



Fresh Water When Cruising

*Water, water everywhere and all the boards did shrink,
Water, water everywhere but nary a drop to drink.
- From the Rhyme of the Ancient Mariner*

Obtaining sufficient quantities of potable water can be a problem on a cruising yacht. Often, yachts, especially smaller sailing yachts, must drastically conserve fresh water. Sometimes this is done by using salt water for washing, followed by a little fresh water for rinsing.

On board AKAMA, we do not use salt water and our fresh water conservation is moderate. We use fresh water for everything from drinking to running the clothes washer. On the other hand, we rarely wash the boat unless we are in a marina and use the dish washer only used if we have a party on board.

AKAMA is fitted with two stainless steel water tanks that hold collectively about 1900 litres. While this may sound like a lot of water, and it is for a boat, Louise-Ann and I generally consume this amount in a week to 10-days. So, sooner or later, we must fill up the tanks. There are three common sources of fresh water on a yacht: tap water, rain water and, more recently, desalination. AKAMA is rigged to use all three of these.

Our source of preference is tap water, mostly because it is cheap and quick. We process the water before it comes on board using two filters. The first filter is a standard string filter, which removes the larger particles, down to about 25 microns (one micron is a millionth of a metre). The second filter element is a carbon block, which removes finer particles and some chemicals that affect the taste, such as chlorine.

AKAMA is set up to catch rain water, something commonly done on small yachts. The monkey island (the deck above the pilothouse) has two scuppers that can be rigged to take hoses routed to the water tank fill holes. In practice, one waits for the first part of the rainfall to wash the deck and then diverts the remaining rain water into the tanks. So far, we have never used this system; we consider this to be for emergencies only.

When we cannot obtain potable water from shore, we make our own using our on-board RO desalination unit (i.e., water maker). This is our only water source when we are at sea for more than a week. Even though they call these machines water makers they don't really "make" water; they just purify seawater by reducing the concentration of dissolved particles and salt ions. In other words, despite the use of high tech terms, such as "reverse osmosis", to describe them, they are just another filter, albeit a very high-tech one.

To purify sea water one needs a filter that can remove things smaller than a thousandth of a micron (i.e., a billionth of a metre), it must be able to separate out the sodium ions, cysts and bacteria from the seawater. To put this into perspective, think of this particle size as being five to ten million times smaller than a grain of sand. A water maker contains such a filter, called a semi-permeable membrane.

An ordinary household water filter operates by forcing water at the tap pressure of 30 to 70 pounds per square inch (psi) through one or more filter elements. The finest element that can operate with reasonable flow rates at such pressures is about two microns. Obviously, to use the semi-permeable membrane in the water maker we must use much more pressure than is available from the faucet. Therefore, a water maker also contains a high pressure pump that can produce up to about 1500 psi. Pressure washers, such as car washes operate at about this pressure. The pump forces seawater into one end of the membrane, which is a hollow cylinder. At the other end, the seawater exits through a needle valve. The needle valve is used to adjust the operating pressure, which must be set dependent upon water temperature and salinity. Typically it is set to around 800 psi. Fresh water molecules pass through the membrane to the outside surface, while excess salt water and impurities go straight through, and then through the needle valve, to be discharged overboard. The fresh water is passes from the metal cylinder in which the membrane is located to AKAMA's storage tanks.

RO water makers are very inefficient, which is why in most places domestic tap water is not produced using such a system. About 680 litres of salt water is pumped through the system on AKAMA per hour, during which time only about 90 litres of fresh water is produced. The process uses a lot of energy. Our water maker runs off the ship's mains (230-volts AC) consuming about 3 kilowatts. That's about the same amount of power as that drawn by two large, portable appliances, such as full size microwave ovens or big window air conditioners. Since it uses so much electricity it will not work unless we are running the generator. There are battery operated and even manually operated models available, but they have much smaller capacities.

To keep up with the demand for water we must run the water maker, and therefore the generator, about two or three hours a day. This is not an inconvenience though, as we must usually run the generator about three or four hours a day to recharge our house batteries (see our special report on electrical needs for details). The combined sound of the generator and the water maker is rather loud. So, we usually make water and charge the batteries when we are moving from place to place, so that the noise is not noticeable.

The water produced by water makers is of very high quality. When we tasted our first glass of it, admittedly somewhat warily, our reaction was, "Wow, this stuff is good." The first things we noticed were the absence of taste and any dusty "mouth feel" so typical of city water. Also, the water is very soft, since the membrane removes all suspended solids and most of the ions present in the sea water; a little soap goes a long way.

Perhaps we are overly cautious, but all the water used aboard AKAMA is filtered again, through a string filter and a carbon block filter, when it is drawn from the tanks.

The water aboard AKAMA is so noticeably pure that when drinking tap water, back on land, our first reaction is invariably, "Ugh"!