

# **Water Tech SCALE-SAFE**

## **Chemical Free, Salt Free, Maintenance Free Scale Control**

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Water Tech SCALE-SAFE with ScaleNet Resin has an efficiency of 99.9%

How does the chemical free water treatment technology work?  
You first have to look at the basics of calcium scale:

### **1. How does the calcium get into the water?**

Our drinking water comes from the groundwater. This groundwater is constantly being added onto by rain water. When the rain passes through the atmosphere, it enriches itself with carbon dioxide (CO<sub>2</sub>). Carbonic acid (H<sub>2</sub>CO<sub>3</sub>) is formed from the connection of H<sub>2</sub>O (water) and CO<sub>2</sub> (carbon dioxide). Carbonic acid is the solvent of calcium. After the rain sinks into the soil, the carbonic acid extracts the calcium from calcium rich stone. Through this process hydrogen carbonate [Ca(HCO<sub>3</sub>)<sub>2</sub>] is formed. This extraction process ends when the water is saturated with calcium. This means that the carbonic acid and the Calcium are in a **carbonic acid – calcium equilibrium**. Depending on the ground quality (amount of calcium and amount of carbonic acid) more or less calcium is extracted into the water.

### **2. How does calcium scale develop on pipes and hardware?**

The calcium rich water comes from private wells or public water plants into the house. The carbonic acid – calcium equilibrium is interrupted in the pipes.

The hydrogen carbonate [Ca(HCO<sub>3</sub>)<sub>2</sub>] is a very weak chemical compound which is very easily broken by temperature increase or movement. (Example: When heating water bubbles appear which is the escaping CO<sub>2</sub>. When shaking a bottle with CO<sub>2</sub> enriched water the CO<sub>2</sub> very easily escapes in form of bubbles.)

If the water is heated or there is a lot of movement in the water, then the CO<sub>2</sub> escapes from the water. This means that there is less and less solvent (CO<sub>2</sub>) present for the calcium. Parts of the calcium are no longer dissolved (Dissolved Solids) and attach themselves to surfaces of pipes, heaters, hardware in the form of calcium carbonate (CaCO<sub>3</sub>).

### **3. Effects of calcium.**

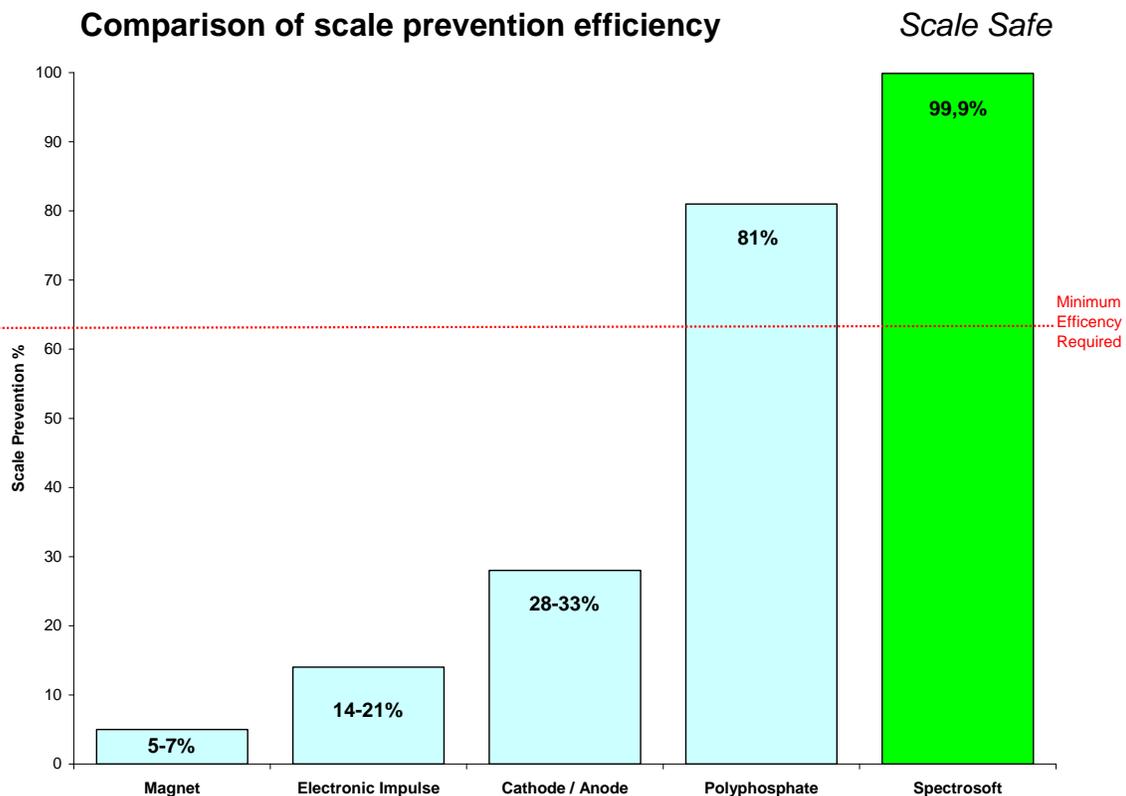
Negative: Calcium creates scale on pipes, hardware and surfaces. This leads to high energy costs for heaters and expensive repairs for ice machines, coffee machines, cooling towers, etc. Another problem is that bacteria can grow in the scale.

Positive: Calcium has several positive effects, especially positive health effects. In some European countries it is illegal to sell RO or distilled water as drinking water. The reason is that the water with no calcium enriches itself with the body's calcium and can cause diseases related to the lack of calcium in the body. Water without calcium also has a bad taste. Dasani water by Coca Cola for example is filtered

with RO systems and is enriched with minerals afterwards to add taste to the water.

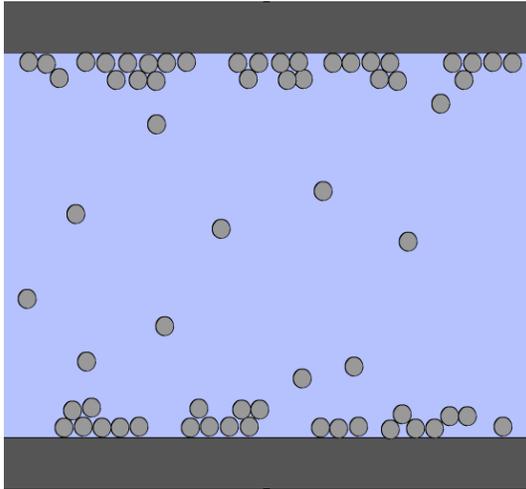
#### 4. What calcium treatments are available?

1. Conventional water softener (ion exchanger). This system exchanges the calcium ions with sodium ions. Scale can be prevented, but the system requires large quantities of salt, water, electricity, and manpower for regen, and discharges large quantities of used brine to the environment. This can damage the environment and cause waste treatment problems, so many US environmentally-sensitive states banned salt regenerated water softeners.
2. Magnetic and electric systems. These systems are supposed to create crystals from the calcium ions. It is known that the calcium crystals cannot attach to surfaces. However, these systems only have an effectiveness of up to 20%. This is not enough to prevent scale. It is easy to create better test results in a laboratory by adding certain amounts of iron to the water before treating it. The conditions for these tests are unrealistic and do not occur in nature.
3. Polyphosphate has a scale prevention effect but releases chemicals into the water and requires maintenance and related costs. The media uses up.
4. Watts has this technology named Scale Net. This technology prevents all the negative effects of calcium, while allowing for the positive health effects to remain. The system is maintenance free, chemical free and salt free and does not require regeneration or backwashing.

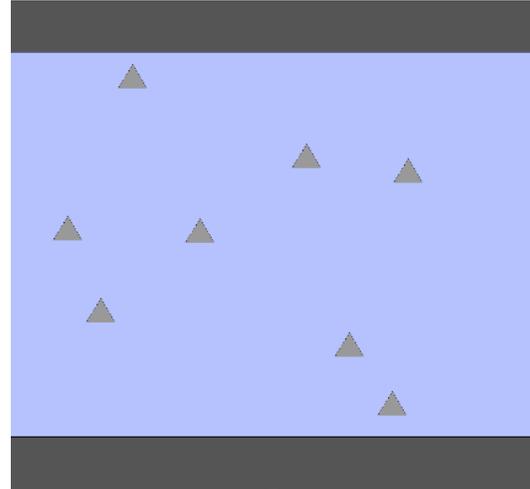


#### 5. How does the SCALE-SAFE Scale Net media prevent scale?

The Scale Net media has all the scale prevention advantages of an ion exchanger, for example the amount of soap and detergents needed is smaller. There are no more spots on dishes, bathroom tiles, etc. The Scale Net reliably transforms the calcium ions into calcium bonds. These bonds are stable and cannot attach to surfaces, hardware, etc. The crystals are rinsed away by the water flow. The size of the bonds is so small that they can only be seen with a microscope. Therefore the effect is the same as if the water was completely free of calcium.



Ions (charged) can attach to Surfaces and create scale buildup.



The bonds (neutral) cannot attach To surfaces and scale is prevented.

Tests lasting several years showed that the bonds cannot attach to any kind of surface and the result is a 100% scale prevention. Also other ions can no longer attach to surfaces because of the structure of the surface created by Scale Net. Because the ions are formed into stable bonds, the TDS is thus lowered. Please note that a TDS meter does not directly measure the total dissolved solids, but rather the conductivity. It cannot distinguish between bonds and dissolved solids, therefore it is not suitable for this system.

## 6. How does the Scale Net process work?

The most important factor in the development of bonds from ions is the surface. The surface which encourages the bonds growth. These bonds are also formed in normal water pipes. According to the "Brownian motion of molecules" a bond is created whenever a certain number of calcium ions meet in a certain constellation. This creation of bonds is completely random. With the knowledge about these surfaces we set out to develop a surface which the calcium ions would accept as a template and form into crystals. Critical for the development of crystals is the enthalpy. This is the energy required to form a crystal or a new layer of crystals. A very important development in the Scale Net catalyst is that the nanostructure on the surface of the catalyst decreases the enthalpy needed enough to allow all ions to form into crystals, even in cold water. Altogether, the Scale Net media can be described as an artificial template which allows for all calcium ions to form into harmless crystals. When the crystals growing, they loose their grip on the

templates and are rinsed away with the water flow. Now new crystals can form on the template.

Real life example of an artificial template:

If you have a saturated salt solution in a glass, no crystals will form. However, if you put a wool thread into the water, crystals will start to form on it. The wool thread functions as an artificial template, reducing the enthalpy and encouraging the dissolved salt to form a crystal.

Descaling effect of the Scale Net media:

The Scale Net media also has a descaling effect on scale already present in old pipes, hardware, etc. The water coming from the media is free of calcium ions. Calcium ions in the already existing scale are attracted to this unsaturated water and add on to the crystals that are now floating in the water. This way existing scale is usually heavily reduced or removed within 1 to 2 months.

Lifetime:

The Scale Net media works chemical, salt and maintenance free and has a lifetime of 5 years. The Scale Net media does not have to be backwashed.

## 7. Corrosion Prevention

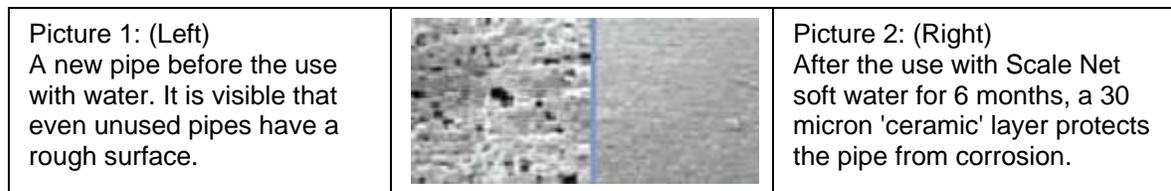
In addition to preventing scale, Scale Net media also prevents corrosion. As explained in the section above, it is important how the calcium carbonate crystal is built.

Scale in pipes is made of calcium carbonate. A pearl is made from the same material. Although these are the same chemical substance, they are completely different products. The difference in these two is the grouping of atoms.

The template or first layer of a crystal is deciding in what the final crystal structure will be. Scale Net media can decide how the crystal will grow and what the atomic grouping of the crystal will be.

The crystals built by us are created so that they cannot stick together and cannot grow larger than 30 microns.

The corrosion prevention works by adding a 30 micron protective layer to the surface of pipes and hardware.



On the surface of a metal pipe there are ions. These ions are always grouped in a + - + - grating. The crystals created by *Scale Net* media attach tightly to the surface. No more crystals can attach to this 30 micron layer.

The effect of the *Scale Net* media is also proven with the fact that the protective layer keeps copper from getting into the water when using a copper pipe. Without the protective layer there is a higher concentration of Cu in the water.

The *Scale Net* layer is even visible on the pipes. If a pipe that was used with the *Scale Net* media treated water is removed and dried, you will see the surface sparkling like diamonds when shining a flashlight into it.

### **8. What happens to a pipe that is not protected by the Scale Net system?**



*Picture 3: Scale buildup in a copper pipe without the use of a Scale Net system.*

Calcium carbonate grows randomly in a copper pipe. The difference is that there is no smooth surface and the growth of the calcium is not restricted. Other compounds can also attach to the calcium. Picture 3 shows cuprous oxide ( $\text{Cu}_2\text{O}$ ) and malachite  $\text{Cu}_2[(\text{OH})_2/(\text{CO}_3)]$  appearing in red and blue.

The *Scale Net* media can be used in all applications where otherwise phosphate is used for corrosion prevention.

### **7. Areas of Application of the Scale Net Media:**

The media is a completely reliable scale prevention and descaling system.

Boiler, Water Heater  
Light/Heavy Manufacturing  
Breweries  
Food Processing Plants  
Restaurants  
Hospital/Medical  
Hotels, Cruise lines  
Car/Truck/Bus wash  
All Hardware

Dishwasher, Washing Machine  
Ice Maker  
Cooling Towers  
Evaporative Condensers  
Coffee Machine  
Pipes  
Laundry industry  
Steam Presses

Other Areas of Application:

The *Scale Net* media works perfectly in combination with other media, such as heavy metal removing media. It is also great in combination with a carbon filter. Through these combinations the area of application is increased immensely.

## 8. Technical Data Sheet:

<b>Matrix</b>	Polyacryl Network
<b>Appearance</b>	Small light yellow/beige balls
<b>Surface</b>	Ceramic Template Surface
<b>Moisture Content</b>	24 to 28%
<b>Density</b>	1,18 to 1,22
<b>Weight</b>	650g/L
<b>Media Particle Size</b>	550 to 750 µm
<b>Small Media Particles</b>	< 0,300 mm: maximum 3,0%
<b>Large Media Particles</b>	> 1,180 mm: maximum 5,0%
<b>Change in Volume</b>	Maximum 60%
<b>Capacity</b>	1 Liter Scale Net media for 4.0 gal/min water flow.
<b>Daily use</b>	Media can be used 24 hours a day, no need for regeneration or back flushing when the direction water flow goes upwards.
<b>Lifetime</b>	Approx. 5 years depending on amount of chlorine in the water.
<b>Operating Temperatures</b>	41 F to 140 F
<b>pH Range</b>	6.0 to 9.0