Designing scale out of a system

Manufacturers should think "scale" when designing a water heater, says Jonny Seccombe, managing director of Lifescience Products

The new requirement under Part L for scale prevention in hot water systems has focused a lot of attention on the use of physical water conditioners (PWCs).

It has also drawn attention to their effectiveness.

Part L describes the need "to treat the feed water ... to reduce the accumulation of limescale". Note the use of the word "accumulation".

Scale can present two problems. First, it has to form onto something – it sticks to pipes or heat exchangers – and "encrustation" is the best way to describe it.

Second, it can break away from whatever it has encrusted and build up a deposit of loose scale in the bottom of a water heater or calorifier.

PWCs vary greatly in their performance. Some are good, some are bad, and some are downright awful.

A good PWC is designed to encourage the formation of scale as a particle in suspension in the water rather than encrusting surfaces. Ideally this particle will be small enough and light enough to be carried away in the general flow of the water.

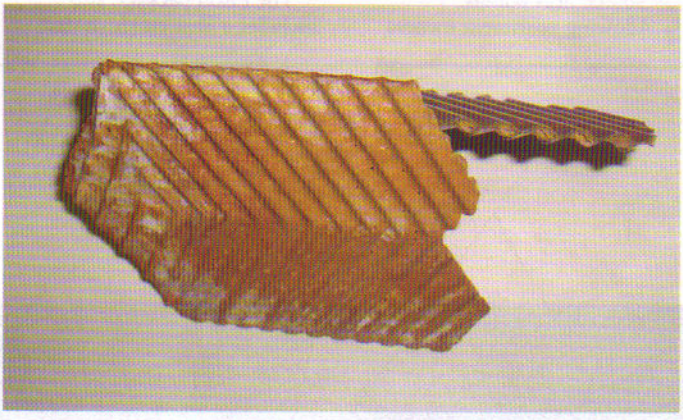
Because of water quality variations, the propensity for encrustation also varies – in other words, sometimes a PWC can work well, while in other water conditions it can be less effective.

A tightly-packed bundle

What tends to get ignored is the importance of the design of the water heater in terms of its propensity for scaling and capability of dispersing loose scale particles.

A well-designed water heater makes the work of a PWC much simpler.

When we look at a hot water delivery system, we look for features that can cause scale to form more easily.



Not a breakfast waffle – scale from a plate and frame heat exchanger

Pumped systems need close scrutiny. Not only do pumps reduce the effectiveness of some PWCs if they are fitted in the wrong place, they can also make scale form a lot quicker.

Sometimes we see a pump installed downstream of a plate and frame heat exchanger.

This means that water is being drawn through the heat exchanger under suction. The reduced pressure created in the heat exchanger encourages much more rapid scale precipitation for a given temperature.

It is much better if the pump is installed upstream and the water is forced through the heat exchanger under pressure.

A new trend in gas water heaters is the use of modular heat exchangers that draw water from an integral tank via a pumped circuit. The pump is generally installed in the correct place, before the heat exchanger. However, they still present a problem for some PWCs.

Treated water that has passed through a pump can show a marked reduction in its treatment. Protection of these heat exchangers is therefore much more difficult to deliver.

These problems affect encrusted scale. However, other problems arise from scale that has fallen away from the place where it has first formed.

It will often accumulate in the bottom of a gas heater where it builds up into a hard pan. This ultimately causes overheating and failure of the bottom of the heater.

Apart from draining down the heater and vacuuming the scale out of it, the only way to solve the problem is by using the inflow of the water to the water heater to disperse the scale.

Some manufacturers pay a lot of attention to this detail. Others seem to ignore it.

If the cold make up water inlet is directed to the bottom of the heater, then scale is much more easily dispersed.

Sometimes a sparge bar is used to increase the dispersal effect. Sometimes a top inlet is fed internally to the bottom of the heater and sometimes a vortex effect is created by introducing the make up water axially to create a circular flow.

Anyone specifying a gas water heater for use in a hard water area should look very closely at these kinds of design features and ask the heater rep: "What happens to any loose scale in the bottom of the tank?"

Electric water heaters present a different set of problems, principally focused around the heater element.

Water inlet design is still important for dispersing loose scale, but also consider the behaviour and life of the heater element.

Widely-spaced bundles are much more efficient at shedding scale than tightly-packed bundles.

Check that Titanium elements are also available for the heater. The life expectancy of a Titanium element significantly exceeds the ordinary element and the cost is not a lot more. Be wary of a manufacturer that does not offer a Titanium option.

Many manufacturers hide behind the mantra that water treatment is the responsibility of the installer. They are right, but they can make the installer's life a lot easier if they think "scale" when designing a water heater.