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THE BENEFITS OF PROPER CLEANING & FLUSHING

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An independent study commissioned by Sentinel, the leading European chemical water treatment manufacturer, shows that Sludge Build-up significantly affects Central Heating System Performance. Whilst this was always believed to be the case, this is the first time that scientific research has been carried out to prove it and to quantify it.

There has been considerable evidence that despite the arrival of the new Part L of the Building Regulations, many installers do not correctly flush out domestic central heating systems when upgrading system hardware, controls and/or replacing the boiler. Many boiler replacements are currently directly or indirectly sponsored (or part sponsored) by Government grants and it is thought that inadequate or absence of flushing may be degrading the value of those system improvements.

In order to gain a greater understanding of the problems, Sentinel Performance Solutions recently commissioned Gastec-CRE - a joint venture company uniting the experience and expertise of Gastec N.V., the centre of gas excellence in the Netherlands and CRE Group Ltd the former research arm of the UK's coal industry - to perform an independent study to determine and quantify:

- any loss in energy efficiency that such inadequate cleaning & treatment may cause, and
- any consequential “gain” (or corresponding absence of loss) of efficiency that can be directly attributable to correct cleaning and treatment using Sentinel products.

The study was undertaken on a purpose-built replica of a simple domestic installation consisting of an 11kW condensing boiler and five extended surface single panel radiators at two levels. The hydraulic load of the system was accurately balanced with flow and return temperatures set at 65/47°C respectively.

The original concept of the experimental programme was to:

- Start with a clean system and determine its thermal efficiency.
- Foul the system with portions of sludge taken from several systems.
- Measure the effect of this upon system thermal performance.
- Fit a new boiler and measure the new efficiency. (This is equivalent to retrofitting a new boiler without power flushing).
- Powerflush the system.
- Measure the system performance with the new boiler in place.
- Add a scale & corrosion inhibitor treatment and study long term performance.

Before this study it was thought there were two major factors affecting the performance of a central heating system firstly that of the boiler and secondly of the pipework and radiators.

To consider these in turn: -

- **The boiler** - In the case of a modern boiler with an aluminium heat exchanger, consisting of a single finned coiled tube, the loss of efficiency with age does not come from the “laying down” of corrosion deposits or sludge within the boiler itself. This is because the high velocity within the boiler is generally sufficient to effectively “scour” such deposits. Similarly, the deposits from the initial hardness of water are not considered significant in a small domestic situation. This might be different in a large commercial installation with long lengths of large diameter pipe, and in conventional industrial boilers

consisting of a large “tank” of water, but this is not an issue with gas boilers of small water content.

- **The pipework and radiators** - The corrosion deposits within an elderly central heating system can cause a substantial reduction in the effectiveness of the radiators themselves or the system as a whole by about 15%. Effects can be as simple as a mechanical blockage adjacent to the water entry point or the blockage of valves.

Either of these two phenomena is certainly sufficient to cause substantial hydraulic imbalance leading to excessive flow through some radiators (with corresponding overheating) and cold spots in others. The only technique the householder has for overcoming this effect is actually turning up the room thermostat, so increasing the delivery of heat to water in the central heating circuit.

When explained in this fashion, it is clear that these are exactly the problems that manifest themselves in so many old heating systems. This is especially true with systems fitted with (or retrofitted with) thermostatic radiator valves that have relatively small orifices.

Raising water temperatures (and possibly reducing water flows) also increases the likelihood of oxidation of the outside of the heat exchanger within the boiler thereby reducing external heat transfer coefficients and reducing boiler efficiency. This can lead to premature failure of fans for example.

The nature of the restriction formed within radiators is easy to imagine. These deposits both “blind” the internal surface of the radiator and distort the water flow causing radiators to display unusually high pressure drops. This phenomenon will eventually lead to the water flows through the system becoming unbalanced.

- This absence of hydraulic balance can lead to wasteful overheating and under-heating of rooms unless each radiator is fitted with a thermostatic valve. Certainly, a system controlled by a single room thermostat is unlikely to give customer satisfaction, will waste energy, increase fuel bills and increase carbon dioxide emissions.
- The requirement to raise water temperature in the central heating circuit has a significant effect upon boiler efficiency, especially with modern condensing boilers.

When a central heating system has a major overhaul, as will occur when fitting a new boiler it is considered essential to return the system to as nearly new condition as possible. However the work has shown that replacing the boiler with a new clean unit has no significant benefit IF the system has not been power-flushed and treated. This “loss” of efficiency is almost equivalent to a full SEDBUK energy band, and, more seriously, is likely to leave an unhappy customer who still does not have a correctly balanced heating system giving uniform heat in all rooms. So it is clear that the whole system should be effectively cleansed at the same time as the boiler change. There are a variety of ways of carrying out this cleansing but, as shown in this study, the best approach is full powerflushing with an appropriate chemical cleaner such as Sentinel X800 Jetflo.

To be more specific:

- The addition of a dispersant such as Sentinel X800 Jetflo demonstrably aids the removal of sludge as part of the power flushing process.
- The power-flushing process cannot be a remote process carried out from the boiler. The preferred approach is to subject individual radiators to reasonably prolonged vibration either by means of air entry or a rubber mallet. This is

inevitably a time consuming process requiring attention to detail but is essential if the system is to be returned to anything like an 'as new' condition.

- The system can be successfully restored using a combination of Sentinel X800 Jetflo and use of the power flush technique.

The question could be asked if, on a perfectly designed system with boiler operation primarily controlled by room thermostat rather than boiler thermostat, a cleansed system operates more efficiently. The answer is yes: the cleaner radiators will allow for lower average operating temperature (irrespective of means of control i.e. valve or room thermostat) and thus will promote lower average water temperature yielding increased boiler efficiency.

The outcome of the research included a number of recommendations based on the findings.

Periodically, as part of routine central heating system maintenance, during **all** boiler changes and where there is any indication of system corrosion, systems should be thoroughly cleansed. This is most conveniently carried out by means of a power-flush of the whole system and should be performed by an appropriately trained operative, using a chemical additive to assist the break up of sludge deposits. The process should preferably include inducing mechanical vibration in individual radiators.

The expected result is:

- An increase in the fundamental heat transfer capabilities of the system radiators by up to 15%, providing greater uniformity of radiator temperature (and as a result, greater client satisfaction).
- An increase in overall boiler energy efficiency of up to 3% i.e. substantial enough to turn a boiler effectively operating within SEDBUK Band B [between 88% & 90%] into an operational Band A boiler.

- Less risk of system hydraulic imbalance (and so again greater client satisfaction).
- Lower fuel bills and less carbon dioxide emissions.

Sentinel Performance Solutions

Sentinel is a leading manufacturer of products designed to clean and protect residential central heating systems. Sentinel's products improve system efficiency, reduce gas consumption and carbon dioxide production, and prolong the life of residential heating systems in the UK and Europe. Sentinel sells its products through European distributors of HVAC and plumbing products. Founded in 1988, Sentinel is headquartered in Runcorn, England. For more information, please visit www.sentinel-solutions.net

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