in a reasoned manner, we mustn't forget the multiple ceiling lights, wall lamps, spots and reading lights present where once we were content with a single lamp. Thus we can consider that the daily energy requirements for a boat ready to go to sea can now be estimated at around 500Ah. Faced with this profusion, we must store, recharge and monitor

## THE BATTERIES

We are witnessing a slow change from classic lead/liquid acid batteries towards three new technologies: gel, AGM and Lithium Ion. Gel batteries, where the electrolyte (a mixture of water and sulfuric acid) is absorbed by a gel, are ideal for 12 and 24 volt service, resist intensive cyclic use over time (800 to 1000 cycles instead of 400 for traditional lead/acid batteries), and can be recharged quickly. AGM (Absorbent Glass Mat) batteries, where the electrolyte is absorbed by fiberglass plates, allow fast discharge at high intensities. They are therefore ideal for example for starting an engine, as they have double the starting power of a wet cell lead/acid battery. On the other hand, the cyclic life is identical. These types of battery can be matched with each standard battery bank. These batteries require no maintenance and release no gasses under normal use; they therefore require no ventilation, so can be fitted in a locker or a waterproof box. But just like the wet cell models, they can only be discharged to 50% of their capacity, hence the growing interest in lithium-ion technology. These batteries are suitable for operating heavy equipment over long periods, with very short charging times. They can withstand over 80% discharge and weight is reduced by 70%. If we take into account their life span which, with a minimum of 2000 cycles, is 4 times greater, and despite a higher purchase price, they can be worthwhile. With 720 Ah, the available power will be 570 Ah, for a weight of 118 kg. With gel batteries, you would need between 6 and 10 batteries to get 1140 Ah, thus 570 available, for a weight of around 400 kg! QED!



1 : Lithium ion batteries are suited to the new consumption modes aboard. More expensive to buy, they offer many advantages and a much greater life span, as can be seen with the new 'Batteries Atomique', which advertise 5000 charge/discharge cycles.

2: Modern Gel or AGM batteries can be stored in waterproof boxes and allocated to the functions for which they are best suited – Gel for the domestic supply and AGM for starting the engines and the windlass. A charge distributor will manage the recharging of both banks.





## CHARGERS – DISTRIBUTORS AND CONTROLLERS

the energy, and fortunately, there is no lack of means. In this first part, we will be looking at the batteries, chargers, generator and controller/management system before tackling the subject – in the next edition – of renewable energies obtained via solar panels or hydro and wind generators.

Now that you have a large storage capacity, you must be able to recharge quickly and in the right conditions. It's best to invest in a latest-generation charger, which will be able to charge at between 80 and 180 A, suited to your battery bank. Coupling two chargers will allow for fast recharging and will avoid you having to run the generator or stay plugged in to shore power for too long. **Aware that blue-water cruising catamarans more often than not have exotic and therefore potentially hot destinations, certain chargers, such as those from Cristec's HPO range, provide recharging in difficult thermal conditions up to an ambient temperature of +50°C, without loss.** The auto-detection system for the shore power network for values of from 90 to 265 V AC and from 43 to 65 Hz is also important. This allows you to use the charger on all networks (115 and 230 V AC and also at the end of the pontoon when the voltage is low). If you have several battery banks, (one dedicated to starting the engines and the

electric windlass, the other for domestic use), a distributor will be necessary. To recharge when motoring, you will have to use an alternator of 100 to 150 A, and a regulator suited to the characteristics of your battery bank. There are some which nowadays are suitable for lithium-ion batteries. All these systems are now interfaced by a bus or communication network whose purpose is to transmit information to a digital meter which allows the energy produced and consumed to be monitored in real time. The graphic screen displays the battery capacity remaining at any moment (expressed in % or Ah). These devices allow several independent battery banks to be monitored. A dry contact allows the generator to be started automatically in the case of an alarm detected when the predefined threshold or the user-predefined low capacity parameter is reached. On certain models, you can read the data on your iPad or smart phone via an NMEA connection.

3 : To recharge the batteries quickly and to be able to use the power, sometimes with consumption peaks, a suitable configuration is of prime importance, as shown here with these two chargers connected in series.

4: For more powerful chargers, the shore power cables must be of a larger section.



## GENERATORS - INVERTERS

The current challenge for the modern cruiser is to have more and more AC power available...whilst sailing! When you aren't plugged into the shore power and you aren't necessarily sailing, the best way of recharging the batteries remains the generator. On modern energy-hungry boats, it is not uncommon to see generators of from 10 to 15 kW. Apart from having an AC supply for the on-board network, with an 8 kW generator it will only take two hours (on the condition that you have a powerful enough charger (or two)) to recharge the 570 A/h you have consumed, without for all that being deprived of the 110 or 220 volts. While you are cruising under sail, or relaxing at anchor, the inverters convert the 12 or 24V from your batteries into 110 or 220V AC, thus avoiding the noise of the generator. Charger/inverters take care of the same task; they can provide up to 3kW, depending on the model, which will allow you to run all the domestic appliances. On the other hand the conversion will make a big dent in the Ah of your 12 volt batteries. A 1500W electric oven used for 10 minutes will need 20 Ah, a coffee machine 10 Ah and the evening's film on the TV will use at least 45 Ah. Your Ampere-hour store can quickly dry up if you are not careful. Monitoring the discharge is therefore very important on well-equipped boats, and we can understand why connected controllers, which avoid you running out completely, are becoming essential. It is therefore better to define an alert threshold in advance, to restart the generator.



5 : On recent boats, the generator is almost more important than the engines. A powerful generator allows a large battery bank to be recharged in two hours, and limits the noise disturbance.

**6: Energy consumption is such that to monitor the level of the battery bank, a controller becomes essential, to see your consumption in real time. Configured correctly, it can even start the generator automatically before it's too late.**