

# Scale build-up: what exactly is it?

Have you ever stopped to think what scale might be or where it has come from? Jonny Seccombe, managing director of Lifescience Products, offers some answers...

Scale precipitates from hard water for a number of reasons. Most significant for a water heater is when the temperature rises above about 55°C. But it also occurs when the pressure drops, often at the hot water outlet. The outlet pipe at the top of a hot tank has the highest temperature of water so scale starts forming at this point. As the pipe starts to become constricted, the water has to accelerate to get past the constriction and the pressure drops, encouraging even more scale to form. Increase in pH, or reduction in acidity, is a third cause but not normally relevant to water heaters. Typically you find scale on urinals and toilet bowls because a bleach cleaner has been used. The bleach raises the pH in the water so scale forms in the urinal waste pipe or around the toilet bowl.

When scale forms it has to stick to another surface, it won't form in isolation on its own. This is why it sticks to heaters and pipe surfaces. When it builds up on a surface it can be called "encrusted" scale and normally you would need an acid cleaner to get rid of it. If something causes it to break away, typically "popping off" an electric heater element, it becomes "debris" scale. Both encrusted and debris scale can cause problems in water heaters, but solving these problems sometimes needs a different approach.

## SCALE REDUCTION

Encrusted scale can be avoided by using a water softener to remove the calcium and replace it with non-precipitating sodium. More commonly these days, a physical water conditioner is used to force the scale to form on a nucleation seed in the water. The scale still occurs but it stays in suspension and flows through the system not attaching itself to a surface.

Some physical water conditioners not only stop scale sticking to surfaces but also, when retro-fitted to an existing system that is already scaled up, they cause the scale to break down. The old scale doesn't dissolve back into the water, the boundary layer where it is attached to a hard surface de-laminates and the scale breaks away into particles or pieces. This debris can take many forms depending on the water source and the other minerals in the water. In some cases the debris breaks down into a soft coloured powder and is harmless to the system. In other cases it can break down into a hard grit or even gravel and these can cause serious problems in a plumbing system.

In a normal residential retro fit the debris scale can cause problems by being trapped behind



An example of debris scale that has accumulated in a Geononi heat exchanger causing it to fail

aerators and showerheads. It can take the form of a hard grit that can get trapped behind a shower nozzle or it can drop into a bath or basin. The debris scale stops being produced after a couple of months so no longer presents a problem, but homeowners should be warned about it happening over the first few weeks after installation.

In larger residential and commercial applications, which have re-circulation systems for the hot water, the problems can get more serious. Very commonly, the debris is drawn back into a water heater from the hot water return and what happens after that depends very much on the design of the heater. Tank type heaters are generally not a problem. As long as the debris gets churned up by the cold inlet or the hot water return it normally breaks down over time and eventually disperses through the hot water outlet. However, it is not a bad idea to plan to open a tank to clean it about three months after installing a water conditioner.

## PROTECTING THE PUMP

In heaters with restricted flow channels the debris can cause complete failure and it is advisable to use strainers to protect them. Putting a strainer on a hot water return is really a "must do". This will protect the pump from debris damage as well as the heater. However, provision must be made for regular servicing of the strainer to avoid cavitation in the pump.

Where water is being pumped from a storage tank to a hot water generator a strainer should

also be considered. Unless the strainer has an auto backwash facility, triggered, for example, by the pressure drop over the strainer, there is always a risk that a clogged strainer will restrict the flow to the heater causing it to lockout. That is the bad news. The good news is that the descaling process should be over in two or three months and the amount of debris in the hot water system will drop significantly. It is obvious that investment in a good automatic hot water backwash system could be money well spent.

Some types of packaged heaters with tanks that are linked to heat exchangers are difficult to fit with strainers so retrofitting these heaters in conjunction with a water conditioner could cause problems with debris scale.

## ELECTRONIC CONDITIONERS

The really interesting thing about the de-scaling process is that no one fully understands how or why it happens. It appears to be caused by resonance from the frequencies used by electronic conditioners, but the dramatic effect being created over considerable distances using so little power is very surprising.

Whether or not there is a satisfactory Scientific explanation, this side effect of some water conditioners is a phenomenon that cannot be ignored. A strategy to deal with the debris that can be created has to be devised and precautions to protect sensitive plant put into action.