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Updated: July 2005



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We take city water, which is clean in terms of impurities and contaminants and put it through specific industrial water treatment equipment. The scale of our processing is sized for our brewing production. It can be upgraded to produce more water as our brewing volume increases.

The process involves four-stages: Carbon Filtration, Water Softening and processing in a reverse osmosis machine. The water is then stored in a large holding tank and when we draw it for brewing or retail sale, an Ultraviolet Light gives the final treatment.

Tap water is passed through a hot and cold water mixing station. This will keep the water temperature in a target range. This range is the optimum temperature that the equipment works at. We get the best results with water at 25 degrees Celsius.

### **Stage 1: Carbon Filtration**

The first stage is a carbon filter, which removes odor, large inorganic and most organic material present in water. The filter is regularly and automatically back-flushed to remove the organic material as well as any bacteria that may be attracted to the organic material.

### **Stage 2: Water Softening**

After the carbon filter, the water now flows into a water softener. Ours is a dual tank machine that cycles between softening water and recharging. Water naturally contains dissolved minerals.

The amount and type of minerals present are specific to the area you live in and the treatment your water receives. Hard water contains a higher concentration of dissolved minerals (inorganic). The water softener "softens" the water by reducing the concentration of dissolved minerals. Water passes over a resin bed of beads that have a large surface to volume ratio. These beads have a slight charge. The dissolved minerals are attracted to the charge on the beads and remain until they are removed when the softener tank recharges. A salt solution is used during the recharging stage because it has a greater charge than the resin beads. This salt solution removes the dissolved minerals and prepares the resin bed to soften more hard water.

After both the carbon filter and the water softener, the water has less and less material dissolved in it.

### **Stage 3: Reverse Osmosis**

After the water softener, the treated water is then put through a Reverse Osmosis machine. This machine consists of a stainless pump and a reverse osmosis membrane housed in a tube. This runs best at 150 PSI and at 25 degrees Celsius. Our unit is industrial with a production capacity of 600 gallons per day (it's not metric!). This machine can have additional membranes added to increase the amount of RO water produced per day.

Osmosis is a type of diffusion, which involves a membrane. Solutions of different concentrations will try to reach equilibrium when mixed, using diffusion. Higher concentrations will become dilute in lower concentration solutions. If a semi permeable membrane separates the solutions, only the molecules that can go through the membrane will. This is the principal behind Osmosis. Reverse Osmosis involves pushing a fluid against a membrane allowing only the smallest molecules to pass through. This results in a solution with a higher concentration on one side of the membrane and a lower concentration on the other side. This is reverse of the osmosis process. The cells in your body act in a similar fashion, only with a lot more complexity, to control their contents.

As the water is pushed through the membrane only the water molecules pass through. The reverse osmosis water is collected into a large sealed holding tank. The RO unit is regularly back-flushed to keep the membrane clean.

### **Stage 4: Ultraviolet Light Sterilization**

We draw out of the holding tank when we are preparing to brew or to sell RO water to our retail customers. The water passes through a quartz crystal tube that contains a powerful UV light bulb. This light generates frequencies that are fatal to any biological organism that could be present.

This is a unique process that provides Black Oak with purified water for brewing. Our equipment provides the best value for water production. We get great quality water at a reasonable cost. The benefit of all this processing is quality, consistent, great tasting beer.