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WHAT IS HARD WATER?

Water described as "hard" is high in dissolved minerals, specifically calcium and magnesium. Hard water is not a health risk, but a nuisance because of mineral buildup on fixtures and poor soap and/or detergent performance.

Water is a good solvent and picks up impurities easily. Pure water -- tasteless, colorless, and odorless -- is often called the universal solvent. When water is combined with carbon dioxide to form very weak carbonic acid, an even better solvent results.

As water moves through soil and rock, it dissolves very small amounts of minerals and holds them in solution. Calcium and magnesium dissolved in water are the two most common minerals that make water "hard." The degree of hardness becomes greater as the calcium and magnesium content increases.

HARD WATER PROBLEMS

Laundering

Clothes washed in hard water often look dingy and feel harsh and scratchy. The hardness minerals combine with some soils to form insoluble salts, making them difficult to remove. Soil on clothes can introduce even more hardness minerals into the wash water. Continuous laundering in hard water can damage fibers and shorten the life of clothes by up to 40 percent.

Bathing

Bathing with soap in hard water leaves a film of sticky soap curd on the skin. The film may prevent removal of soil and bacteria. Soap curd interferes with the return of skin to its normal, slightly acid condition, and may lead to irritation. Soap curd on hair may make it dull, lifeless and difficult to manage.

Problems in Water Boiler Systems and Pipework

Hard water also contributes to inefficient and costly operation of water-using appliances. Heated hard water forms a scale of calcium and magnesium minerals (lime scale deposits) that can contribute to the inefficient operation or failure of water-using appliances. Pipes can become clogged with scale that reduces water flow and ultimately requires pipe replacement. Lime scale has been known to increase energy bills by up to 25%

Lime Scale in Solar Heating Systems

Solar heating, often used for heating swimming pools is prone to lime scale buildup, which can reduce the efficiency of the electronic pump and therefore the overall systems performance will deteriorate. A low cost solution to this problem is to install a magnetic water conditioner before the pump, this will prevent lime scale buildup and, over time, it will remove existing lime scale.

Hard Water Benefits

Hard water is not a health hazard. In fact, the National Research Council (National Academy of Sciences) states that hard drinking water generally contributes a small amount toward total calcium and magnesium human dietary needs. They further state that in some instances, where dissolved calcium and magnesium are very high, water could be a major contributor of calcium and magnesium to the diet.

The ideal solution would be to leave the calcium in the water, but alter its state so that it couldn't form lime scale. This is exactly what **magnetic water conditioners** do.



HARD WATER TESTING

If you are on a municipal water system, the water supplier can tell you the hardness level of the water they deliver. If you have a private water supply, you can have the water tested for hardness.

As a guide, 60% of the UK population live in a hard water area.

Most water softener companies will be able to supply you with a free water testing kit.

Once you've tested your water supply, the hardness of your water will be reported in grains per gallon, milligrams per liter (mg/l) or parts per million (ppm). One grain of hardness equals 17.1 mg/l or ppm of hardness.

<u>Classification</u>	<u>mg/l or ppm</u>	<u>grains/gal</u>
Soft	0 - 17.1	0 - 1
Slightly hard	17.1 - 60	1 - 3.5
Moderately hard	60 - 120	3.5 - 7.0
Hard	120 - 180	7.0 - 10.5
Very Hard	180 & over	10.5 & over

WATER TREATMENT METHODS

There are many commercial ways of treating hard water including water filters, water softeners, electromagnetic water conditioners and reverse osmosis. In this section we will look at the pro's and con's of several of the available methods to treat hard water.

Method	Chemical Water Softeners	Water Filters	Mechanical Water Softeners	Magnetic Water Conditioners
Description	Chemicals added in laundering process	Drinking water from the tap is filtered with a portable unit	Permanently installed in plumbing system to replace calcium and magnesium with sodium	Permanently installed in plumbing system to alter calcium ions so they cannot cause lime scale
Advantages	Removes Calcium and Magnesium Lengthens lifespan of clothes	Output water is fit for drinking Chlorine removed Water Softened	Prevents lime scale Increases heating efficiency Lengthens lifespan of clothes	Output water is fit for drinking Prevents lime scale Increases heating efficiency Lengthens lifespan of clothes Calcium retained, good for diet Low running cost

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Packaged Water Softeners

These are chemicals which help to control water hardness. There are two types, precipitating and non-precipitating.

Precipitating water softeners include washing soda and borax. These products form an insoluble precipitate with calcium and magnesium ions. The mineral ions then cannot interfere with cleaning efficiency, but the precipitate makes water cloudy and can build up on surfaces. Precipitating water softeners increase alkalinity of the cleaning solution and this may damage skin and other materials being cleaned.

Non-precipitating water softeners use complex phosphates to sequester calcium and magnesium ions. There is no precipitate to form deposits and alkalinity is not increased. If used in enough quantity, non-precipitating water softeners will help dissolve soap curd for a period of time.

Mechanical Water Softeners

Mechanical water softening units can be permanently installed into the plumbing system to continuously remove calcium and magnesium.

Water softeners operate on the ion exchange process. In this process, water passes through a media bed, usually sulfonated polystyrene beads. The beads are supersaturated with sodium. The ion exchange process takes place as hard water passes through the softening material. The hardness minerals attach themselves to the resin beads while sodium on the resin beads is released simultaneously into the water.

When the resin becomes saturated with calcium and magnesium, it must be recharged. The recharging is done by passing a salt (brine) solution through the resin. The sodium replaces the calcium and magnesium which are discharged in the waste water.

Hard water treated with an ion exchange water softener has sodium added. According to the Water Quality Association (WQA), the ion exchange softening process adds sodium at the rate of about 8 mg/liter for each grain of hardness removed per gallon of water.

For example, if the water has a hardness of 10 grains per gallon, it will contain about 80 mg/liter of sodium after being softened in an ion exchange water softener if all hardness minerals are removed.

Because of the sodium content of softened water, some individuals may be advised by their physician, not to install water softeners, to soften only hot water or to bypass the water softener with a cold water line to provide unsoftened water for drinking and cooking; usually to a separate faucet at the kitchen sink.

Mechanically softened water is not recommended for watering plants, lawns, and gardens due to its sodium content.

Water Filters

Water filters generally come in two forms. Portable ion exchange water filters, and reverse osmosis water filters. Both are used for "point of use" drinking water, that is, to filter out harmful or unwanted particles before the water is used for human consumption.

Reverse Osmosis works by forcing the water through a semi-permeable membrane, that stops certain particles from passing through.

Portable water filters work using a cartridge containing activated carbon and ion exchange resin. The carbon absorbs and helps reduce the levels of chlorine and chlorine compounds, as well as pesticides, colour and other organic substances. This improves taste and appearance. The ion exchange resin works to reduce temporary hardness.

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Magnetic Water Conditioners

Magnetic water conditioners have been significantly improved with the use of more powerful magnets. The idea is that by passing water through a magnetic field, the calcium and magnesium ion's are altered in such a way that they lose their ability to cause scale.

This has a number of benefits; although the water is not technically soft, it has the useful properties of soft water, that is, it won't cause lime scale in your pipes thus increasing heating efficiency and lengthening the lifespan of any clothes washed in the conditioned water.

Calcium is an important dietary element, so the fact that conditioned water still retains its calcium content is an added benefit.