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Technical Water Risk Assessment Background Information

Legionella Background Information

This section contains details of the criteria used to assess the risk of Legionellosis from each system examined. The risk of Legionellosis from water systems examined has been assessed with respect to the criteria detailed below. Legionellosis is the generic term given to diseases caused by the bacterium Legionella.spp. The two most common diseases are Legionnaires'

Legionnaires' Disease is a type of pneumonia and Pontiac Fever is a self-limiting infection of the upper respiratory tract resulting in flu like symptoms. Both diseases are contracted by the inhalation by susceptible persons of small droplets of water (aerosols) containing the bacterium Legionella pneumophila in sufficient numbers to cause infection. For a water system to be associated with a case or outbreak of Legionellosis the following criteria must be satisfied:

A. Contamination

Legionella bacteria must be able to enter the system.

B. Multiplication

Favourable conditions must exist for the survival, growth and multiplication of the bacteria into significant concentrations. There are many factors which may permit Legionella growth, the most significant of these being temperature. Legionella bacteria are able to grow in the temperature range 20°C to 50°C, the optimum temperature for growth being 37°C.

C. Aerosolisation

Water containing the bacterium must be produced as an aerosol containing droplets of a size capable of being inhaled deep into the lungs. Aerosols of this size are known to be produced from the operation of wet evaporative cooling towers and evaporative condensers, from use of showers and also from flushing of taps and filling of hand wash basin.

D. Inhalation

Susceptible persons must inhale aerosols containing legionella bacteria.

The susceptibility of a population to legionnaire's disease increases with age. Males are known to be more susceptible than females. Smokers are known to be more susceptible than non-smokers. Persons who are already ill or mmune-compromised (e.g. after transplant surgery or suffering from AIDS) are especially susceptible.

Drinking Water Systems Inherent Risks

The extremely low numbers of legionella bacteria thought to be present in mains water supplies do not make any further treatment either necessary or practicable.

It is unlikely that conditions within drinking water distribution system will permit the growth and multiplication of Legionella bacteria to significant levels.

Domestic Cold Water Systems - Inherent Risks

The risks of contamination and subsequent multiplication of Legionella bacteria with domestic cold water systems is normally low if the following criteria are met:

- Storage cisterns are protected from aerial contamination
- Storage cisterns are appropriately sized with respect to demand such that water turnover occurs at least once every 24 hours
- Water is stored and distributed at temperatures less than 20°C
- Cisterns and pipework are configured such that there are no sites of possible stagnation of water (e.g. reservoir cisterns, deadlegs, etc.)

Domestic Hot Water Systems - Inherent Risks

By nature of its function, a domestic hot water system incorporating a calorifier, immersion heater or other hot water storage cylinder presents a potential risk of Legionellosis. This risk is discussed with respect to the four criteria required for infection of persons with Legionella detailed above.

Cold water derived from the mains water supply is supplied to the calorifier either directly or via a storage cistern. Legionella bacteria have been detected in extremely low concentrations in mains water.

Legionella bacteria may also be present in a desiccated form attached to dust particles in the air. These particles may enter a storage cistern if it is not of a satisfactory design.
It is assumed therefore that the calorifier can become contaminated with Legionella bacteria present in the cold water supply to the unit.

Temperatures in calorifiers are in the range 20°C-60°C. In most calorifiers, there is a temperature gradient within the stored water. It is possible for temperatures favourable for the growth and multiplication of Legionella bacteria to exist within these units. By operation of the system, scale, corrosion and sediment deposits may collect in the base of the unit. These deposits may contain nutrients and provide a suitable environment for microbial growth.

General Considerations - Domestic Systems

Aerosols may be produced upon flushing of outlets, whilst filling hand wash basins and sinks, and during usage of shower units. Studies have shown that many of these droplets of water may be of a size, which are known to be easily inhaled deep into the lung. It can be assumed that within the employed workforce and visiting population there will be susceptible persons using such outlets.

Evaporative Cooling Towers and Evaporative Condensers - Inherent Risks

By nature of its' normal function, a cooling tower or evaporative condenser presents an inherent risk of Legionellosis. This risk is discussed with respect to the four criteria required for infection of persons with Legionella detailed above.

A. Contamination

Cooling of condenser water is achieved by the evaporation of small droplets of water falling against a counter flow of cool air. This process also has the effect of removing any debris that may be present in the airflow and depositing it in the re-circulating water.

Legionella bacteria may be present in a desiccated form or attached to other debris in the atmosphere. Occasionally aerosols containing Legionella may also be present in the atmosphere.

Make up water derived from the mains water supply is supplied to the tower to replace that lost through evaporation. Legionella bacteria have been occasionally been detected in extremely low concentrations in mains water.

It is assumed therefore, that the re-circulating condenser water system can become contaminated with Legionella bacteria in two ways:

- From debris removed from the atmosphere in the tower;
- From the mains water supply.

B. Multiplication

Favourable conditions exist within evaporative condensers for the survival, growth and multiplication of Legionella bacteria and other micro-organisms.

As a result of the operation of the system, nutrients and other debris may contaminate the condenser water. These contaminants increase in concentration as a result of evaporation of the re-circulating water.

Re-circulating water temperatures are typically in the range 20°C to 40°C. Such temperatures are favourable for the growth of Legionella bacteria. Scale, sediment and corrosion deposits within the system may provide suitable sites for attachment of Legionella bacteria and other micro-organisms.

C. Aerosolisation

To achieve cooling, condenser water is either sprayed or spilled over a convoluted heat exchange surface within the cooling tower or evaporative condenser against a counter flow of air. The effect of this process is the production of many droplets of water, some of which are of a size known to be easily inhaled deep into the lung.

D. Inhalation

Aerosols produced from the evaporative cooling process may be ejected from the tower. Studies have shown that aerosols may travel over 500 metres from the site of production. In an area of high population, it can be assumed that there will be susceptible persons in the immediate environment of the site.

Deadlegs, Swan-Necks and Pig-Tails

Many argue that swan-necks and pigtails should not be regarded as a significant source of legionellae because they are usually considerably shorter than the 2m length allowed in HTM04-01 for pipe connections to hot and cold water outlets.

Deadlegs

Deadlegs of any length represent a risk if the water temperature is conducive to microbial growth.

The 2m length quoted in HTM04 refers to the maximum permissible length of a deadleg in blended hot and cold water outlets. Clearly, there is no option but to have a small section of pipe from blended hot and cold water supplies to the outlet.

The length of this section of pipe can vary and may be very short e.g. where the thermostatic mixing valve is incorporated as an integral part of the blended outlet; however it should not exceed 2m in length.

The risk in such situations is mitigated because at some point these sections of pipe should have water flowing through them; and at least twice weekly in healthcare premises, if compliant with HTM04-01.

The regular use of outlets helps prevent the proliferation and accumulation of legionellae both in the outlet and associated sections of pipe.

Swan-Necks & Pigtails

In most cases there is no flow of water through swan-necks and pigtails, therefore there is no opportunity to discharge and dilute any accumulating biofilm.

One option to reduce Legionella related risks in these devices is to fit valves that would allow them to be flushed to waste at a suitable frequency. However, this additional responsibility is often unpopular with users, particularly if there are alternative systems available that do not require flushing.

There are suitable alternatives to pigtails and swan-necks in which the volume of retained water is considerably reduced.

It has been suggested that the material from which swan-necks and pigtails are constructed (copper or brass) is sufficiently antibacterial to prevent the accumulation of biofilm within the device.

It is recognised that heavy metals, particularly copper and probably also brass ((although there is no peer reviewed evidence confirming the efficacy of the latter in controlling biofilm), have antibacterial properties and so can delay the accretion of biofilm.

However, passivity eventually occurs due to a fine coating of inorganic deposits and scale build-up on the internal surface, which can afford protection to microorganisms that alight on the surface, so enabling them to form into biofilm.

Over time, even copper and probably brass surfaces will support biofilm, particularly if exposed to warm and stagnant water as indeed many pigtails and swan necks are.

Recent Study

A recent study carried out by Dr Mathys and colleagues from Munster University, Germany, showed that plumbing systems with copper pipes were more frequently contaminated than those made of synthetic materials or galvanized steel.

Other studies have shown copper to be better than plastics and other materials at resisting the development of microbial colonisation in aquatic systems. Perhaps certain types of copper are more susceptible to accretion of biofilm than others, but all at some point will succumb to microbial colonisation.

Conclusion

In each case, where swan-necks and pigtails have been installed it will be necessary to assess the risk of Legionella proliferation in those devices.

If a Legionella risk is shown to exist, then it should be controlled, where it is reasonably practicable to do so.

Both manufacturers and installers of these devices have responsibilities, as highlighted in the HSE's Approved Code of Practice and Guidance (L8), with regard to helping to control the risk of Legionella infection linked to such devices (although there is no peer reviewed evidence confirming the efficacy of the latter in controlling biofilm).

Thermostatic Mixing Valves

TMVs are valves that use a temperature sensitive element and blend hot and cold water to produce water at a temperature that safeguards against the risk of scalding, typically between 38 °C and 46 °C depending on outlet use. The blended water downstream of TMVs may provide an environment in which legionella can multiply, thus increasing the risks of exposure.

The use and fitting of TMVs should be informed by a comparative assessment of scalding risk versus the risk of infection from legionella. Where a risk assessment identifies the risk of scalding is insignificant, TMVs are not required. The most serious risk of scalding is where there is whole body immersion, such as with baths and showers, particularly for the very young and elderly, and TMVs should be fitted at these outlets.

Where a risk assessment identifies a significant scalding risk is present, e.g. where there are very young, very elderly, infirm or significantly mentally or physically disabled people or those with sensory loss, fitting TMVs at appropriate outlets, such as hand wash basins and sinks, is required.

Where TMVs are fitted, consider the following factors:

- Where practicable, TMVs should be incorporated directly in the tap fitting, and mixing at the point of outlet is preferable;
- Where TMVs are fitted with low flow rate spray taps on hand wash basins, the risk is increased;
- TMV valves should be as close to the point of use (POU) as possible to minimise the storage of blended water;
- Where a single TMV serves multiple tap outlets, the risk can be increased;
- Where TMVs are designed to supply both cold and blended water, an additional separate cold tap is rarely needed and may become a low use outlet.

Thermostatic mixing valves should be subject to routine monthly temperature profiles to ensure that hot water is supplied at a temperature of 38°C to 46°C +/- 1°C to prevent scalding to users and should be subject to maintenance in accordance with the manufacturer's instructions

The table below is taken from ACoP L8 and supporting Guidance HSG 274 Part 2:

TMVs	Risk assess whether the TMV fitting is required, and if not, remove. Where needed, inspect, clean, descale and disinfect any strainers or filters associated with TMVs. To maintain protection against scald risk, TMVs require regular routine maintenance carried out by competent persons in accordance with the manufacturer's instructions. There is further information in paragraphs 2.152 to 2.168.	Annually or on a frequency defined by the risk assessment, taking account of any manufacturer's recommendations.

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Paragraphs 2.152 to 2.168

The strategy for monitoring for legionella should identify patients at increased risk, e.g. in areas where immuno-compromised patients are present, such as oncology, haematology and transplant units. The strategy should identify all components of the recirculating water system in those units and representative outlets where water samples can be taken and results interpreted to determine the level of colonisation.

2.159 Legionella monitoring should be carried out where there is doubt about the efficacy of the control regime or where recommended temperatures, disinfectant concentrations or other precautions are not being consistently achieved throughout the system. Where considered appropriate, monitoring for legionella should be carried out in line with BS 7592 Sampling for legionella in water and related materials.

2.160 Monitoring results to determine appropriate action levels, depending on whether colonisation is local to an outlet or more widespread within the water system, should be interpreted by a competent person. To establish if the circulating hot water or the distributed cold water is under control, samples should be taken from separate hot and cold water outlets which are not blended. This will ensure the sample is representative of the water flowing around the system and not just of the area downstream of the mixing valve. Monitoring of hot and cold water systems where TMVs are fitted needs careful consideration to ensure the results are interpreted in the context of the conditions in place at the time of sampling.

2.161 Table 2.3 describes the action levels in healthcare premises with susceptible patients at an increased risk of exposure. Whereas, in a general healthcare setting where legionella monitoring is considered appropriate, Table 2.2 describes the actions to be taken.

2.162 Where considered necessary for on-going patient management, POU filters should be used primarily as a temporary control measure while a permanent safe engineering solution is developed, although long-term use of such filters may be required in some cases.

2.163 There is a risk of scalding where the water temperature at the outlet is above 44°C. In certain facilities with 'at risk' patients this is especially so where there is whole body immersion in baths and showers of vulnerable patients, including the very young, elderly people, and people with disabilities or those with sensory loss who may not be able to recognise high temperatures and respond quickly. Where there are vulnerable individuals and whole body immersion, testing of outlet temperatures using a thermometer can provide additional reassurance.

2.164 The potential scalding risk should be assessed and controlled in the context of the vulnerability of those being cared for. The approach will depend on the needs and capabilities of patients or residents. For most people, the scalding risk is minimal where water is delivered up to 50 °C at hand washbasins and using hot water signs may be considered sufficient, where a TMV is not fitted. However, where vulnerable people are identified and have access to baths or showers and the scalding risk is considered significant, TMV Type 3 (TMV3) are required. Further advice on safe bathing can be found in the UK Homecare Association (UKHCA) guidance Controlling scalding risks from bathing and showering.34

2.165 Where the risk assessment considers fitting TMVs appropriate, the strainers or filters should be inspected, cleaned, descaled and disinfected annually or on a frequency defined by the risk assessment, taking account of any manufacturers' recommendations. To maintain protection against scald risk, TMVs require regular routine maintenance carried out by competent individuals in accordance with the manufacturer's instructions. HSE's website provides further information.

Please Note:
Where monthly temperature profiles of thermostatic mixer valve outlets are undertaken to prevent scalding to users with temperatures ranging between 37 – 42°C +/- 1°C, with no identified concerns relating to reduced flow of water or operation of the TMV and fail safe testing of the TMV undertaken (where the cold water feed to the TMV is isolated the TMV must prevent discharge of hot water) these Management Controls could be considered suitable & sufficient to negate the need for annual maintenance.

Should any of the Management Controls fail or not be in place, TMV strainers or filters should be inspected, cleaned, descaled and disinfected annually.

The Management Controls must be reviewed at the time of the next Water Risk Assessment to determine if they remain effective.

Flushing

2.166 The risk from legionella is increased in peripheral parts of the hot and cold water system where there are remote outlets such as hand wash basins, and deadlegs. Where reasonably practicable, dead legs should be removed or the risk minimised by regular use of these outlets. Where outlets in healthcare facilities with susceptible patients are not in regular use the risk assessment may indicate the need for more frequent flushing, i.e. twice weekly and water draw off should form part of the daily cleaning process to achieve temperature control for both hot and cold water and/or biocide flow through.

2.167 In circumstances where there has been a lapse in the flushing regime, the stagnant and potentially contaminated water from within the shower or tap and associated dead leg should be purged to drain without discharge of aerosols before the appliance is used.

2.168 For comprehensive advice about the legal requirements, design applications, maintenance and operation of hot and cold water supply, storage and distribution systems in healthcare premises, refer to Water systems: Health Technical Memorandum 04–01 (for England and Wales), or to Scottish Health Technical Memorandum 04–01 (for Scotland).

Expansion/Accumulator Vessels

Expansion vessels in systems operating at steady temperature and pressure may have long periods without exchanging any significant amount of water and therefore can be at risk of aiding microbial growth.

To minimise the risk of microbial growth, expansion vessels should be installed:
- In cool areas on cold flowing pipes;
- Mounted as close to the incoming water supply as possible;
- Mounted vertically on pipework to minimise any trapping of debris;
- With an isolation and drain valve to aid flushing and sampling;
- To minimise the volume retained within them;
- Designed to stimulate flow within the vessel.

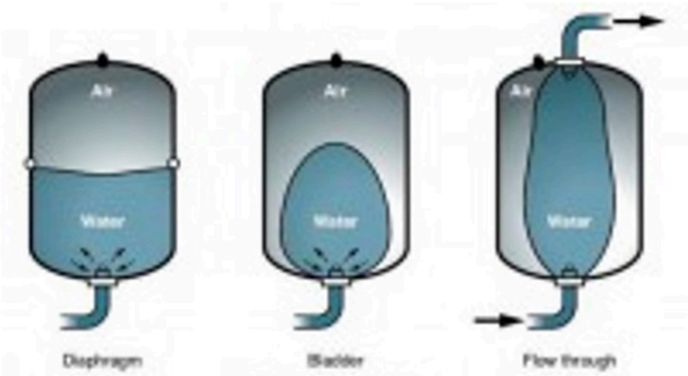
Hydraulic accumulators

Where water is boosted via pumps, hydraulic accumulators (pressurised vessels that buffer variations in pressure so acting like a shock absorber) are often used to reduce pressure surges from the pumps and may reduce the demand frequency. When correctly installed, hydraulic accumulators will partially fill and empty between each pump run and should exchange water at regular intervals, which will reduce the risk of stagnation.

In pressurised systems, a means of accommodating water expansion (caused by the water heating) is required. This is often achieved with the use of an expansion vessel. However, these may not fill and empty where the system pressure and temperature remains steady.
There are several types of vessel available including diaphragm or bladder type, with fixed and interchangeable (replaceable) bladders.

These internal bladders are often made of synthetic rubber such as EPDM and may support the growth of microorganisms including legionella, so check to see if these are approved against BS 6920. Vessels with a ‘flow through’ design should provide less opportunity for water to stagnate and become contaminated (as in the latter design).

Operating Procedure: Fire Hose Reels and Sprinkler Systems



Expansion vessels

The Aim
The aim of this procedure is to comply with the Approved Code of Practice & Guidance L8: The Control of Legionella Bacteria in Water Systems, and hence to control the risk of Legionellosis.

The Risk
All water systems should be subjected to a Risk Assessment. During normal events, these systems present negligible risk of Legionellosis since the water does not come into contact with people (a 'closed' system). However, during testing, commissioning and maintenance they can present a high risk of infection. This is because water has normally lain stagnant in the system for some considerable time and will therefore have had the opportunity for bacteria to multiply. This is particularly likely in buildings where 'wet' systems exist and where ambient temperatures exceed 20oC. Testing can release a significant spray of small water droplets - hence the potentially high risk during this time. Please Note: The primary concern is always that of fire, and this should not be outweighed by the risk of Legionellosis.

System Design
Ideally, systems should be of the 'dry' type. Where possible, water temperatures between 20oC and 50oC should be avoided. The creation of 'dead-legs' should also be avoided. When unavoidable, non-return valves should be used to mitigate the risk.

Cleaning & Disinfection
This would not normally be of much benefit, due to the likelihood of stagnancy and lukewarm temperatures.

Water Treatment
The use of water treatment chemicals would not normally be of benefit with regard to the control of Legionellosis.

Monitoring
There would not normally be any significant benefit to be gained from monitoring.

Control of Risk
During essential testing, commissioning or maintenance, the following steps should be adopted:
1. Remove all non-essential personnel from the area.
2. If possible, test without release of water to the atmosphere.
3. If (2) is not possible, minimise aerosol/droplet production by release under water in an enclosed space.
4. If (3) is not possible, all personnel involved in the testing should wear positive pressure R.P.E.

Operating Procedure: Closed Systems (e.g. Low Pressure Hot Water / Chilled Water)

The Aim
The aim of this procedure is to comply with the Approved Code of Practice & Guidance L8: The Control of Legionella Bacteria in Water Systems, and hence to control the risk of Legionellosis.

The Risk
All water systems should be subjected to a Risk Assessment. During normal events, these systems present negligible risk of Legionellosis since the water does not come into contact with people, (a 'closed' system). However, during testing, commissioning and maintenance they may present a risk of infection. This is because water may have lain stagnant for some time and may therefore have had the opportunity for bacteria to multiply. Testing and maintenance can release a spray of small water droplets - hence the potential risk during this time.

System Design
The design of these systems is such that water temperatures between 20oC and 50oC should not occur during normal operation. However, such lukewarm temperatures may occur out of season or during maintenance.

Cleaning & Disinfection
This would not normally be of much benefit with regard to control of Legionellosis.

Water Treatment
Water treatment chemicals are normally used in closed systems to control corrosion and scale. These would not normally be of benefit with regard to control of Legionellosis.

Monitoring
This would not normally be of much benefit with regard to control of Legionellosis.

Control of Risk
During essential testing, commissioning or maintenance, the following steps should be taken:
1. Remove all non-essential personnel from the area
2. If possible, test without release of water to the atmosphere
3. If (2) is not possible, minimise aerosol/droplet production by for example, placing a damp cloth over the joint(s) to be opened.
4. If (3) is not possible, all personnel involved in the work should wear positive pressure R.P.E.

Operating Procedure: Air Handling Units

The Aim
The aim of this procedure is to comply with the Approved Code of Practice & Guidance L8: The Control of Legionella Bacteria in Water Systems, and hence to control the risk of Legionellosis.

The Risk
All water systems should be subject to a Risk Assessment. Condensation can occur within air handling units and ductwork systems. This is particularly likely in systems where humidification and/or cooling of air take place. Such condensation may produce pools of water which can lie stagnant, thereby creating an opportunity for bacteria to multiply. Very small droplets of water may then be ‘scoured’ into the atmosphere by the action of the air - hence the potential risk during this time.

Cold water humidifiers of the “once-through” type are normally mains-fed and should include on-line disinfection such as ultra-violet light. This should be verified. Cold water humidifiers of the re-circulating type should be removed as these present a high risk of Legionellosis. Steam humidifiers themselves do not present a risk in normal operation, since the boiling of the water eliminates any bacteria which may emanate from the supply.

System Design
The design and purpose of these systems is such that it is virtually impossible to prevent the risk of condensation occurring within them. This can be controlled by the correct application of cooling and humidity levels (where appropriate), and the insulation of ductwork. Areas where condensation can collect should be avoided. Condensate trays should be run to drain.

Cleaning & Disinfection
Condensate trays should be regularly cleaned and disinfected in accordance with the manufacturer’s instruction.

Water Treatment
This would not normally be of much benefit with regard to the control of Legionellosis.

Monitoring
This would not normally be of much benefit with regard to control of Legionellosis.

Control of Risk
Condensate trays should be cleaned and disinfected regularly as above and in addition after shut-down periods, prior to re-use.

Steam humidifiers should be operated in accordance with manufacturer’s instructions.

Cold water humidifiers of the re-circulating type should be isolated from the system immediately and decommissioned. Cold water humidifiers of the ‘once-through’ type should be maintained in accordance with the manufacturer’s instructions, paying particular attention to the on-line disinfection equipment.

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ACoP Requirements Guidance Information

Recommended General Maintenance tasks as Recognised by L8 (2008)

This is a guide only and may require additions or alterations depending on the configuration of the systems within the building(s).

Service	Task	Frequency
Hot water services	Samples to be taken from hot water heaters, in order to note the visual condition of drain water.	Annually
	Check temperatures in flow and return at hot water heaters.	Monthly
	Check water temperatures up to one minute to see if it has reached between 50°C-60°C in the sentinel taps.	Monthly
	Visual check on internal surfaces of hot water heaters for scale and sludge. Check representative taps for temperature as above on a rotational basis.	Annually
	Visual check of the cold water storage of fortic heaters to ensure the cleanliness of the system and the water in it. Carry out cleaning and disinfection where necessary.	Six monthly
Cold water services	Check tank water temperature remote from ball valve and mains temperature at ball valve. Note maximum temperatures recorded by fixed max/min thermometers where fitted and ensure that these thermometers are calibrated.	Six monthly
	Check that temperature is below 20°C after running the water for up to two minutes in the sentinel taps.	Monthly
	Visually inspect cold water storage tanks and carry out remedial work where necessary. Check representative taps for temperature as above on a rotational basis.	Annually
	Visual inspection of the cold water storage tanks to ascertain the cleanliness of the system and the water in it. Carry out cleaning and disinfection where necessary.	Annually
Shower heads	Dismantle, de-scale and disinfect shower heads and hoses.	Quarterly or as necessary
Little used outlets	Flush through and purge to drain, or purge to drain immediately before use, without release of aerosols.	Weekly

RECOMMENDED TEMPERATURE MONITORING AS RECOGNISED BY L8 (2007)

This is a guide only and may require additions or alterations to allow for other means of control.

Frequency	Check	Standard to meet		Notes
		Cold water	**Hot water**	
Monthly	Sentinel taps	The water temperature should be below 20°C after running the water for up to two minutes.	The water temperature should be at least 50°C within a minute of running the water.	This check makes sure that the supply and return temperatures on each loop is functioning as required.
	If fitted, input to TMVs on a sentinel basis.	Supply temperature must be less than 20°C.	The water supply to the TMV temperature should be at least 50°C within a minute of running the water.	One way of measuring this is to use a surface temperature probe. Check outlet temperature max 43°C. 1°C +/- 2°C at 41°C.
	Water leaving and returning to calorifier.		Outgoing water should be at least 60°C, return at least 50°C.	If fitted, the thermometer pocket at the top of the calorifier and on the return leg are useful points for accurate temperature measurement. If installed these measurements could be carried out and logged by a building management system.
Six monthly	Incoming cold water inlet (at least once in the winter and once in the summer).	The water should preferably be below 20°C at all times.		The most convenient place to measure is usually at the ball valve outlet to the cold water storage tank.
Annually	Representative number of taps on a rotational basis.	The water temperature should be 20°C after running the water for two minutes.	The water temperature should be at least 50°C within a minute of running the water.	This check makes sure that the whole system is reaching satisfactory temperatures for Legionella control.

Water Sampling

It is not necessary to carry out routine monitoring for Legionella in hot and cold water systems if the control parameters of either temperature or biocide are maintained within the desired limits. However, where routine monitoring identifies that system control levels have constantly not been achieved e.g. poor water temperatures, low biocide levels etc. then a competent person (UKAS accredited) should be appointed to carry out Legionella sampling.

If Legionella is detected at a concentration of, more than 100 cfu/litre but less that 1000 cfu/litre then the following action should be taken:

1. If two or less samples are found then the system should be re-tested and if a similar result is obtained then the risk assessment should be reviewed along with necessary control measures;
2. If the majority of samples are positive the system is probably colonised at a low level. Disinfection of the entire system should be considered and an immediate review of the risk assessments and control measures carried out.

If Legionella is detected at concentrations of greater than 1000 cfu/litre then an immediate review of the control measures and risk assessment must be carried out. It is likely that the whole system will need to be disinfected by a competent person and then re-sampled.

Disinfection of the system can be by either chlorination or thermal disinfection. Chlorination must be carried out by a competent person to BS 6700 and will include achieving free chlorine levels at the storage tank of 20-50 mg/l of free chlorine which is then flushed through every outlet until chlorine can be smelt.

The system is then left to stand for a period of at least one hour before being drained and refilled. Chlorine levels are monitored throughout the period of disinfection. Thermal disinfection is carried out by raising the temperature of the water in the whole system to 60°C and then flushing each outlet for five minutes while monitoring the temperature of the outlet being flushed.

Bacterial Results

Acceptable results for the mains cold water (drinking water outlet(s) or from a cold water storage cistern, bacterial levels should have no abnormal change and in any case the level should not exceed:

Coliforms - 0 per 100 ml
Enterococci - 0 per 100 ml
E-coli - 0 per 100 ml
TVC - 22°C - 100 cfu/ml
TVC - 37°C - 10 cfu/ml

For more information please contact us on 020 7960 3939 or visit our website: **www.metrosafety.co.uk**

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