

WATER TREATMENT FOR CENTRAL HEATING SYSTEMS

INTRODUCTION

Few car owners would expect their vehicle to perform reliably for years without ever checking levels of oil and water or servicing the vehicle. Yet many householders do just this when it comes to the “engine” of their heating system, their central heating boiler, or the other parts of the system that provide vital warmth and hot water throughout the year.

Water treatment (WT) is one of the measures necessary to ensure good heating system performance and reliability. An efficient boiler, effective controls, fully-functioning radiators and correct system protection and maintenance achieved by the right water treatment regime – all help to keep your central heating system working, your hot water flowing and your energy bills lower.

That is why Building Regulations ^[1], British Standards ^[2] and most boiler manufacturers’ installation instructions now give recommendations on the use of WT chemicals and other devices such as system filters. These help to ensure that both the boiler and the heating system perform reliably and efficiently throughout their expected lifetime.

The following is a *brief* guide to the different types of WT chemicals and devices and what they do. More detailed information is given in the documents listed under References, or in the instructions for the WT product concerned.

The WT manufacturer’s dosage specifications and user instructions must be followed and the correct procedures must be used when carrying out the operations described below. “Conventional” cleaning and flushing and use of inhibitors as described below should ideally be carried out by a competent person. Power-flushing should only be carried out by a competent person.

Water treatment for central heating systems covers three main areas – cleaning, protection and maintenance.

CLEANING

The boiler manufacturer’s instructions (and warranty) require that cleaning and flushing of the system is carried out prior to boiler installation. This is also a recommendation in Building Regulations (*see box below*).

BUILDING REGULATIONS - APPROVED DOCUMENT L
Domestic Heating Compliance Guide (Part L) 2013:

“Central heating systems should be thoroughly cleaned and flushed before installing a new boiler”

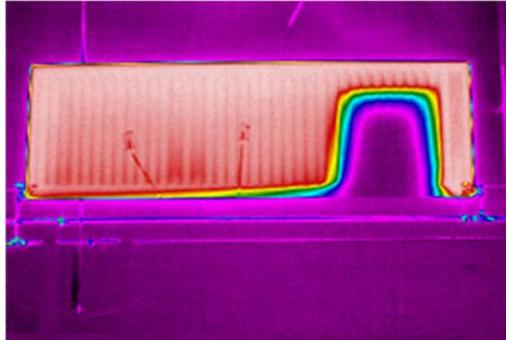
A newly-installed central heating system may contain residual debris such as metal particles, solder residue etc., while an older system which has not been correctly protected with inhibitors (see below) may contain corrosion deposits in the form of accumulated “sludge” in pipes, radiators etc. The illustration below shows accumulated sludge being removed from a radiator.



Accumulation of sludge is an indication of corrosion in the heating system and may be accompanied by the accumulation of gases within the radiators – which may be mistaken for air accumulation in very severe cases.

If a new boiler is to be installed then it is obviously important to ensure that the heating system (pipes and radiators) to which it is being connected, whether old or new, is as clean as possible. Any internal debris or deposits could ultimately be washed into the boiler and its heat exchanger, affecting performance and possibly causing a major breakdown. Accumulated sludge in radiators can also affect the circulation of water in the primary circuit, affecting heat output and leading to a reduction in efficiency of the system as a whole.

A common symptom of sludge accumulation is that radiators are cold at the bottom but hot at the top – due to reduced water flow. The illustration below shows a “thermal image” of a radiator with reduced water flow due to blockage (*cooler region in purple*).



Treatment chemicals may range from mild detergent-based cleaners suitable for removing debris after the installation of new systems or modification of existing systems, through to more aggressive cleaners designed to remove accumulated deposits in existing systems which may not have been treated for some time.

BS 7593 specifies a number of cleaning methods which will meet the requirements of Building Regulations. Detailed guidance is given in the standard, but in outline these are as follows –

1. A conventional clean and flush - using gravity to empty and re-fill the system and adding WT chemicals as required.

Cleaning and flushing are accomplished by repeated filling and draining of the system, after using appropriate WT chemicals to suspend, disperse and remove accumulated material. This is then followed by a “flush” with clean water, before any inhibitors are added to protect the system (see below).

2. Mains pressure clean and flush – This involves the connection of a mains pressure hose to an appropriate point on the heating system and another hose from the system’s drain valve to a suitable foul drain. After using WT chemicals to suspend, disperse and remove accumulated material, individual radiators on the heating circuit are flushed using mains pressure water by opening/closing their isolation valves in turn, before flushing the whole system with all valves open. The system is then refilled, using inhibitor (see below) as required and returning all radiator valves to their previous settings.

A second possibility is to drain and remove individual radiators and clean them (preferably having taken them outside) by flushing with mains pressure water. This can be a time-consuming process and may result in some disturbance and mess. This method may not clean any accumulated deposits in the system pipework and further flushing may be necessary to achieve this. Use of inhibitors will again be required once the system has been re-assembled and refilled.

3. “Power-flushing” – which uses a specially-designed pumping system to rapidly circulate water and treatment chemicals around the heating circuit.

If a new boiler is being installed, power-flushing should be carried out prior to installation, or with the boiler isolated from the system. If an existing system is being maintained then isolation of the boiler is normally required to avoid blockage by deposits dislodged during cleaning.

The manufacturer of the power-flushing system will provide detailed instructions and may also specify the treatment procedures and chemicals to be used. These instructions must be followed.

Note: power-flushing may not be suitable for some systems – e.g. gravity systems, single pipe systems and some micro-bore systems. More detailed guidance is available elsewhere – e.g. from power-flushing equipment manufacturers.

With all cleaning methods it is important to ensure that the cleaning agent and suspended debris are completely removed from the heating system as they may nullify the effect of any inhibitor subsequently used. Additionally, if the cleaner and suspended debris remain present in the system, the resultant mixture can lead to premature failure of system components (e.g. pumps). Loss of inhibitor effectiveness can also lead to gases being formed within the central heating circuit if corrosion re-occurs.

PROTECTION

BUILDING REGULATIONS - APPROVED DOCUMENT L Domestic Heating Compliance Guide (Part L) 2013:

“During final filling of the system, a chemical water treatment inhibitor meeting the [boiler] manufacturer’s specification or other appropriate standard should be added to the primary circuit to control corrosion and the formation of scale and sludge”

Once the system has been cleaned, it is important to ensure that the corrosion processes which caused internal deposits to form and accumulate do not re-occur. Left untreated, internal corrosion can again lead to sludge formation, which will cause reduction of water flow and reduced system efficiency. The system water content must therefore be treated with a chemical “inhibitor” to minimise corrosion of the various metals within the system.

It is important to ensure that the inhibitor used is compatible with the metals and other materials present in the heating system – as specified in accompanying instructions. It is also important to ensure that the product is Buildcert approved (or equivalent) ^[3].

WT chemicals such as inhibitors for “open vented” heating systems are usually added to the system via the header tank in the loft.

For unvented/sealed systems, WT products are often sold in containers which attach to “mastic guns”, as used for bathroom filler/sealant products. Other systems are available which use “aerosol” containers to allow injection of the product. Both allow the WT product to be introduced via an appropriate connection to the sealed heating system – following the instructions provided by the manufacturer.

Lack of water treatment, particularly in hard water areas, can also lead to formation of limescale in the boiler’s heat exchanger, which can lead to reduced efficiency and boiler noise. Most inhibitors will contain ingredients to prevent limescale formation.

MAINTENANCE

Once a system is cleaned and protected it is important to ensure that the concentration of inhibitor is checked and maintained so that it continues its preventative action. Inhibitors are designed to have an extended lifetime in the heating system; however most WT manufacturers recommend checking concentration at annual boiler service intervals and will offer a simple test kit to do this.

A major cause of corrosion is oxygen introduced when the system is “topped up” with fresh water. Water may occasionally be drained from the heating system for maintenance, or to allow removal of radiators whilst decorating. If the system is then re-filled without adding further inhibitor the concentration will be reduced – possibly to zero if the system was completely drained. It is therefore important to ensure that inhibitor is always “topped up” after system drainage.

Note: an unvented system should not require frequent “topping up” due to gradual loss of system pressure. If frequent topping up is required then the system is leaking and this should be rectified so that associated corrosion does not take place.

It is also recommended that whenever WT products are used, a label (normally provided with the product) is attached to the system to act as a record of which product was used, in what concentration – and when. The Benchmark Commissioning Checklist, completion of which is required when a new boiler is installed, should also be used to record the inhibitor type and concentration used on commissioning.

Note: current BEAMA Water Treatment ^[4] guidance suggests that mixing of different WT manufacturers’ products is not advisable. If the make of the inhibitor

is not known then it is better to drain the system and re-fill, adding new inhibitor to the manufacturer's recommended concentration.

BENCHMARK CHECKLIST

Completion of the Benchmark Checklist (located in the back of every boiler installation manual) is viewed by boiler manufacturers as a condition of warranty. The Checklist should be completed on commissioning a new boiler and then left with the householder as a record that the installation complies with the requirements listed.

The Checklist includes provision to record that the system has been correctly cleaned and flushed and that an inhibitor gas been used. The type of cleaner and inhibitor should also be recorded – as indicated in the illustration below, taken from the Checklist.

ALL SYSTEMS			
The system has been flushed and cleaned in accordance with BS7593 and boiler manufacturer's instructions	Yes		
What system cleaner was used?			
What inhibitor was used?	Quantity	litres	
Has a primary water system filter been installed?	Yes		No

SYSTEM FILTRATION DEVICES

BUILDING REGULATIONS - APPROVED DOCUMENT L Domestic Heating Compliance Guide (Part L) 2013:

“A filter can also be fitted to the central heating circuit to help maintain the efficiency and reliability of the system”

A number of different filtration devices are now on the market, in addition to the chemical water treatments described above. These can incorporate magnetic or “cyclone” arrangements (or a combination of these) to remove fine particles suspended in the water circulating around the system. These devices help to maintain system cleanliness and provide an additional level of protection.

WATER SOFTENERS AND CENTRAL HEATING BOILERS

Where a water softener is present in the dwelling, ensure that the heating system primary circuit is filled with mains water via the general bypass valve as required in BS 14743.

Note: A water softener installation must comply with BS 14743 (this states that there must be 'a general bypass valve which enables the softening unit to be isolated from the mains, while maintaining water supply to the end user'. For installation requirements, refer to WRAS Information and guidance Note No 9-07-01 "Information for the installation of ion exchange water softeners for systems supplying water for domestic purposes".

Refer to the boiler manufacturer's instructions for any additional advice on softened water.

REFERENCES

[1] Building Regulations, Approved Document L - Domestic Heating Compliance Guide

http://www.planningportal.gov.uk/uploads/br/domestic_building_services_compliance_guide.pdf

[2] British Standards – available from BSI

BS 7593 - *Code of practice for treatment of water in domestic central heating systems*

BS 6798 - *Specification for selection, installation, inspection, commissioning, servicing and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*

BS EN 14743 - *Water conditioning equipment inside buildings. Softeners. Requirements for performance, safety and testing*

[3] BuildCert Chemical Inhibitor Approval Scheme (CIAS)

<http://www.beama.org.uk/download.cfm/docid/83DC22C1-2FCB-4D80-A663E9BD1277BDA5>

[4] BEAMA Code of Practice for Chemical Cleaning and Inhibiting of Domestic Hot Water

Central Heating Systems.

<http://www.beama.org.uk/download.cfm/docid/E2280148-AB02-4E16-B7E1710BE610870A>