

## 4. External Factors and their Influence on the Treatment

As the eco-friendly technology of physical water treatment operates within the laws of nature, we have to consider some of these laws. It is important for the Vulcan water treatment to create as many of the mono-crystals as possible. However, the mono-crystal structure does not last forever. From the moment of its creation, it has only a limited life expectancy. Time, distance and temperature determine how long the crystal will last and this again determines how long the effect will last.

### 4.1 The Time Factor

**The effect of the Vulcan lasts a minimum time span of 48h in cold water and up to 7 days in warm water.**

- In warm water (= more than 30°C/ 86°F) the effect lasts up to 7 days
- In cold water (= below 30°C/ 86°F) the effect lasts up to 2 days

**Why does the temperature have an effect on how long the Vulcan effect is active?**

When mono-crystals are created by the impulse variation, it is important that they grow as long as possible before they start their way through the piping system. The larger the crystals, the longer it takes until they fall apart again.

It is well known in nature that **heat** speeds up the growth process. It is the same with the mono-crystals. In **warm water**, the crystals grow faster and longer than in cold water. This results in a much higher number of crystals, together with a larger size of the individual crystals. The larger crystals then survive up to 7 days.

**Cold water** does not promote the crystal's growth as much and they are usually smaller. However, in cold water the scale deposits are usually less prominent. In the cold-water setting the effect lasts up to 2 days.

### 4.2 The Distance Factor

We know that the mono-crystals do not last forever. The travelled distance has an effect on the crystal's life expectancy. When they begin their journey through the piping system they fall apart during that time.

Several factors such as complexity of the piping, the number of intersections and divisions, variations of pipe diameters throughout the piping system or the existence of pumps all have some influence on the crystal's life. For example, passing through turbulence in a bend promotes the growth of a mono-crystal and will help to extend its life.



Experience shows that the Vulcan effect will start to diminish after a distance of approximately 2.000 m (~ 1.2 miles) in the pipe. However, long distances of 2 km (~ 1.2 miles) or more are rarely reached within buildings. Furthermore, with the favorable pipe system setup, the effect often last longer.

### 4.3 The Combination Factors: Temperature - Pressure - Type of heating

#### a. Temperature and its effect on the treatment

The water temperature itself is one factor that has some influence on the duration of the treatment (how long the effect will last). We learned that warm water (30°C/86°F or more) has a positive effect on the growth of the mono-crystals (see section 4.1) and therefore supports the Vulcan treatment.

Extreme heat such as a heating element surface temperature of above 97°C (207°F) may also influence the treatment's outcome. What we observe with the scale situation on a heating element is that the heating element stays cleaner at 98°C (208°F) surface temperatures than at 110°C (230°F) or than at 130°C (266°F) and so on. This is a natural finding as heat promotes the scale formation. In general, the calcium crystals naturally want to gain back their common shape.

#### Combinations: A mixture of influences

The combination of several external factors together influence the treatment and it is not always possible to know the exact outcome in advance:

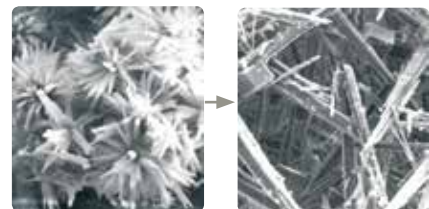
Temperature is one influence to consider. A second factor to keep an eye on is high pressure (e.g. in boilers/ steamers). What also comes into the equations is the way the heating is generated (gas, electrical, heat exchanging, burner etc).

▶ When there is extreme heat, a specific pressure and heat generation involved, this mixture may have a somewhat different treatment effect. Please consider that in such a situation it may be best to test and see.

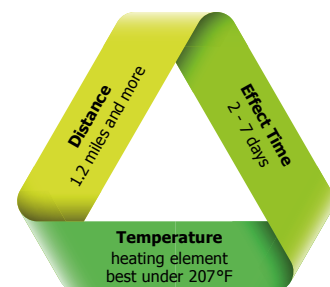
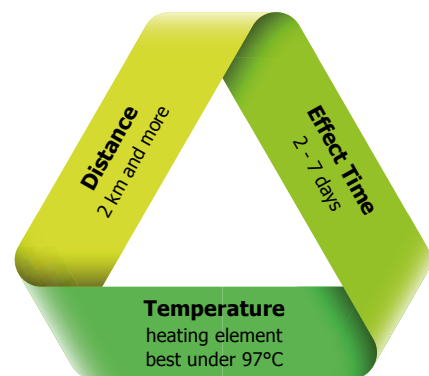
For example, a typical finding can be: the hot surfaces of burners, heating elements or steam generators may show some more deposits from 95°C up. For example: the heating element stays cleaner at 98°C (208°F) surface temperatures then at 110°C (230°F) then at 130°C (266°F) and so on.

#### Conclusion

When several factors including extremely high heating element temperatures and high pressure together with one of the several possibilities occur together, the treatment effect is not always easy to predict. Always put in a trial installation! When the customer understands these variables he knows what to expect and what not.



Vulcan working range - metric system (°C, km)



USA System (°F, miles)