

BS 8554:2015



BSI Standards Publication

Code of practice for the sampling and monitoring of hot and cold water services in buildings

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 September 2015. It was prepared by Technical Committee EH/3, *Water quality*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

In particular, it is expected that users of this standard understand the importance of sampling using aseptic techniques.

Test laboratory accreditation. Users of this British Standard are advised to consider the desirability of selecting test laboratories that are accredited to BS EN ISO/IEC 17025 by a national or international accreditation body.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard gives guidance and recommendations for investigative and planned collection of hot and cold water samples during the life of a building, including sampling locations and the selection of laboratory or on-site testing for those samples.

This standard covers sampling from wholesome water systems and water used for make-up where the water is used for immersion or contact, such as spas, swimming pools and therapeutic units. Wholesome water services are systems designed to provide hot and cold water, including water for cooking, drinking and food preparation or washing.

Recommendations are given for sampling for the following reasons:

- a) one-off sampling for compliance, to evaluate whether the water quality conforms to regulations, guidance, specifications or imposed conditions;
- b) ad hoc sampling for verification, to provide assurance that the water being used is suitable for its intended use;
- c) sampling for investigation – searching for the cause of concerns or complaints about water quality;
- d) random sampling – economically-driven or voluntary sampling used to help confirm or otherwise that water hygiene controls remain effective; and
- e) identification and implementation of schemes for commissioning, routine and investigative monitoring of water quality.

This standard is not applicable to the sampling of water following outbreaks of Legionnaires' disease or for the sampling of water from closed systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 7592:2008, *Sampling for Legionella bacteria in water systems – Code of practice*

BS 15883, *Washer-disinfectors*

BS EN ISO 5667-1, *Water quality – Sampling – Part 1: Guidance on the design of sampling programmes and sampling techniques*

BS EN ISO 5667-3, *Water quality – Sampling – Part 3: Preservation and handling of water samples*

PD 855468, *Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilages*

Other publications

[N1] AUTOMATIC VENDING ASSOCIATION OF BRITAIN (AVAB). Technical Handbook: *Water Hygiene and Quality in Food and Drink Vending and Dispensing*. Cheam: AVAB. 1997.

[N2] DEPARTMENT OF HEALTH. *Choice Framework for local Policy and Procedures 01-06 – Decontamination of flexible endoscopes: Operational management*. London: Department of Health. 2013.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 calorifier

closed cylindrical vessel in which water is indirectly heated under a pressure greater than atmosphere for the supply of hot water services, for central heating purposes and for industrial applications

NOTE The water is heated by tubular primary heaters, with hot water, steam or oil as the heating medium, or electric immersion heating elements.

[SOURCE: BS 853-1:1990+A3:2011, 2.1, modified]

3.2 cistern

fixed, vented container for holding water at atmospheric pressure

[SOURCE: BS 8558:2015, 3.1.5]

NOTE A cistern is commonly referred to as a "cold water storage tank".

3.3 dip sampling

process by which a sample is obtained by immersing an open, sterile container or device into a body of water

3.4 disinfection

control of microorganisms by chemical or non-chemical means

NOTE Disinfection here relates to the outlets and systems. Disinfection is not the same as sterilization (see 3.12).

3.5 flow straightener

device that is inserted into a water outlet to smooth out turbulent and transitional flows

3.6 flushing

purging of water from areas of a distribution system to remove installation residues or mitigate the effects of stagnation

3.7 organism of concern

organism whose presence is not acceptable in the context of the building use

3.8 outlet fitting

device that is placed into the end of the tap faucet to control and shape the water stream and can include flow straighteners, regulators and aerators

3.9 post-flush sampling

process by which a sample is taken after an outlet or fitting has been disinfected where necessary and water has been run to waste for a prescribed length of time or until a particular endpoint has been reached (e.g. a temperature measurement), to represent the quality of the water supplied to the outlet or fitting

3.10 pre-flush sampling

process by which a sample is taken immediately after an outlet or fitting is opened, to represent water held within the outlet or fitting

NOTE This does not involve disinfection of the outlet.

3.11 sampling operative

person who has been trained and can demonstrate appropriate competence in taking samples

3.12 sterilization

complete elimination or destruction of all living microorganisms

NOTE This is not achievable in a distributed water system.

3.13 water safety plan

plan for:

- a) system assessment and design;
- b) operational monitoring of the control measures; and
- c) management, including documentation and communication, of a) and b)

(SOURCE: WHO 2004 [1], modified)

4 Assessing water quality and developing the sampling plan

4.1 Objectives of sampling

4.1.1 Those planning a testing programme should determine the reason for sampling [see a) to c)] and take measures to ensure that the results accurately reflect the quality of the water at the time it is sampled.

- a) Ad hoc sampling for verification, to provide assurance that the water being used meets the needs of its intended use, e.g. validating a new or altered control regime.
- b) Sampling for investigating complaints from users relating to, for example, taint, odour, skin reaction or illness; investigating a case(s) of illness potentially associated with water use or consumption; investigating the causes of scaling, fouling or corrosion.
- c) Random sampling: economically-driven or voluntary sampling used to help confirm or otherwise that water hygiene controls remain effective.

Example: Monitoring of water quality in hospitals. *Pseudomonas aeruginosa* (PA) can cause serious infection in hospital patients, particularly those who are in “augmented care units”, e.g. neonatal units, critical care units, burns units, transplant units and other units determined by local risk assessment. PA positive samples from outlets are a consequence of biofilm colonization that mainly occurs at or very near the tap outlet. To determine whether PA is present at the outlet pre-flush, post-flush and representative systemic samples might be required and, as a consequence, different sampling strategies are applied.

NOTE Sampling for PA can be carried out in accordance with HTM 04-01 [2] and the SCA's The Microbiology of Drinking Water (2010) – Part 8 – The isolation and enumeration of Aeromonas and Pseudomonas aeruginosa by membrane filtration [3] and Examining food, water and environmental samples from healthcare environments. Microbiological Guidelines [4]. Technologies other than membrane filters are available, such as polymerase chain reaction (PCR).

4.1.2 Where there is a water safety plan (WSP) this should include identification of all potential hazards (see 4.3), chemical, physical and biological. The WSP should require an ongoing sampling programme for monitoring control measures.

4.2 Sampling plan

4.2.1 A sampling plan should provide sufficient information to satisfy the data user's requirements by establishing compliance with regulations, specifications or imposed conditions, and/or identifying the cause(s) of changes in water quality. The sampling plan should be varied periodically to achieve this or to investigate out-of-specification results, for example sampling to verify or confirm the effectiveness of cleaning and disinfection following commissioning and re-commissioning of water systems, storage cisterns and/or equipment using water.

4.2.2 Sampling should be designed to take into account the time water is resident in the building, from the time it crosses the curtilage to when and where deviating quality is observed. The sampling plan should take account of such factors as:

- a) residual disinfection decay;
- b) the lag and exponential growth phases of bacteria within biofilms;
- c) storage capacity and residence time/water age;
- d) the effects of temperature; and
- e) other relevant factors likely to have an effect on the water quality, e.g. condition of components, presence of lead pipework (especially in combination with other metals).

4.2.3 A responsible person should be appointed to oversee sampling at the time of construction and commissioning, as well as during the operational use of a water system. To ensure the sampling results are used effectively, the sampling plan should be prepared in accordance with BS EN ISO 5667-1 for agreement before the operations begin, taking into account any regulatory requirements or other agreed objectives. Schematic drawings should be consulted, where available, when compiling the plan.

4.2.4 Sampling points should be designated according to the sampling plan, and indicated on a schematic diagram of the water system in the sampling plan. Each outlet being sampled should be representative of the potential water quality change being investigated. The sampling plan should identify equipment that best represents the risk being investigated, e.g. equipment that constitutes a significant risk of infection because it produces an aqueous aerosol, or where there is the potential for ingress, stagnation and biofilm build-up.

4.2.5 Where it is feasible to carry out long-term periodic monitoring, the sampling plan should require sampling from both fixed and randomly selected points for each batch of samples to enable both trending of results and increased coverage of the whole system.

NOTE A single sample location might not be representative of a dynamic system where use patterns vary spatially and over time.

4.2.6 To indicate the relative risk of poor water quality from an outlet and the system, both pre-flush (see Clause 5) and post-flush (see Clause 6) samples should be taken. Whenever possible, samples should be collected from individual taps, rather than mixer taps, as this ensures that the samples are representative of the hot or cold system, rather than a combination of both.

4.3 Sampling task risk assessment and other considerations

4.3.1 A risk assessment should be performed and control measures put in place consistent with ensuring the health and safety of the sampling operative and others, protection of the water supply and associated asset protection.

NOTE Attention is drawn to The Health and Safety at Work etc. Act 1974 [5], the Management of Health and Safety at Work Regulations 1999 [6] and the Control of Substances Hazardous to Health Regulations 2002, as amended [7].

4.3.2 An estimate of the potential risk from each component of the system should be made based on a variety of factors, including:

- a) the opportunity for microbiological colonization: uncontrolled water supply, lack of use or known contamination – the greater the complexity of the system, the greater the risk;

NOTE Practical advice regarding Legionella is given in HSE Approved Code of Practice L8 [8] and HSG274 Part 2 [9].

- b) the suitability of conditions to sustain growth of bacteria (including legionellae), for example the use within the system of materials that do not conform to the Water Fittings Regulations [10], [11] and [12];
- c) mechanisms of exposure to the sampling operative, building occupants or members of the public;
- d) the susceptibility of the sampling operative and population exposed; and
- e) the potential for scalding or valves breaking during sampling.

4.3.3 The effectiveness of mechanical, chemical and operational parameters of the control programme, management procedures and training should be taken into account when defining a safe system of work.

4.3.4 Employers should consider the possible increased risks to individuals who are particularly prone to legionellosis during sampling operations, due for example to underlying conditions or immunosuppression.

4.3.5 The laboratory carrying out the analysis should be consulted about:

- a) selecting the correct sample containers (see 5.1.6) and determining whether any chemical neutralizing agent is required: for safety reasons glass bottles should not be used in certain circumstances, e.g. when sampling food outlets, food production facilities, swimming pools, spa pools and hydrotherapy pools (see Annex A);

NOTE Where glass bottles are required to maintain sample integrity, the risk ought to be assessed and appropriate controls put in place.

- b) any specific limitations specified within legislation, regulation, guidelines or the prescribed testing method, such as a time limit between taking the sample and testing;
- c) the transport conditions required to minimize any changes in the sample;
- d) the transport and delivery requirements, to ensure that samples can be analysed as close to delivery time as possible;
- e) the need for any supplementary testing, e.g. for some microbiological parameters, such as *Legionella*; the temperature and/or residual disinfectant concentrations should be noted to ensure the results can be put into context for interpretation;
- f) the information that needs to be obtained at the time of sampling to accompany the sample to the laboratory;

- g) the methods used by the laboratory for each of the parameters requiring testing within its scope of accreditation (see also BS 8550 and “Information about this document” in the Foreword);
- h) the method of transporting samples to the laboratory; and
- i) any chain of evidence for investigations that might be required where legal actions could ensue.

4.4 Preparation for sampling

When the sampling operative arrives on site, they should:

- a) if necessary (e.g. at a hospital), attend an induction meeting to familiarize themselves with the site and comply with any site-specific safety requirements;
- b) acquire all necessary documentation and schematic drawings to understand the layout and operation of the water system;
- c) determine whether there are any restrictions to taking samples, such as secondary safety and security risks;
- d) review any existing WSP or sampling plan;
- e) if there is no WSP or sampling plan, note this; and
- f) review and update the sampling task risk assessment (see 4.3).

4.5 Sampling following construction completion

4.5.1 General

4.5.1.1 The sampling and testing programme should be designed to verify that the quality of water delivered by a new or altered water system meets statutory/regulatory and contractual requirements.

4.5.1.2 Sampling during and following disinfection should be designed to ensure:

- a) effective distribution of disinfection materials in accordance with PD 855468;
- b) disinfectants have been flushed out after the allotted contact time and the system is left with a residual disinfection consistent with guidance for the maintenance of wholesome water quality; and
- c) system water quality after disinfection meets the applicable requirements and client specification.

4.5.1.3 The agreed sample locations should be documented in the sampling plan which forms the basis for assessment of:

- a) the effective distribution of disinfectant through the water systems at the time of initial application;
- b) the concentration of disinfectant within the system after the allotted contact time, with the plan sufficient to demonstrate, with adequate samples, that there has not been excessive disinfection demand, e.g. due to the presence of biofilms or organic material which would lessen the effectiveness of the disinfectant process; and

- c) post-flush and disinfection verification samples, for example:
- total viable counts (TVC), sometimes known as heterotrophic plate counts, measured at 22 °C;
 - TVC measured at 37 °C;
 - *Coliform* bacteria;
 - enterococci;
 - *E. coli*;
 - *Legionella*;
 - *Pseudomonas aeruginosa*; and
 - any other water quality parameter.

4.5.2 Construction completion

4.5.2.1 Samples should be:

- a) appropriate for the specified purpose, i.e. microbiological assessment, chemical analysis or on-site testing;
- b) sufficient in number to be fully representative of the distribution system, sub-branches, tanks, cisterns and hot water storage vessels, as well as the condition to be evaluated, e.g. completion of a cleaning process, efficacy of distribution of disinfectant; and
- c) taken at a frequency which is representative of the time series to be demonstrated, e.g. taking into account the growth rate of the organism when designing the monitoring scheme to check for potential microbiological colonization.

NOTE For further guidance on sampling, see BS EN ISO 5667-3, BS ISO 5667-5, BS EN ISO 19458 and BS 7592.

4.5.2.2 The microbiological tests should be carried out and the results provided at handover to demonstrate that the system is clear of organisms of concern, such as those listed in 4.5.1.3c).

NOTE There is a number of generalized methods for obtaining counts for Pseudomonas, e.g. BS EN ISO 16266 for the enumeration of presumptive Pseudomonas in meat and meat products, but these need to be interpreted on a method-specific basis.

4.5.2.3 Where *Coliform* or other organisms of concern are present, the sampling point should be flushed and retested, using pre-and post-flush samples to determine the location of the microbial contamination. If positive results persist, investigation into the cause should be extended with a view to repeating the disinfection process on the distribution system.

4.6 Re-sampling before occupancy

4.6.1 When required, sampling for microbiological quality (including *Legionella*) should be carried out following mothballing, refurbishment, etc., and in advance of occupation (see PD 844568).

4.6.2 Where the system has been disinfected in accordance with PD 855468, sampling for disinfection residues and microbiological water quality should be carried out to ensure that the water quality is suitable for its intended use.

4.6.3 The sampling plan should include samples from the incoming mains water (as close to the building inlet as possible), cisterns, hot water storage vessels and outlets as indicated in the risk assessment.

NOTE Good practice in an unoccupied building is for these not to be filled until the building is occupied, i.e. bypassed so that only mains is used until there is the need for stored water.

4.7 Lifecycle monitoring

NOTE Microbiological sampling during occupancy can demonstrate the efficacy of supplementary disinfection, based on a programme of regular evaluation at sentinel taps.

The samples should be collected together with other information to evaluate the efficacy of water quality management at the monitoring point.

4.8 Operational monitoring and sampling

NOTE This stage of system monitoring is often referred to as "routine monitoring".

4.8.1 For routine monitoring purposes, the representative sampling points identified in the sampling plan (see **4.2.4**) should be used.

4.8.2 Because the risk of deterioration in water quality varies over time the monitoring should be designed to indicate whether that risk is rising or falling. Monitoring should cover a range of material factors, for example those giving rise to:

- a) factors that increase risk:
 - 1) as water gets warmer during the summer months the risk of microbiological growth increases, particularly in supply water, storage tanks and poorly insulated pipes;
 - 2) extended holidays or shut-down periods result in less water use in the building, causing a longer residence time and opportunity for microbiological growth;
 - 3) change of use of a building or part of a building; and
- b) factors that reduce risk:
 - 1) removal of a dead leg reduces the risk of a stagnant zone of water and localized microbiological growth that can seed the system;
 - 2) system flushing and chlorination to remove biofilm accumulation.

NOTE Guidance on appropriate statistical tools for evaluating the data acquired as a result of monitoring water is given in Annex B (see also Clause 7).

4.8.3 Operational monitoring should inform the implementation and maintenance of the WSP or written scheme for the building or estate, and provide confidence that:

- a) the plan is robust and water is of satisfactory quality in both normal and abnormal operating conditions;
- b) where improvements in management are needed, the WSP is reviewed;
- c) the design and operation of any water storage system is preserving water quality; and
- d) remedial actions or alternative sources of supply can be implemented when required.

4.9 Sampling during incident investigations

4.9.1 The planning of sampling for incident investigation should only be undertaken by competent and experienced people with a detailed knowledge of the building and any plant that is implicated in the water quality deviation.

4.9.2 The sampling plan design should ensure that changes in water quality can be identified at any and all critical points from where the water enters the building to the outlets.

NOTE Such sampling might need to be more intense than that conducted for routine monitoring, involving the collection of more samples.

4.9.3 Depending on the nature of the incident under investigation there is likely to be a range of organisms and system-specific water quality criteria to be assessed, so the precise sampling needs should be assessed and documented in the sampling plan.

NOTE Specialist techniques might be required for the assessment of the cleanliness of the outside of a tap in a hospital intensive care unit, or for Legionella sampling of a showerhead (see BS 7592).

4.10 Common sampling points

4.10.1 Drinking fountains and vending machines

An investigation of the water supply to a vending machine or in-situ water chiller and its influence on the water quality it delivers should be conducted in accordance with the Automatic Vending Association (AVA) *Water Hygiene and Quality in Food and Drink Vending and Dispensing* [N1].

NOTE 1 Drinking fountains that are directly connected to the mains cold water supply may be treated as cold taps, but a dynamic reappraisal of the sampling location might be needed to ensure correct equipment and techniques are applied.

NOTE 2 The need to sample drinking water provided through refrigerated and/or filtered dispensers depends on the objectives and scope of sampling. Outlet quality is often tested for Coliforms and *E. coli* transferred by human contact, while TVC counts are compared with supply counts to identify significant change.

4.10.2 Water supply points with removable hoses and devices

Any pre-flush sample should be taken directly through the outlet in accordance with Clause 5, after which the outlet should be disconnected and cleaned. The orifice should also be sampled. The outlet should then be reconnected to the hose/device, and another sample taken if verification of the clean is required.

4.10.3 Domestic hot and cold water outlets

NOTE 1 Sink and basin taps provide the majority of sample locations for hot and cold water services in typical buildings

Where a risk assessment for Legionnaires' disease indicates that there is a need to sample for *Legionella* bacteria, samples should be collected from locations indicated by the risk assessor.

NOTE 2 Additional samples may be collected from outlets of particular concern showing discolouration or other concerns.

NOTE 3 Outlets regularly used for routine monitoring include "sentinel taps". These are chosen to be representative of the system condition. In a simple cold water system, the sentinel points are typically the tap furthest (far sentinel) and the tap nearest (near sentinel) to the supply or storage tank (see HSG274 Part 2 [9]).

4.10.4 Cold water cisterns and hot water storage vessels

4.10.4.1 Stringent precautions should be taken when sampling water inside a cistern, to prevent contamination. Sterile dip samplers should be used.

4.10.4.2 The quality of water entering a cistern or hot water storage vessel should be determined by post-flush sampling either the last outlet or the dedicated sampling point before the inlet valve. The quality of water in a cistern or hot water storage vessel should be determined by post-flush sampling the first outlet after the cistern or vessel.

4.10.4.3 Drain points should not be used to determine the outlet quality for cistern or hot water vessel sampling as stagnant regions in the base of the cistern or hot water storage vessel are not representative of the supplied water.

NOTE Sampling these points could be useful for investigative purposes.

4.10.5 Storage calorifier drain-off point

4.10.5.1 Storage calorifier drain-off points should only be sampled if specifically indicated by the sampling plan, and where it is safe to do so.

NOTE A visual clarity check is required by HSG274 Part 2 [9].

4.10.5.2 When taking microbiological samples, the outside and inside surfaces of the outlet side of the drain valve should be disinfected. Any pipework connected to the drain should be removed, if possible, before disinfecting the valve. The drain valve should then be opened for a few seconds in order to rinse out any remaining disinfectant from the valve. If there is insufficient space to place a sample container under the outlet to collect the sample, then clean, sterile silicone rubber tubing can be attached to the drain valve. The visual appearance of the water, for example the presence of rust deposits, sediment or corrosion products, should be noted in order to facilitate the assessment of the cleanliness of the calorifier.

4.10.6 Water closet cisterns

Water closet cisterns (flush toilets) should only be sampled as part of an investigation or if a risk assessment indicates that this is necessary. Sampling should be carried out in accordance with **6.4.5**.

4.10.7 Showers and thermostatically-controlled outlets

4.10.7.1 Samples from mixer taps are not likely to be representative of the whole system or of hot or cold water quality. Showers or thermostatic mixing valve (TMV) outlets with mixers should not be used as sentinel outlets, but might be the most likely to develop localized problems, so pre-flush outlet sampling can be informative.

NOTE It is difficult to prevent legionellae growing downstream of TMVs that are set to control temperatures below 45 °C and are not well used and maintained.

4.10.7.2 Pre-flush sampling of showerheads is a useful indicator of conditions and should be conducted when indicated in a risk assessment or specified in a sample plan, or to determine whether control measures are effective.

NOTE A quality-assured system of shower disinfections and temperature checks is not able to detect localized user-induced stagnation or deterioration of components giving rise to localized problems.

4.10.8 Dedicated sampling points not intended for use by building occupants (see Annex C)

4.10.8.1 Dedicated sampling points should be installed without creating a dead leg.

4.10.8.2 The outlet of the sample valve should be loosely plugged when not in use to avoid accidental discharge and the ingress of external contamination.

Example 1: Water softeners: the sampling operative should have access to the feed water and the softened water before any other plant, and the sampling points should be suitable for sampling for non-microbiological and microbiological purposes.

NOTE Reasons for investigating softeners include:

- evaluation of microbiological burden (growth on media bed);
- evaluation of softening performance; and
- assessing the efficiency of valves during brine regeneration cycles to ensure that chloride backwash does not enter the outlet stream.

Example 2: Carbon filters for removing disinfection residuals: where activated carbon treatments are applied for the necessary depletion of chlorine, chloramine or chlorine dioxide, for example before treatment of water by reverse osmosis, dedicated sampling points should be available to check the efficacy of the carbon bed in order to assess the need for replacement/regeneration or amendment of contact time through the bed. Such sampling points might also be required for microbiological samples.

4.10.9 Special (medical) devices

Sampling of special (medical) devices should be conducted in accordance with the applicable part of BS 15883 and CFPP 01-06 [N2].

4.10.10 Expansion vessels

Where it is suspected that an expansion vessel holding water above 20 °C is harbouring bacteria, the supply valve should be closed and a sample taken from an appropriate outlet representative of the water in the vessel.

4.10.11 Point-of-use (POU)/instantaneous heaters (see 5.5)

NOTE 1 Low volume POU water heaters (<15 L storage) or instantaneous water heaters are usually employed to avoid the need for larger centrally-heated systems. They are often supplied with direct mains-fed or boosted cold water. Such systems generally heat water to a point dependent upon a manually-adjusted setting. Low volume systems normally deliver a small volume of stored hot water, after which time they need to recover back to the set temperature. Instantaneous systems generate hot water as they are used.

A point-of-use/instantaneous heater should only be sampled where the need for this is indicated by the risk assessment or investigation of a complaint.

NOTE 2 Samples may be pre-flush or post-flush, though post-flush samples are likely to have reduced temperatures due to the limited water volume present. Post-flush samples are therefore more likely to demonstrate the water quality of the cold water supplied to the water heater, and this type of sampling might be more relevant for water heaters which have limited use and whose supply line might be stagnant.