

HEATBASE Ltd FACT SHEET 15

LIMESCALE AND SYSTEM CORROSION (SLUDGE)

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Lime scale

When water is heated, naturally occurring calcium or magnesium carbonate is deposited in the form of lime scale. The higher the temporary water hardness, the higher the alkalinity of the water and the higher the temperature the water is heated to the more scale will be deposited.

Sludge

Corrosion or Sludge forms in untreated systems when an electrolytic reaction occurs. This happens when two dissimilar metals carry a different electrical charge. Basically the radiators and boiler are rotting away. Reddy brown water and deposits (ferrous oxide) are caused by air entering the system. It can enter in various ways; micro leaks on joints, badly designed pipe work layouts, or by frequent intake of fresh oxygenated water. It is often a sign of active corrosion.

Black magnetite sludge (ferric oxide) forms dense sediments in radiators and the boiler. It clogs pumps and reduces the flow of water through pipes and radiators. It is often a result of a system not having been flushed out correctly after installation.

Black water that can be drawn from a radiator air bleed, boiler bleed or drain cock is usually a sign of an advanced state of corrosion. Black oxide is formed in all untreated heating systems.

Clear water does not always indicate a clean system as the sludge can actually fuse itself to metal within the system. One of the by-products of corrosion is the production of hydrogen gas. If regular gassing of a heating system occurs (air in radiators), great care should be taken as hydrogen gas is highly flammable.

If scale or sludge forms in the heat exchanger it will produce an insulated coating which can have two effects.

1. The heat the boiler produces can't get into the water jacket as easily and so ends up leaving through the flue, thus increasing fuel consumption as well as potentially damaging flues and flue seals.
2. The insulated coating can shield the boiler control stat leading to inaccurate control, the scale or sludge also continues to heat the water after the heat source has finished, raising the temperature further and causing what is known as localised boiling.

Other symptoms of corrosion are: Failure of circulating pumps, sticking motorised or thermostatic radiator valves, cold spots in the radiators, leaking joints or radiators/boiler, failure of pressure gauges auto air valves and pressure relief valves or what may appear to be the failure or inaccuracy of boiler control thermostats.

1mm of scale can increase fuel consumption by 7.5%, while a 12mm layer can raise this figure to 70%.

The most effective way to cleanse the system is to power flush it. This involves dosing the system with a sludge/scale removing chemical, allowing it to be circulated for a specified time, and flushing out the fouled water with the use of a very powerful pump. Flushing with water only removes about 10% of the debris in a system; add a power flush and you can expect to remove up to 30%. By using chemicals and a power flush you can remove around 80%.

Once the system is clean it must then be dosed with corrosion inhibitor, which is a substance that when added to a water system, reduces the rate at which corrosion takes place. In simple terms Corrosion inhibitors form a very thin film between the metal and the water to try to prevent corrosion taking place. The film is only maintained by the continued presence of inhibitor in the water. Systems require a sufficient dose to "coat" the internal surfaces of the system plus some excess to maintain this film. If the dose is below the level required to achieve protection, exposed areas of metal will continue to corrode. Over dosing with inhibitor is unlikely to have any detrimental effect.

For corrosion inhibitor to work the system must be clean; it cannot work in a fouled system.

Installers can now fit a Magnetic filter such as the Adey Magnaclean within the system that will attract Sludge particles, and help maintain a healthy and efficient system.