Guidelines for the Control of Legionella

in Manufactured Water Systems in South Australia

Government of South Australia
SA Health

2008

Control of Legionella in Manufactured
Water Systems in South Australia

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for the South Australian Health Minister

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Foreword

In a modern and highly mechanised world, water is used in a wide range of devices designed to improve standards of living. However, these devices have to be correctly managed to ensure that they do not represent risks to health. There are many micro-organisms that grow in water and, while most are harmless, some may give rise to human illness.

Manufactured water systems that contain warm water and produce aerosols are of particular concern. Although there are a range of devices that operate under these conditions, water-based air-cooling systems, hot water systems, warm water systems (see Schedule 1) and spas have been identified as having the greatest potential to grow and disseminate *Legionella*, the cause of Legionnaires' disease and Pontiac Fever.

Under the *Public and Environmental Health Act 1987* (the Act), the Public and Environmental Health Council can initiate measures to promote public and environmental health standards and has the responsibility to keep the operation and administration of the Act under review.

The Public and Environmental Health Council has requested that a Guideline be prepared consistent with section 47(5) of the Act to support the Public and Environmental Health (Legionella) Regulations 2008 (the **Legionella Regulations**). This Guideline has been prepared for use as a guide by the relevant authorities responsible for administering the Act and Legionella Regulations and provides advice and assistance to persons who design, install, own, operate or maintain manufactured water systems.

Although this Guideline applies to a range of manufactured water systems, the primary focus is those of higher risk, namely, cooling water systems and warm water systems. This Guideline specifies:

> maintenance and decontamination procedures;

> the keeping of records and manuals;

> the responsibilities of owners and occupiers of premises on which manufactured water systems are situated; and

> the role of relevant authorities in monitoring the operation of such systems.

The only types of premises to which this Guideline does not apply are high risk manufactured water systems installed in Class 10, Class 1A or 4 buildings or sole-occupancy units in Class 2 buildings (as defined in the Building Code) unless they are warm water systems that serve more than 1 dwelling.

This Guideline has reference to a number of other documents that must be read in conjunction with it. These documents include the Act, the Legionella Regulations, Australian/New Zealand Standard (AS/NZS) 3666: Parts 1, 2 and 3, *Air-handling and water systems of buildings – Microbial control*, Handbook SAA/SNZ HB32, *Control of microbial growth in air-handling and water systems in buildings*, Australian/New Zealand Standard (AS/NZS) 3500.4 *National Plumbing and Drainage Part 4: Heated water services*, and the Building Code of Australia.

This Guideline is prescribed by the Legionella Regulations and incorporates some of the provisions of Australian/ New Zealand Standard (AS/NZS) 3666: Parts 1, 2 and 3, *Air-handling and water systems of buildings – Microbial control* and Handbook SAA/SNZ HB32, *Control of microbial growth in air-handling and water systems of buildings*. However, where the provisions of this Guideline and the AS/NZS Standards differ, the provisions of this Guideline will prevail.

Users of this Guideline should also be aware of the requirements of the Act and Regulations and Codes of Practice that apply to spa pools and hydrotherapy pools.

Note:

Where required, all applications for approval by the Minister are to be submitted to:

The Minister
C/– Environmental Services Section
Public Health Directorate
Department of Health
PO Box 6 Rundle Mall
ADELAIDE SA 5000

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1. Introduction

This document is prescribed as a Guideline under the *Public and Environmental Health Act 1987* and deals specifically with the control of *Legionella* in manufactured water systems. It is concerned with all manufactured water systems that can incorporate water in which *Legionella* can grow and that have the potential to generate aerosols that can spread any organisms that are present. Cooling water systems, warm water systems and spas have been identified as representing the highest risk in this regard. Of particular focus are high risk manufactured water systems which are cooling water systems and warm water systems. Although a potential source of *Legionella*, spa pools are dealt with in other legislation; the Public and Environmental Health (General) Regulations 2006 and associated Codes of Practice.

Manufactured water systems that can grow *Legionella* but do not disseminate aerosols (such as ice machines) are not considered to be a high risk for most people but may represent a risk for the severely immunocompromised.

The most effective way of minimising the growth of *Legionella* is to keep water systems visibly clean and to apply appropriate water treatment. The presence of biofilms, sediments, sludge, solids, scale, corrosion and other micro-organisms can all provide a favourable environment for *Legionella* to grow.

This Guideline outlines operation and maintenance procedures designed to keep systems visibly clean and free from *Legionella* contamination. It also sets out decontamination procedures that may be required if there is an outbreak or suspected outbreak of legionellosis or if it is suspected that a water system may contain high numbers of *Legionella*. Further detail on these matters is provided in Australian/New Zealand Standard (AS/NZS) 3666: Parts 1, 2 and 3, *Air-handling and water systems of buildings – Microbial control* and Handbook SAA/SNZ HB32: *Control of microbial growth in air-handling and water systems of buildings*, as in force from time to time.

This Guideline has been prepared to assist relevant authorities with the administration of the *Public and Environmental Health Act 1987* (the Act) and the Public and Environmental Health (Legionella) Regulations 2008 (the Regulations). It describes the role of the relevant authorities in monitoring compliance and in maintaining registers of cooling water systems and warm water systems. The Guideline also provides advice and information for use by designers, installers, owners, operators and maintenance personnel to ensure that manufactured water systems are constructed, operated and maintained in a manner that prevents or represents minimal risk of causing outbreaks of legionellosis and complies with the requirements of the Act and Regulations.

Unless otherwise stated, the legislation and other documents referred to in this Guideline include any amendments made from time to time. The provisions of this Guideline do not derogate from the need to comply with other applicable legislation.

In summary, the key points of this Guideline and the Legionella Regulations are that:

> Manufacture
  - manufactured water systems should be manufactured, installed, maintained and operated in a manner that prevents the transmission of disease organisms to persons
  - a cooling water system must be fitted with an automatic biocide dosing device and be operating effectively at all times while the system is in operation
  - drift eliminators must be fitted to every cooling tower in a cooling water system unless otherwise determined by the Minister
  - pipes after thermostatic mixing valves or their equivalent to outlet points on hot water or warm water systems should not exceed 6 metres in length

> Maintenance
  - high risk manufactured water systems must be inspected at least monthly as part of a routine maintenance program and be cleaned if found to be dirty
  - cooling water systems must be cleaned at least 6 monthly, or more frequently where required to maintain cleanliness
  - the temperature of water stored in hot and warm water systems must be maintained at a minimum of 60°C
  - hot water system and warm water system outlet taps that are not used on a weekly basis should be flushed every week
  - dead legs (lengths of pipe that do not allow circulation of water) should be removed or disconnected

- warm water systems must be completely flushed at least 6 monthly with water of not less than 70°C for 5 minutes (or an equivalent temperature/time combination) or be treated with chlorine to provide a minimum free chlorine residual of 1–2 mg/L at all outlets
- temperature controlling devices such as thermostatic mixing valves or tempering valves should be regularly serviced in accordance with the manufacturer's instructions and AS 4032 and, in any case, at least once every 12 months

> Administration

- the owner of premises on which a cooling water or warm water system is situated must ensure that manuals for the operation and maintenance of the system are available and that records are maintained of any inspection, maintenance, repair, replacement, alteration or upgrading of the system. Records will include the result of any testing of the system, microbiological testing of water samples and details of the type and use of biocide

> Authorities

- the relevant authority must maintain a register that records details of premises on which cooling water systems or warm water systems are situated
- an annual inspection of each cooling water and warm water system must be undertaken, either by the relevant authority or by a third party on behalf of the owner of the premises on which the system is situated. In the latter case a report must be provided to the relevant authority. The costs incurred in the annual inspection are to be met by the owner of the premises
- the relevant authority may require testing for the presence of *Legionella* organisms in the event that a high risk manufactured water system is inadequately operated or maintained. Testing may also be required as part of an investigation of a case or suspected case or an outbreak of legionellosis
- in the event of the failure by the owner of premises on which a manufactured water system is situated to comply with a notice given by the relevant authority requiring maintenance of the system to be carried out, the relevant authority may require the system to be remediated, shut down and/or decontaminated and may recover all necessary associated costs from the owner.

2. Definitions

Act (The Act)	*Public and Environmental Health Act 1987*.
aerosol	airborne water particles less than 10µm in diameter.
air-house	an industrial humidifier commonly used in paint, electroplating and finishing shops.
authorised officer	a person appointed as an authorised officer by the Minister or a council or authorised by the Minister to exercise the powers of an authorised officer under the Act.
the (relevant) authority	as defined in the *Public and Environmental Health Act 1987*.
automatic biocide dosing device	a device that automatically discharges a measured amount of biocide to the cooling water system using a feedback control loop or timer.
biocide	a substance capable of killing micro-organisms, including *Legionella*.
biofilm	a film, formed on solid surfaces, containing biological flora.
bleed-off	the removal of water from a system to limit the concentration of total dissolved solids and suspended solids.
calorifier	an apparatus for indirect heating of water in a vessel, the source of heat being a separate coil of heated pipes immersed in the water.
clean	free from visible sludge, foam, slime, rust, scale, dirt, dust and any deposit or accumulation of impurities, or any foreign material.
cfu/mL	colony forming units per millilitre.
cooling tower	a device for lowering the temperature of water by evaporative cooling in which atmospheric air is in contact with falling water thereby exchanging heat. The term also includes those devices which incorporate a water-refrigerant or water-water heat exchanger.
cooling water system	a heat exchange system comprising a heat-generating plant, a heat-rejection plant and interconnecting water recirculating pipe work and associated pumps, valves and controls. The term includes cooling towers and evaporative condensers.
community wastewater management scheme (CWMS)	a wastewater management scheme for a community, sub-division or town, consisting of wastewater collection drains and other components directing wastewater to a common treatment plant and disposal or irrigation area.
competent person	a person who has had the appropriate training or practical experience (or both) in the subject, sufficient to provide safe and satisfactory performance and compliance with the legislative requirements.
container (heated water)	a vessel, including fittings, in which heated water is stored, sometimes referred to as a storage container, cylinder or tank.
dead leg	a section of a hot water or warm water system that does not permit the circulation of hot or warm water.
decontamination	the reduction, to negligible or low concentrations, of known or suspected high concentrations of a specific contaminant, such as *Legionella*.
drift	water lost from the cooling tower as liquid droplets in the exhaust air, excluding condensation. Drift is not to be confused with plume which is condensed water vapour.
DPD Test Kit	a test kit containing 'diethyl-p-phenylene diamine' a chemical reagent used in a colorimetric comparator for testing water for free, combined and total chlorine.
evaporative condenser	a heat exchanger in which refrigerant is cooled by a combination of air movement and water spraying.

heterotrophic colony count	a measure of heterotrophic aerobic bacterial populations present in a water sample (not including *Legionella* populations). It is often referred to as a heterotrophic plate count or total plate count.
high risk manufactured water system	a cooling water system or warm water system.
hot water system	a reticulated water system that distributes or recirculates hot water through the majority of its branches primarily at or near a temperature of 60°C. A hot water system may include temperature control devices to regulate the temperature near outlets. See Figures 1 and 2 of Schedule 1.
instantaneous water heater	an unvented water heater in which the heat energy is applied only while the water flows to an outlet.
Legionella Regulations	Public and Environmental Health (Legionella) Regulations 2008.
manufactured water system	a man-made system that incorporates water as part of its functionality.
mg/L	milligram per Litre.
outbreak	2 or more cases of legionellosis linked by time or place.
occupier	in relation to premises, means a person who has, or is entitled to possession or control of the premises and includes a person who is in charge of the premises.
owner	in relation to premises, can include an occupier of the premises as defined in the Act.
pH	a scale (ranging from 0 to 14) that indicates the acidity (0 to 7) or alkalinity (7 to 14). Water with a pH of 7 is neutral.
relevant authority	in relation to a local government area – the council for the area; or in relation to a part of the State not within a local government area – the Minister.
sporadic case	a single case of legionellosis with no discernible link to another case by time or place.
TDS (total dissolved solids)	the total weight of dissolved solids in water, which would remain if all the water were evaporated.
temperature control device	a device used to alter the water temperature to produce water that reduces the risk to users of scalding. Examples include thermostatic mixing valves and tempering valves.
tempering valve	a mixing valve that is temperature actuated and is used to temper a hot water supply with cold water to provide hot water at a lower temperature e.g. 50°C, at one or more outlet fixtures.
thermostatic mixing valve	a mixing valve in which the temperature of the water from the mixed water outlet is automatically controlled by a thermostatic element/sensor to a preselected temperature that is suitable for direct contact with the skin.
Minister	the Minister of the Crown to whom the administration of the Act is committed for the time being (Minister for Health).
storage water heater	a water heater that incorporates a thermally insulated container in which the water is heated and stored for subsequent use. Heated water must be stored at a minimum temperature of 60°C to inhibit the growth of *Legionella* bacteria. A storage water heater does not include a calorifier.
water storage tank	a container for storing water.
warm water system	a reticulated water system that distributes or recirculates warm water through the majority of its branches at a nominal temperature of 45°C by means of a temperature controlling device. See Figures 3 and 4 of Schedule 1.

3. Legionella Regulations cross-reference

Table 1

Cross-reference between the Legionella Regulations, relevant Australian Standard and references within this Guideline

Table 1 briefly summarises individual regulations with specific requirements from the Legionella Regulations, and provides a reference to the relevant location within this guideline and to the corresponding Australian Standard referred to within the regulation, where applicable. Regulations that are not referenced within this guideline have not been included.

Regulation number and title	Requirement	Relevant Australian Standard	Reference in this Guideline	Page no.
5. Duty to ***register*** high risk manufactured water system	All high risk manufactured water systems must be registered with the relevant authority		**12.4**	20
6. ***Register*** of high risk manufactured water systems	The authority is to establish and maintain a register of high risk manufactured water systems		**12.4**	20
7. Cooling water systems to be fitted with ***automatic biocide dosing devices***	Automatic biocide dosing device to be fitted to cooling systems and operate effectively at all times that the system is in operation		**6.1** **8.8.1**	9 15
8. Cooling water systems to be fitted with ***drift eliminators***	Drift eliminators to be fitted to all cooling water systems (unless the Minister determines otherwise)		**6.1**	9
9. ***Commissioning*** of high risk manufactured water systems	Cooling water systems and components to have appropriate cleaning, pre-treatment and microbial control before being brought into service	**AS/NZS 3666.1 – Clause 4.7**	**6.**	9
10. ***Plans and manuals*** relating to high risk manufactured water systems to be kept readily accessible etc	Plans, Operating and maintenance manuals to be kept on the premises in a readily accessible place and be available for inspection upon request by an authorised officer	**AS/NZS 3666.2 – Clause 2.6.1** **HB32**	**6.** **11.**	9 18
11. High risk manufactured water systems to be ***operated and maintained*** by ***competent person***	The owner of premises with a high risk manufactured water system installed to ensure that the system is operated and maintained by sufficiently competent, knowledgeable person		**7.**	12
12. ***Maintenance of cooling water systems***	Cooling water systems to be maintained in accordance with the relevant Australian Standard or a program approved by the Minister	**AS/NZS 3666.2 – Section 2.5** or **AS/NZS 3666.3 – Section 3**	**8.1**	13
13. ***Maintenance of warm water systems***	Warm water systems to be maintained in accordance with the requirements set out in regulation 13	**AS 4032** (for temperature control devices)	**8.2**	14
14. ***Maintenance log books***	Up-to-date maintenance log books to be kept on premises in a readily accessible place and be available for inspection upon request by an authorised officer Log books to be kept for at least 5 years	**AS/NZS 3666.2 – Clause 2.6.2** **HB32**	**11.**	18
15. ***Annual inspection*** and ***microbiological testing***	High risk manufactured water systems are to be inspected and have microbiological testing conducted at least once in every 12 months	**AS/NZS 3896** (for micro-biological testing)	**9.** **12.**	16 19 24
16. Power of authority to require ***microbiological testing*** in other circumstances	The authority may serve a notice requiring microbiological testing when investigating an occurrence of Legionellosis or if a system is not being maintained in accordance with the Legionella Regulations	**AS/NZS 3896** (for micro-biological testing)	**12.**	19
17. Results of ***microbiological testing to be reported*** to authority within 24 hours in certain cases	The owner of premises with a high risk manufactured water system to report microbiological test results to the authority within 24 hours as required by this regulation		**9.1**	16
19. Power of authority to ***require immediate decontamination*** of high risk manufactured water systems	The authority must notify the Department of Health of microbiological test results as specified by regulation 17		**10.**	17
20. Power of authority to require ***shut down*** or ***maintenance*** etc	The authority may require shut down or maintenance of systems not being maintained in accordance with these regulations Where notice requirements are not complied with, the authority may cause them to be carried out and recover appropriate costs		**12.**	19
21. ***Determinations*** and ***approvals***	Applications for determinations and approvals to be made to Minister on an approved form accompanied by relevant fee and necessary information		**Foreword**	–

4. *Legionella* and illness

Legionella bacteria must be inhaled to cause illness; however, most people who are exposed to *Legionella* do not become ill. *Legionella* generally infects the lung causing pneumonia and a disease known collectively as legionellosis. Legionellosis can take the form of the pneumonic, often very severe and potentially fatal Legionnaires' disease or the non-pneumonic, often non-fatal Pontiac fever. *L. pneumophila, L. anisa, L. feelii* and *L. micdadei* have been associated with Pontiac fever, while waterborne Legionnaires' disease is classically caused by subtypes of *L. pneumophila* serogroup 1, although other species can also cause disease. The incubation period for legionellosis infection is 2–10 days, and symptoms include flu-like symptoms including fever, chest pain, cough, breathlessness, and diarrhoea. Diagnosis is usually made by a series of blood tests, and infections caused by *L. pneumophila* serogroup 1 may be identified rapidly by testing a sample of urine. Occasionally the organism can be grown from a sample of sputum or lung fluid.

Other species have also been identified as causes of pneumonic illness, including *L. longbeachae* associated with potting mixes. While legionellosis from potting mixes is not covered in this Guideline, further information can be obtained from other Department of Health publications as referenced in Appendix A.

Legionellosis infection generally requires treatment with antibiotics and some cases may require admission to hospital. Severe cases of *Legionella pneumophila* serogroup 1 infection will need to be treated in hospital and may require intensive care.

Infections caused by *Legionella* are notifiable diseases in South Australia, meaning the doctor and the laboratory diagnosing the disease are required to notify all cases to the Communicable Disease Control Branch of the South Australian Department of Health. Notification ensures that steps are taken, where necessary, to prevent further disease in the community.

4.1 *Legionella* in the environment

Legionella are widely distributed in the natural environment and have been isolated from water sources such as lakes, rivers, streams, groundwater, thermal lagoons, and habitats such as soils and mud. The organism obtains nutrients from other micro-organisms such as algae, protozoa and other bacteria, and by the utilisation of some organic and inorganic material. *Legionella* multiply at temperatures ranging from 20°C to 45°C, with maximum growth occurring between 32°C and 43°C. They can survive freezing and are killed with increasing rapidity as temperatures exceed 45°C. Survival time decreases from hours at 50°C to minutes at 60°C, while at 70°C the organism is killed almost immediately.

Legionella from natural sources can enter and colonise manufactured water systems such as air-handling systems incorporating cooling towers or evaporative condensers (collectively known as cooling water systems), hot water and warm water supply services, spa pools, spa baths, hydrotherapy pools, air-houses, humidifiers, nebulisers and decorative fountains. These systems are typically found in commercial, industrial, educational, child care, aged and health care facilities. The relative risk of *Legionella* growing in such systems is shown in Figure 1 overleaf.

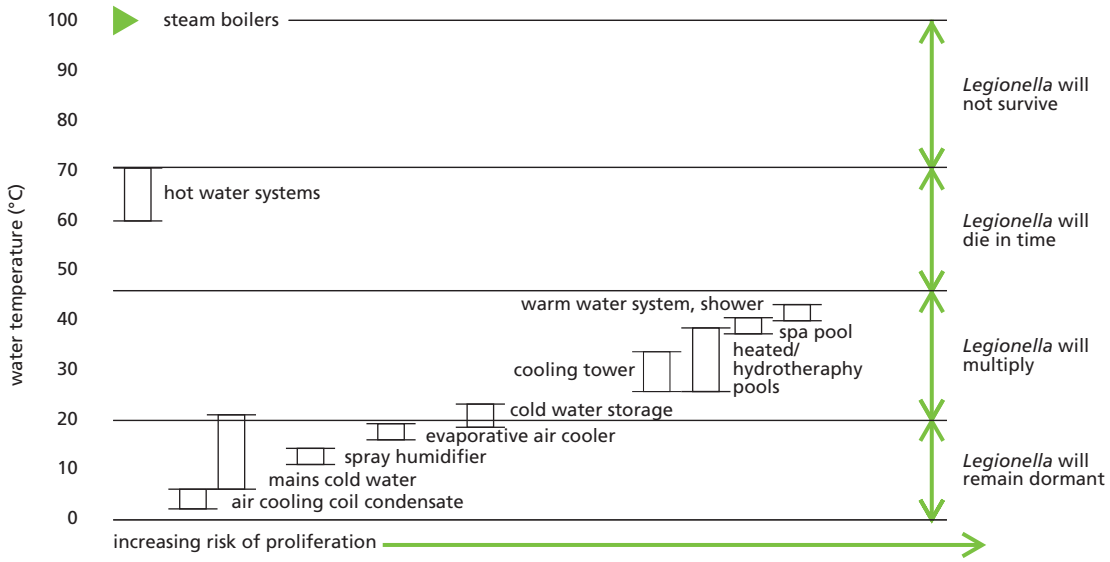
The figure shows the relationship between proliferation of *Legionella* and temperatures of water systems when in use, and when other growth factors are present. The bars represent the average range of operating temperature of various manufactured water systems.

Legionella growth is temperature dependent. In broad terms, the temperature characteristics are:

below 20°C	dormant
20 to 25°C	virtually dormant although very slow growth is possible
25 to 30°C	slow growth if other factors are satisfied
30 to 37°C	increase in growth rate
37 to 43°C	optimum temperature range for replication of *Legionella*
45°C	maximum temperature for growth
46°C	stationary phase (dies over about 1 week)
50°C	dies slowly (about 10 hours)
55°C	dies in about 1 hour
63°C	dies in a few minutes
70°C	dies in seconds.

Figure 1

Water temperature & increasing risk of *Legionella* proliferation



(Modified from: New South Wales Health Department, Code of Practice for the Control of Legionnaires' disease*.)*

4.2 Risk factors for illness

Legionella infection or illness can result from the inhalation of aerosols containing *Legionella* bacteria which may be generated by some manufactured water systems. However, most people who are exposed to *Legionella* do not become ill. The risk of illness is increased by:

> being of male sex (possibly related to smoking)
> smoking
> chronic heart or lung disease
> diabetes
> kidney failure
> some forms of cancer
> being aged over 50

Infection caused by *Legionella* cannot be transmitted from person to person.

4.3 Reducing risk in manufactured water systems

Legionella present in biofilms or protected within amoebae may proliferate in a manufactured water system if temperatures are favourable (25–45°C). The most effective way of reducing risk associated with *Legionella* is to keep systems clean and to use an appropriate disinfection procedure. All wetted surfaces and water basins need to be kept clean and the stagnation of water in any manufactured water system should be avoided. The ability of a system to be effectively cleaned is an important factor in minimising presence and growth of *Legionella*.

The development of biofilms and the effectiveness of disinfection will be influenced by corrosion and the deposition of scale and solids. Degraded plumbing, such as decomposing gaskets and sealing washers and corroded pipes provide sites for the development of biofilms. Some plumbing materials are known to contain nutrients that enhance the growth of biofilms. The formation of biofilms and deposition of scale and solids need to be minimised. Materials used in water systems should comply with AS/NZS 4020 and SAA MP 52.

The inhalation of contaminated aerosols by a susceptible person may result in legionellosis. Accordingly, minimising the generation and spread of any aerosols will reduce the risk of disease in the community.

5. Spa pools and hydrotherapy pools

Spa pools and hydrotherapy pools operate at temperatures that are ideal for *Legionella* growth and at which disinfection concentrations can be difficult to maintain. In addition, aerosols can be produced. Spa and hydrotherapy pool operators must be knowledgeable and competent in the operation and maintenance of public pools and spas in accordance with the Public and Environmental Health (General) Regulations 2006, and the prescribed Codes, *Standard for the Operation of Swimming Pools and Spa Pools in South Australia,* including Supplement B: Hydrotherapy Pools, and *Standard for the Inspection and Maintenance of Swimming Pools and Spa Pools in South Australia*.
These documents are available online at: http://www.health.sa.gov.au/

6. Design, installation and commissioning of systems

Generally, any manufactured or other water system that can generate warm water and produce aerosols can represent a risk of legionellosis.

Evaporative air conditioners, while falling into this category, have not been associated with any cases of legionellosis in Australia. However, units should be regularly maintained and kept clean (for further information refer to AS/NZS 3666.2).

The design and installation of new manufactured water systems and modification of existing systems must comply with the Legionella Regulations, and should comply with AS/NZS 3666.1 and this Guideline. The commissioning of new or modified plant must include thorough cleaning and the provision of operation and maintenance manuals. It is important to ensure in the design, installation and commissioning of manufactured water systems that they are appropriately located, with consideration given to access and clean-ability issues. Dead legs in cooling water systems, hot water systems and warm water systems need to be avoided. For air-handling devices incorporating cooling water systems, the location of air inlet and discharge points in relation to building geometry, location of inlet and discharge points of adjacent buildings and predominant wind direction should be considered. Materials used in plant construction need to be corrosion resistant and able to withstand extremes in water quality and presence of water treatment chemicals.

Upon installation and commissioning of new high risk manufactured water systems, the Legionella Regulations (regulation 10) require the owner to keep on the premises in a readily accessible place; plans showing the location of all parts of the system. Existing systems are required to have plans showing the location of all major components of the system. These components include (but are not limited to) cooling towers, condensers, drift eliminators, filtration devices, automatic biocide dosing devices, water inlets, waste outlets and discharge points, water heating devices and water storage facilities. The location of other major parts of the system such as major pipe mains, valves, and any water treatment devices installed should be shown where possible or appropriate.

The owner of the premises is required to ensure the plans for the system are kept in a readily accessible place and are made available to authorised officers upon request.

6.1 Cooling water systems

Air-handling systems that incorporate water cooling, such as cooling towers and evaporative condensers, can generate aerosols and produce warm water. These systems typically have large internal surface areas and, if not well maintained, may accumulate considerable quantities of organic material and debris, and provide nutrients and ideal environments for microbial growth.

These systems can be found associated with many types of facilities including factories with process cooling operations, commercial buildings, hospitals, hotels, shopping centres, schools, dairies, wineries, fruit and vegetable storage sheds, ice works, cold rooms and dry cleaners.

Well designed systems should be easy to clean and disinfect and should not contain dead legs or sections where debris and biofilms may accumulate. Systems should be designed and commissioned with consideration given to the quality of the outside air introduced into the system, and installed at a suitable distance from nearby cooling towers. In accordance with the provisions of AS/NZS 3666.1, sections 4.3 and 4.6, cooling towers should be located in areas free from accumulated soils and other material that may be a source of nutrients liable to be sucked into the system.

Regulation 7 of the Legionella Regulations requires an automatic biocide dosing device to be fitted to a cooling water system and to be operating effectively at all times while the system is in operation. Regulation 8 of the Legionella Regulations requires a drift eliminator to be fitted to a cooling tower of a cooling water system unless the Minister has approved an alternative system following an application to the Department of Health. Where drift eliminators need to be retrofitted to an existing system, a more rigorous management program based on the approach described in AS/NZS 3666.3 will be required until drift eliminators are in place.

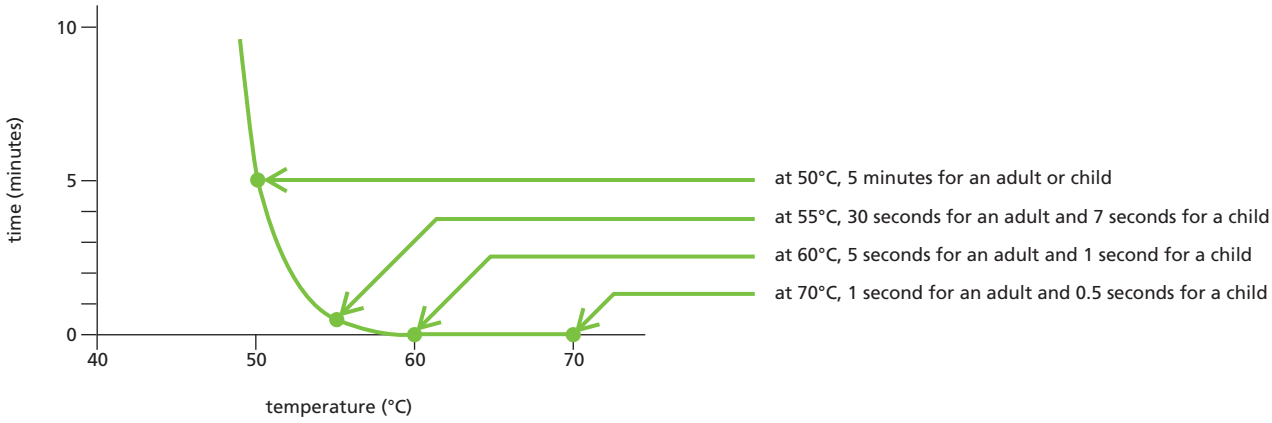
6.2 Hot water systems and warm water systems

Hot water systems and warm water systems are used to provide heated water in buildings for a range of purposes (e.g. bathing or cleaning). Hot water systems are those that heat water and distribute or recirculate it through the majority of the pipe work at or around 55–60°C. To inhibit the growth of *Legionella* bacteria, AS/NZS 3500.4 and the Legionella Regulations (regulation 13) require hot water to be stored at a minimum 60°C. Lowering the thermostat temperature of a water storage container is not permitted if it results in water being stored at less than 60°C. Care should also be taken to avoid temperature stratification in heaters or storage containers; this can be achieved by the installation of a stirring or mixing device. Further information can be found in SAA/SNZ HB32:1995.

Warm water systems are typically found in care facilities such as early childhood centres, primary and secondary schools, nursing homes for young, aged, sick or disabled persons and other health care facilities. Warm water systems are those that distribute or recirculate water through the majority of the pipe work at a temperature of approximately 45°C as per AS/NZS 3500.4. This is achieved by the use of a temperature controlling device (usually located at the outlet of a water storage container or instantaneous heating unit) or by way of setting the thermostat on an instantaneous heating system. Lower temperatures in distribution systems can favour the growth of *Legionella* but this must be balanced against the increased risk of scalding associated with water temperature exceeding 50°C. Figure 2 provides details of the relative contact times for full thickness burns to occur at varying water temperatures.

Figure 2

Full thickness burns – contact times with water



Reference: Henriques FC, Moritz AR. Studies of thermal injury V: the predictability and the significance of thermally induced rate processes leading to irreversible epidermal injury. Arch Pathol 1947; 43: 489–502.

Warm water reticulated systems provide water at temperatures within the growth range for *Legionella*; and as a consequence these systems require greater maintenance to minimise risks from *Legionella*.

Dead legs need to be avoided in warm water systems and hot water systems. Where possible, branch mains should be less than 6 metres in length. Where thermostatic mixing valves or their equivalent are fitted, the length of main after the valve should be between 1 and 6 metres.

6.3 Spa baths

Spa baths are used as "fill and empty" type devices. Spa baths should be designed and installed to ensure that all pipe work and pumps are self-draining to prevent stagnation of water. Spa baths should comply with AS 3861.

6.4 Air-houses, humidifiers and nebulisers

Air-houses are industrial humidifiers used in paint, electroplating and finishing shops. Humidifiers can be found as part of an air handling plant, manufacturing processes, fruit or vegetable storage and in the domestic setting. Nebulisers are commonly found in hospitals and other health care facilities. Air-houses, humidifiers and nebulisers incorporating water reservoirs generate aerosols and have the potential to transmit *Legionella*, making it imperative that these systems are properly managed and maintained in a clean state. Only sterile water should be used to fill a nebuliser reservoir or basin.

6.5 Decorative fountains

Aerosols are created by the splashing or spraying of water in a fountain, however fine droplets or mists are considered to be high risk as opposed to large droplets. The recirculating water in such systems may be inadvertently heated (for example by submerged lighting) producing conditions that may favour the multiplication of *Legionella*. When designing fountains these factors should be taken into consideration.

6.6 Ice machines and other non-aerosol producing devices

Manufactured water systems such as ice machines may also produce conditions that enable *Legionella* to survive and grow, but due to their lack of aerosol production, these devices are only considered a high risk to the severely immunocompromised. Where extraordinary procedures such as air filtration, restricted food diets and so on are used to protect high risk patients from infection, these procedures should extend to water and ice machines. Ice machines should be inspected monthly and cleaned as necessary as per the manufacturer's instructions, and in any event at least once annually.

7. Reponsibility for manufactured water systems

The Legionella Regulations (regulation 5) require the owner of premises in which a cooling or warm water system is situated to register the system with the relevant authority. The Regulations (regulation 11) also require the owner of premises in which such a system is installed to ensure that that the person responsible for the operation and maintenance of the system is sufficiently knowledgeable and competent to ensure that the system is operated and maintained as required. A competent person is one who has had the appropriate training or practical experience (or both) in the subject, sufficient to provide safe and satisfactory performance of the system in compliance with the legislative requirements. Evidence of attendance at a course run by a reputable agency may constitute prima facie evidence of the knowledge and competence required of the person responsible for the cooling tower or warm water system for the purposes of the Legionella Regulations. The knowledge and competence of an operator may be assessed by observing the standard of water quality within the system and the overall level of compliance and maintenance of the system.

The competent person nominated by the owner may be a contractor or company.

8. Operation and maintenance of systems

The safe operation and maintenance of manufactured water systems requires frequent visual inspections, regular cleaning and, in some cases, the use of water treatment processes. Inspections should be carried out at least once every month and be used as a basis for assessing the efficacy of the system performance, cleaning programs and water treatment processes. It is the responsibility of the owner of the premises on which the manufactured water system is situated to ensure this takes place.

Regulation 14 of the Legionella Regulations requires up to date maintenance log books to be kept (see Part 9).

8.1 Cooling water systems

Regulation 12 of the Legionella Regulations requires cooling water systems to be maintained in accordance with section 2.5 of AS/NZS 3666.2 or, AS/NZS 3666.3 or a maintenance program approved by the Minister. If the maintenance program set out in AS/NZS 3666.2, 2.5 or AS/NZS 3666.3 cannot be achieved, an alternative maintenance program which must provide an equivalent level of control to that of AS/NZS 3666.2 or, AS/NZS 3666.3 is to be submitted to the Department of Health for the Minister's approval. The assessment of alternative maintenance programs by the Minister will generally be based on the approach set out in AS/NZS 3666.3.

AS/NZS 3666.2 requires cooling water systems to be inspected at least monthly for mechanical condition, biocide dosing and cleanliness, and be cleaned at least once every 6 months. A clean system will be free from visible sludge, foam, slime, rust, scale, dirt, dust and other deposits or growths. Cleaning procedures are detailed in AS/NZS 3666.2 and SAA/SNZ HB32. Water quality parameters such as pH, TDS and temperature should be monitored and recorded. Inspections and cleaning should be carried out more frequently as required by operational conditions or as indicated by visual inspections (operating conditions, water quality parameters, and the general condition of the cooling tower and basin). Stagnation of water should be avoided, as this can be conducive to the growth of *Legionella*. The Legionella Regulations (regulation 12) require that cooling water systems that have been shut down on a seasonal basis or for more than 30 days shall be cleaned, and water treatment re-instated before recommissioning.

Areas around cooling water systems should be kept clean to minimise the accumulation of soil, dust or other organic material that could enter the system.

8.1.1 Filtration devices

Water filters are designed to reduce particulate matter that is suspended in the water. Suitably designed and correctly installed water filtration systems will help to reduce fouling of water cooling systems with particulate matter and may increase the effectiveness of disinfection processes.

The efficacies of filters vary depending on factors such as type, pore size, media used and membranes. Filters should be regularly inspected, cleaned, and flushed as per the manufacturer's instructions. Filters should be kept visibly clean, and should be inspected at times of monthly inspection and annual audit inspection. The filter media should be replaced periodically, and in accordance with the manufacturer's instructions.

8.1.2 Trade waste discharge

Discharges from cooling towers have the potential to adversely affect the sewerage system as they can contain high levels of suspended solids, organic matter, biocides and heavy metals and may be considered a "trade waste". Appropriate management practices at each site are to be employed in accordance with SA Water's Trade Waste Guideline 16 – Cooling Water Discharge Guideline.

8.2 Warm water systems

The maintenance requirements for warm water systems are set out in regulation 13 of the Legionella Regulations. Temperatures should be monitored at the most distal outlet and at a range of outlets randomly selected within the system (the number will depend on the size and design of the system). The intent of this monitoring is to measure the temperature at the key outlets in order to detect any temperature changes over time and throughout the system. If relatively low temperatures are indicated in any area of a warm water system, the area should be investigated for evidence of poor water flow or stagnation. All warm water outlets that are not frequently used should be flushed weekly at full flow for at least 15 seconds, and all outlets on individual branches should be flushed simultaneously. At least once in every 12 months, temperature control devices such as thermostatic mixing valves or tempering valves should be:

(a) maintained and serviced as recommended by the manufacturer and set out in AS 4032; and

(b) disinfected (for example, using a chlorine solution or pasteurisation) before being returned to service.

8.3 Hot water systems

Hot water systems should be inspected at least once every month and the water temperatures of water stored in a storage water heater container (which must be at least 60°C) and at outlets should be measured. All outlets that are not frequently used should be flushed weekly at full flow for at least 15 seconds. At least once in every 12 months, temperature control devices such as thermostatic mixing valves or tempering valves should be:

(a) maintained and serviced as recommended by the manufacturer and set out in AS 4032; and

(b) disinfected (for example, using a chlorine solution or pasteurisation) before being returned to service.

8.4 Spa baths

Spa baths should be cleaned and rinsed between uses and the application of proprietary cleaning agents is supported, particularly in the pipe work and pump.

8.5 Air-houses, humidifiers and nebulisers

Air-houses, humidifiers and nebulisers incorporating water reservoirs are capable of generating mists or aerosols and, as such, are potential sources of legionellosis. Therefore these systems need to be properly managed and maintained in a clean state. Humidifiers and nebulisers should also be drained, cleaned and kept dry when not in use.

Sterile water should be used in the preparation of aerosol solutions for use in nebulisers. Nebuliser pumps should be serviced and filters changed regularly. Nebuliser bowls should be rinsed after each use, and it is best to wash the chamber and mask daily in hot water with dishwashing liquid. Allow all components to air dry.

8.6 Decorative fountains and other aerosol producing devices

Decorative fountains include bodies of water that could allow the growth of *Legionella*. Aerosols may be formed by the splashing of water in a fountain. Regular cleaning and maintenance should be undertaken.

Other aerosol producing devices such as dentist's chairs and misting devices need to be properly managed and maintained in a clean state at all times as per manufacturer's instructions. The systems should be drained, cleaned and kept dry when not in use.

8.7 Ice machines and other non-aerosol producing devices

Ice machines should be maintained in accordance with the manufacturer's instructions and, in any case, should be drained, cleaned and refilled at least once every 12 months.

Any manufactured device that can contain water needs to be kept clean and be regularly maintained and serviced.

8.8 Water treatment

Effective water treatment programs minimise microbial growth and can also be used to inhibit corrosion and the build up of scale. When choosing a water treatment system, the efficacy of the treatment regime should be established for the intended use, including its suitability for the materials used in the construction of the manufactured water system. The supplier should provide proof including independent test data verifying any claims. The supplier should also provide advice on appropriate treatment and monitoring regimes. Mixtures of chemicals also need to be compatible.

8.8.1 Disinfection

Disinfection of water systems reduces the numbers of *Legionella*, algae, fungi, protozoa and other bacteria that may provide nutrients for the growth of *Legionella*. Disinfection can be achieved either by the addition of chemical biocides or by using processes such as ultraviolet (UV) light irradiation and ozonation. It should be noted that UV irradiation and ozonation do not provide residual disinfectant throughout water systems, although may be useful adjuncts to other disinfectants that do produce a residual. The use of UV as a biocide does not fulfil the requirements of the Legionella Regulations.

Automatic biocide dosing devices are required for cooling water systems in accordance with regulation 7 of the Legionella Regulations. The types of biocides used should be alternated on a regular basis to reduce the potential for bacterial resistance to develop. It is important that biocide is present and can be detected throughout the entire system. Particulate matter may also reduce the effectiveness of biocides used to treat water and associated surfaces.

8.8.2 Corrosion

Corrosion and scale development can cause fouling of water distribution systems resulting in poor system efficiency and premature failure. These factors can also provide an environment that promotes the colonisation and growth of organisms such as *Legionella*.

8.8.3 Discharges

Waste water must not be discharged to stormwater, surface waters (such as rivers, streams, wetlands or lakes) or underground waters. It may be disposed of to a sewer or community wastewater management scheme, but not to a septic tank unless it can be demonstrated to the relevant authority that the biocide concentrations or the quantity or hydraulic flow will not have adverse impacts on the operation of the septic tank. Approval for discharge into a sewer or community wastewater management scheme will need to be obtained from the appropriate authority or authorities which may be the local council, SA Water, the Department of Health or the Environment Protection Agency. Cooling water discharged to sewer must comply with the SA Water Trade Waste Guideline no.16 ‘Cooling Water Discharge Guideline’.

9. Microbiological testing

The analysis of microbiological samples must be undertaken by a laboratory that is NATA accredited to perform the required testing. Prior to the collection of samples, it is essential that you contact your testing laboratory to ensure it has the capacity to process your samples within 24 hours as described in Appendix A of AS/NZS 3666.3. Methods for collecting samples for microbiological testing are set out in Schedule 2.

It is advisable for the owner of premises on which a high risk manufactured water system is installed to establish an effective communication process for the rapid provision of microbiological results from the laboratory. It is important that an effective process is implemented to ensure an effective response to results exceeding mandatory reporting and decontamination levels (e.g. detection of *Legionella* >10 cfu/ml in a warm water system, and >1000 cfu/ml in a cooling tower). The owner of the premises may consider specifying reporting methods and deadlines in agreements or contracts of service.

9.1 Testing for *Legionella*

Sound engineering practices, and regular maintenance and cleaning programs are the key to reducing the risk of *Legionella* transmission. The microbiological monitoring of manufactured water systems for *Legionella* should never be used to replace these practices, but may be used in conjunction with them to determine their effectiveness. Microbiological monitoring only provides a snapshot into the water quality at a given time and is never acceptable as a stand-alone measure or as an indicator of ongoing water quality without the continuation of regular inspections, cleaning and maintenance.

Testing for *Legionella* is useful in two circumstances:

- Special Investigations – if there is any evidence of legionellosis associated with a manufactured water system or if the operation or maintenance of such a system indicates unsatisfactory conditions.
- Validation – that maintenance programs when introduced are effective in controlling *Legionella*. Validation testing is performed over a relatively short period and the number of samples required will vary depending on the size and nature of the water system. As a guide, a minimum of weekly samples for 4 to 6 weeks could be collected from cooling towers, while a minimum of 4 to 6 sets of samples could be collected on a fortnightly basis from 2 or more locations within warm water systems. The verification process could be extended for warm water systems, in particular, by taking samples for measurement of heterotrophic bacterial counts (see 8.2 below).

Even in the event of legionellosis, inspection, cleaning, decontamination or decommissioning of a system, where appropriate, should take priority over testing. The substantial delay (at least 7 days) in current methods used to test waters for the presence of *Legionella* requires that corrective measures be taken on a precautionary basis and not solely based on testing.

The interpretation of test results should be carefully considered as it has a number of limitations. The detection of *Legionella*, even in the event of an outbreak, should be treated with caution as legionellosis is only caused by a limited number of strains of *Legionella*. Specific genetic typing is required to demonstrate links between environmental and clinical isolates. The testing of water samples for *Legionella* only detects the bacteria present in the flowing water and not the bacteria that may be present in biofilms within the system.

If testing is performed, appropriate responses are set out in Schedule 4. The Legionella Regulations (regulation 17) require the relevant authority to be notified within 24 hours if 1000 colony forming units per mL (cfu/mL) or more of *Legionella* are detected in any sample from a cooling water system, or if 10 or more cfu/mL is detected in any sample from a warm water system.

9.2 Heterotrophic colony count

While no clear relationship exists between heterotrophic colony counts and the presence of *Legionella*, they can be used to give an indication of the effectiveness of maintenance and treatment procedures. Heterotrophic colony counts in excess of 100,000 cfu/mL for cooling water systems and 100 cfu/mL for warm water systems may indicate that maintenance practices are not satisfactory.

10. Emergency decontamination

Emergency decontamination is required if:

- a manufactured water system is suspected of being associated with an outbreak of legionellosis; or
- a system is known to or suspected of containing *Legionella* populations of:
  - more than 10 cfu/ml for a warm water system;
  - more than 1000 cfu/ml for a cooling tower; or
- the system is not being maintained in accordance with the requirements of the Legionella Regulations.

According to regulation 14; operating and maintenance manuals must comply with clause 2.6.1 of AS/NZS 3666.2 which requires the manuals to set out emergency decontamination procedures.

The procedure for off-line decontamination of cooling water systems set out in Part 1 of Schedule 3 is prescribed for the purposes of regulation 19(1). If a cooling water system cannot be shut down, online system decontamination must be carried out in accordance with a decontamination procedure approved by the Minister.

In warm water systems and hot water systems, decontamination can be achieved either by the 'pasteurisation' or 'chlorination' method (operators of systems should be aware that chlorine can be corrosive). These procedures are detailed in Part 2 of Schedule 3, and prescribed for the purposes of regulations 13 and 19(2).

When carrying out a decontamination procedure; appropriate personal protective clothing and equipment (PPE) must be worn, and the *Occupational Health, Safety and Welfare Act 1986* must be complied with. This requires conducting a risk assessment, determining appropriate control measures e.g. PPE, developing safe operating procedures and providing training in the task to ensure the operator is protected from exposure to hazardous substances and aerosols. Examples of appropriate PPE may include chemical and particulate respirators (Class P2 minimum), gloves, goggles and protective clothing.

Responses and control strategies for the presence of *Legionella* in high risk manufactured water systems (including decontamination) are set out in Schedule 4, any alternative decontamination procedures need to be submitted to the Department of Health for approval by the Minister.

11. Operating and maintenance manuals and maintenance records

All manufactured water systems must have operating and maintenance manuals, ideally provided by the installer of the system. The Legionella Regulations (regulations 10 and 14) require the owner of the premises on which a high risk manufactured water system is situated to ensure that operating and maintenance manuals and maintenance records are kept as set out in 2.6.1 and 2.6.2 of AS/NZS 3666.2 (further information can be found in SAA/SNZ HB32). Maintenance staff, contractors or service agents are required to enter into the records full details of inspections, servicing and maintenance work performed and the results of any tests taken

Operating and maintenance manuals with up-to-date entries of maintenance procedures and test results must be kept readily available for inspection at any time by an authorised officer upon request. The operation and maintenance manuals should include the names, addresses and contact telephone numbers, including after-hours telephone numbers, for persons responsible for the operation and maintenance of the manufactured water system, including any contractors or service agents.

12. The role of relevant authorities

The relevant authorities administering the Act and Legionella Regulations have a key role in the control of *Legionella* in South Australia.

Authorised officers administering the *Public and Environmental Health Act 1987*, Legionella Regulations and this Guideline should have a clear understanding of the operation and maintenance of the manufactured water systems and be aware of the principles of control and the problems that can be encountered. They should ensure that the owner of the premises operates and maintains manufactured water systems on the premises in accordance with the requirements of the Act and Legionella Regulations

It is important that the relevant authorities monitor compliance with the legislation and inspections are a vital aspect of compliance monitoring. Poorly maintained and defective systems pose considerable risk and are often only detected by inspections. With the exception of annual testing required by regulation 15, relevant authorities will not necessarily routinely collect water samples for testing for the presence of *Legionella* bacteria. However, if a high risk manufactured water system has not been maintained or cleaned properly, the relevant authority can require the owner of the premises to undertake microbiological testing for the presence of *Legionella*. Such testing is to be at the expense of the owner. If the owner fails to carry out required testing, the relevant authority may take such samples for testing and recover the costs from the owner.

Relevant authorities are required to take action to ensure that owners immediately correct faults or problems that indicate non-compliance. If these faults or problems cannot be rectified immediately and it is believed that a potential health hazard exists, the relevant authority may require the manufactured water system to be shut down and decontaminated.

12.1 Annual inspections

Regulation 15 requires that annual inspections of cooling water systems and warm water systems are to be performed by either the relevant authority or a suitable third party auditor and entail a thorough investigation of the operation of the water system for compliance with requirements of the Legionella Regulations. In addition, 1 sample of water will be collected from each cooling water system and 2 samples of water will be collected from each warm water system for the determination of the presence and number of *Legionella*. The cost of testing and the annual inspections will be borne by the owner. Third party auditors are required to submit to the authority written reports setting out the findings of the annual inspection and the results of the microbiological testing.

12.2 Random inspections

In addition to an annual inspection, random inspections may be undertaken from time to time by the relevant authority. Samples for *Legionella* testing may be collected at this time if it is considered necessary, and this may include instances where non-compliance with the Legionella Regulations is detected. The cost of testing will be borne by the owner.

12.3 Legionellosis investigations

When investigating possible sources of illness, under the provisions of the Act the relevant authority may enter premises, inspect the manufactured water system and collect samples. Regulation 16 allows the authority to require the owner to undertake *Legionella* testing in certain circumstances. Cost recovery mechanisms may apply as appropriate.

12.4 Register

Regulation 6 requires relevant authorities to maintain registers of cooling water and warm water systems situated on premises in their areas (other than those excepted). The Legionella Regulations empower the relevant authorities to charge a fee for registration and annual renewal of registration. A relevant authority may vary, reduce or remit a fee as they see fit. It is the responsibility of the owner of the premises to notify the relevant authority of details of the system as required. Owners must, within 1 month after any change in the particulars of the system, notify the authority of the change. Regulation 5 requires newly installed systems to be registered within 1 month of the system being brought into service.

A register of high risk manufactured water systems must include:

- the type of system; and
- the address and location of the premises on which the system is situated; and
- the full name and residential and business addresses of the owner and occupier of the premises on which the system is situated; and
- the full name, residential and business addresses, and residential and business telephone numbers, of the person nominated by the owner as being responsible for the operation and maintenance of the system.

The register may include such other information as the relevant authority thinks fit to include. This may include but is not limited to:

- out of hours contact in case of emergency
- in the case of cooling towers, information regarding the maintenance regime being undertaken.

12.5 Inspection guide

Schedules 5 and 6 provide guides to the issues to be addressed when inspecting cooling water and warm water systems.

Schedule 1

This information relates to the following diagrams of hot and warm water systems:

- All hot and warm water systems are required to comply with AS/NZS 3500.4.2
- All dead legs (branches without outlets) must be disconnected or isolated
- Hot water storage units must be maintained at a minimum storage temperature of 60°C
- Thermostatic mixing valves (TMV's) are generally used in early childhood centres, primary and secondary schools and nursing homes or similar facilities for young, aged, sick or disabled persons to ensure hot water is delivered to the outlets of all sanitary fixtures used primarily for personal hygiene purposes not exceeding 45°C, to prevent scalding
- All branch line outlets should be flushed as often as necessary to ensure that all of the hot water in the branch line is replaced at least once a week
- Recirculation loops and reticulation mains or branch mains may serve a single storey or multi-storey building/s
- Where a recirculation branch loop or reticulation branch main is to be isolated for more than 7 days; it is recommended that isolating valves be shut and outlets drained

Legend

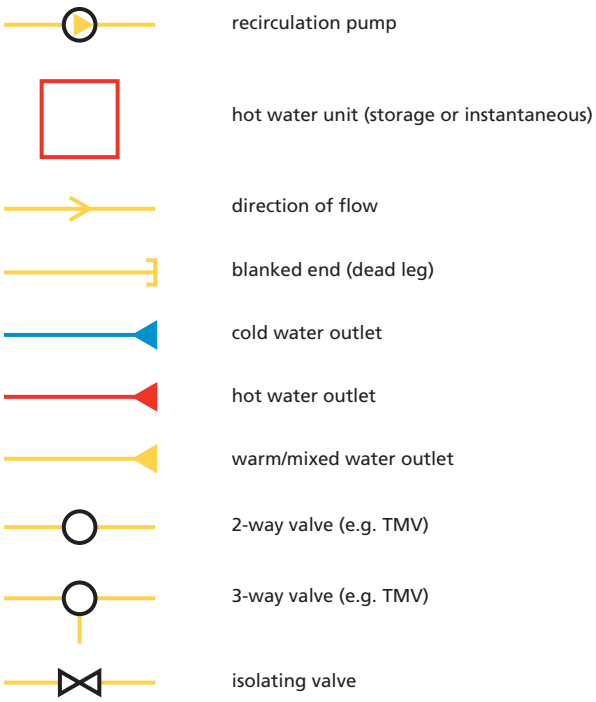


Figure 1

Hot water system – recirculation (flow and return)

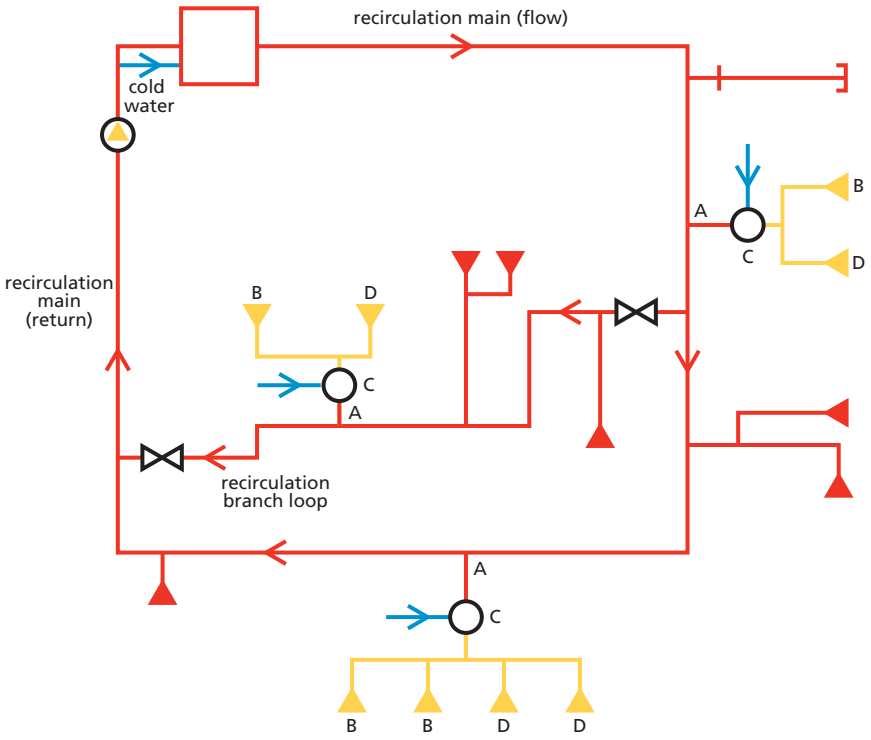
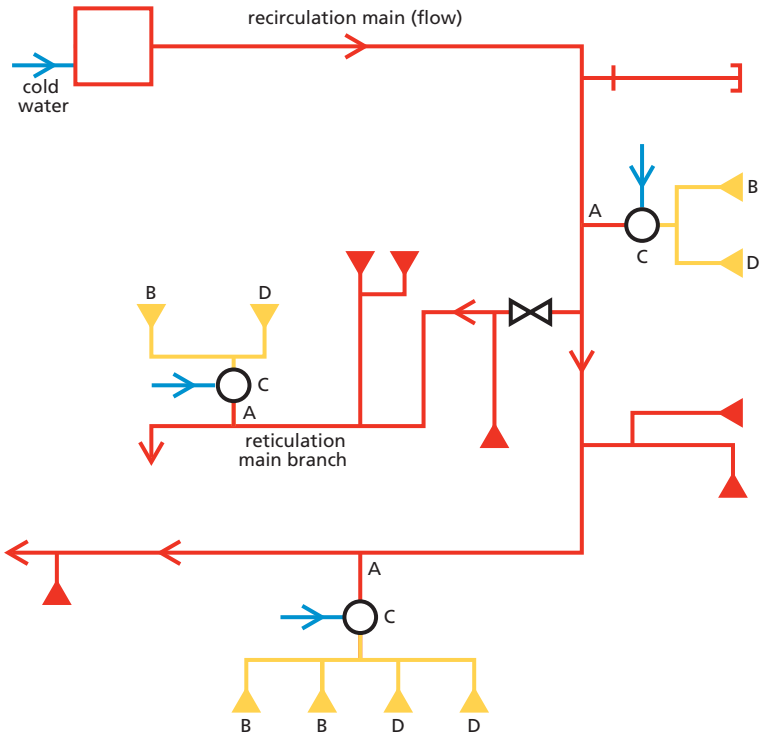


Figure 2

Hot water system – reticulation (flow)



A–D; A–B – preferably less than 6m. C–D; C–B – between 1and 6m. Hot water lines: 50°C for personal hygiene use in other than facilities for the young, aged, sick, disabled or similar; 60°C for other than personal hygiene use e.g. kitchen/laundry use

Figure 3

Warm water system – with a hot water loop (recirculation, flow and return)

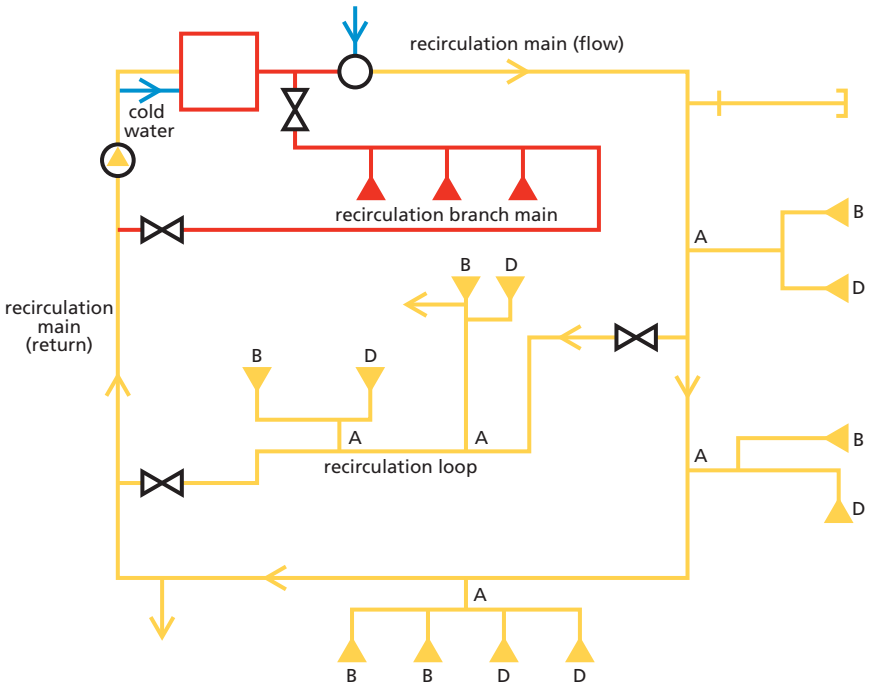
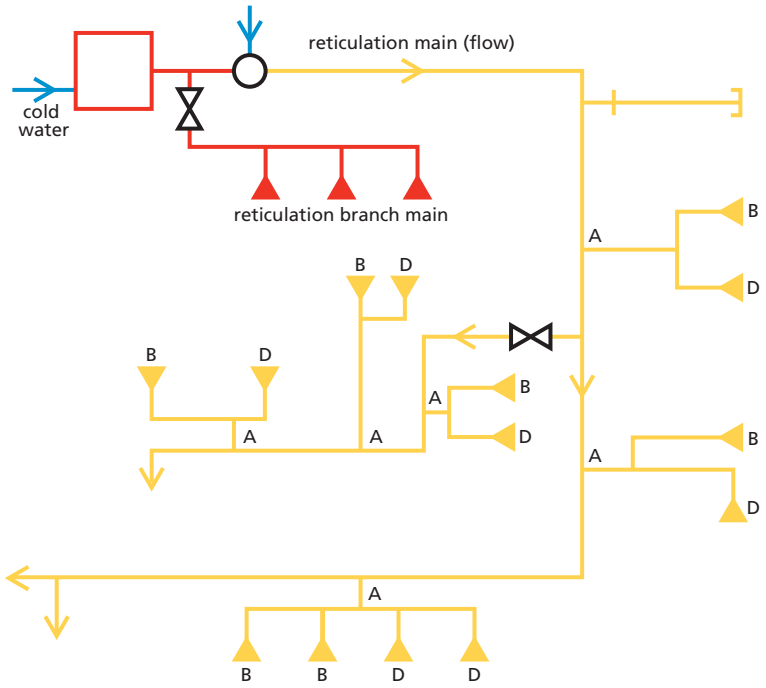


Figure 4

Warm water system – with a hot water branch (reticulation, flow)



A–B – preferably less than 6m. Warm water lines: temperatures at outlets not to exceed 45°C
Hot water lines: used for outlets other than sanitary outlets; typically up to 60°C (kitchen/laundry)

Schedule 2

Procedure for sampling for microbiological testing

Prior to the collection of samples, it is essential that you contact your testing laboratory to ensure it has the capacity to process your samples within 24 hours as described in Appendix A of AS/NZS 3666.3.

1. Cooling water systems

Samples should be collected from a purpose-made sampling point, preferably on the return line prior to water entering the cooling water system, or from falling water just above the basin, or from the collecting basin, away from the water make-up point and not just downstream of the biocide dosing point of a cooling water system.

The system should be operating, and water circulated through the system for at least 1 hour prior to the collection of a sample. If the system is not operating, results will not be representative of the microbiological conditions of the system.

1. Label a sterile container with sample location, date, time and sampling officer's name.
2. Fill out a laboratory request form providing the details required by the testing laboratory.

   NOTE: *It is preferable to have the owner or occupier of the premises, or person responsible for the operation of the system, present to turn off the system if required, and provide access to the collecting basin of the tower.*
3. Take the sample as follows:

   (a) if sampling from a collecting basin, using gloved hands, remove the sample container cap and hold the cap between the fingers taking care not to contaminate the inside of the cap. Hold the sample container near its base, avoiding contact with the open neck and insert it, neck downwards to about 50mm below the surface of the water in the tower collecting basin and then turn the neck of the bottle upwards and allow the bottle to fill, moving the bottle slowly forwards as it fills. Remove the bottle and replace the cap; or

   (b) if sampling from water collected from a purpose-made sampling point, allow the water to flow for at least 30 seconds before collecting the sample.

   NOTE: *Do not:*
   - *stir up sediment from the bottom or side of the collecting basin as it should not be collected with the sample (sediments can be collected as a separate sample if required); or*
   - *collect sample near a make-up water inlet; or*
   - *collect samples from any outlet lines attached to the collecting basin or any other line in the water system (unless it is collected as part of a specific investigation of fittings).*

2. Hot water systems and warm water systems

1. Label a sterile container with sample location, date, time and sampling officer's name.
2. Fill out a laboratory request form providing the details required by the testing laboratory.
3. Collect heated water into a sterile sample container from the initial run of water from the outlet of the shower, bath tap or other outlet.

   NOTE: *Do not run the water and hence flush the outlet prior to collection (contrary to sampling for other microbiological examinations). Separate samples, collected after flushing are required if evaluating heterotrophic colony counts.*

3. Other manufactured water systems

Water from other kinds of manufactured water systems should be collected from the collecting basins or reservoirs of the system (see 1 above).

4. Water filters

When conducting specific investigations, swab samples should be collected from any membrane or other solid material filters. A sterile swab and container should be used. Samples of sand or any other loose filter media should be collected in a sterile specimen jar. All samples should be collected using gloved hands.

Samples are to be labelled and documented as for water samples from cooling water systems (see 1 above).

5. Transportation of samples

Samples for *Legionella* testing need to be maintained below 20°C, protected from sunlight and promptly transported to the laboratory in insulated containers to minimise significant temperature variations and maintain sample integrity. If other microbiological tests are required, the sample should be cooled to 4°C as soon as possible.

Samples should be received by the laboratory as soon as possible (less than 6 hours) and within 24 hours of collection provided samples remain in the dark and are kept cool (2–10°C).

6. Safety precautions

When carrying out sampling or inspection of air-handling systems which are in service Occupational Health, Safety and Welfare (OHS & W) legislation needs to be complied with to ensure that the operator is protected from exposure to hazardous substances and aerosols. This requires conducting a risk assessment, determining appropriate control measures e.g. appropriate personal protective equipment (PPE), developing safe operating procedures and providing training in the task. A suitable face mask with a particulate filter of at least Class P2 that complies with AS/NZS 1716 needs to be worn. Additional PPE may also include gloves, hardhat, and harness. Appendix A of AS/NZS 3666.2 has further details relating to specific tasks and appropriate PPE.

Schedule 3

Procedures for decontamination of cooling water systems and hot water and warm water systems

Part 1 – procedure for off-line decontamination of cooling water systems

BEFORE COMMENCING THE PROCEDURE: ensure that the operator is protected from exposure to hazardous substances and aerosols according to relevant OHS & W legislation. A suitable face mask with a particulate filter of at least Class P2 that complies with AS/NZS 1716 needs to be worn. Additional PPE may also include gloves, hardhat, and protective clothing. Appendix A of AS/NZS 3666.2 has further details relating to specific tasks and appropriate PPE.

1. Shut down the system.
2. Isolate cooling tower fans to prevent operation.
3. Circulate a dispersant throughout the system.
4. Dose with sodium hypochlorite and circulate to maintain a free chlorine residual of 5–10 mg/L at pH 7.0–7.6, maintain these concentrations and monitor at 15 minute intervals for at least 60 minutes.
5. Isolate the system and drain water to a sewer or trade waste in accordance with the requirements of the appropriate relevant regulatory authority, ensuring that any isolated pipe work such as bypass pipes and secondary pumps are also drained.
6. Open all system drains temporarily to flush drain lines with disinfected water.
7. Clean all wetted surfaces in accordance with the manufacturer's instructions or by using water spray and mechanical cleaning as necessary. Exercise care to avoid damaging components.
8. Refill the cooling tower.
9. Dose the circulating cooling water with sodium hypochlorite to maintain a free chlorine residual of at least 1–5 mg/L at pH 7.0–7.6 and monitor these concentrations at 15 minute intervals for at least 30 minutes.
10. Drain the system, refill, and recommission. Reinstate water treatment programs.

NOTE: *Waste water must not be discharged to stormwater, surface waters (such as rivers, streams, wetlands or lakes) or underground waters. It may be disposed to a sewer or community wastewater management scheme, but not to a septic tank unless it can be demonstrated to the relevant authority that the biocide concentrations or the quantity or hydraulic flow will not have adverse impacts on the operation of the septic tank. Approval for discharge into a sewer or community wastewater management scheme needs to be obtained from the appropriate authority which may be the local council, SA Water, Department of Health or the Environment Protection Agency. Any cooling water discharged to sewer must comply with the SA Water Cooling Water discharge guideline (Trade Waste Guideline No.16).*

Part 2 – procedure for decontamination of hot water systems and warm water systems

BEFORE COMMENCING THE PROCEDURE: ensure that the operator is protected from exposure to hazardous substances and aerosols according to relevant OHS & W legislation. A suitable face mask with a particulate filter of at least Class P2 that complies with AS/NZS 1716 needs to be worn. Additional PPE may also include gloves, hardhat, and protective clothing. Appendix A of AS/NZS 3666.2 has further details relating to specific tasks and appropriate PPE.

Pasteurisation method

NOTE: take reasonable precautions to ensure that the risk of scalding to building occupants is reduced during the pasteurisation process.

1. Water is flushed throughout the system at a minimum of 70°C at the outlet (this may involve increasing the temperature of the water at the water heater to above 70°C).
2. Each outlet is then allowed to flow for at least 5 minutes, starting at the most distal point from the water heater and working back.
3. Temperature is to be measured at the most distal outlet and at a few chosen outlets throughout the system.

The number of outlets tested will depend on the size and configuration of the system (e.g. the presence of long branch mains). All outlets of the system are to be flushed individually, however all outlets on individual branches should be flushed simultaneously (e.g. hand basins and showers).

If a temperature of 70°C cannot be achieved:

1. Water is flushed through the system at between 60–70 °C (minimum of 60°C), measured at the outlet.
2. Each outlet is allowed to flow for at least 10 minutes, starting at the most distal point from the water heater and working back.

   ** Please note that the minimum acceptable temperature for the pasteurisation method is 60°C. If this temperature cannot be achieved; the chlorination procedure must be undertaken as an alternative.*

Chlorination method

NOTE: operators should be aware that chlorine can be corrosive, and is considered a dangerous and hazardous substance which must meet the legislative requirements of the Dangerous Substances Act 1979 and Regulations.

1. Add chlorine to the system, sufficient to produce a minimum free chlorine residual of 1–2 mg/L at all outlets. This may require chlorination of a water container at 20–50 mg/L.
2. Each outlet is allowed to flow for at least 5 minutes, starting at the most distal point from the water heater and working back.
3. Flush each outlet in turn until chlorine is flushed throughout all outlets of system.

Chlorine concentration is to be measured by a DPD test kit or similar test kit at the most distal outlet and at a few chosen outlets throughout the system. The number of outlets tested will depend on the size and configuration of the system (e.g. the presence of long branch mains).

All outlets of the system are to be flushed individually, however all outlets on individual branches should be flushed simultaneously (e.g. hand basins and showers).

Schedule 4

Responses to detection of *Legionella* in cooling water systems and warm water systems

Part 1 – control strategies for the presence of *Legionella* in cooling water systems

Test result (cfu/mL)	Required control strategy
Not detected (<10)	(1) Continue effective maintenance procedures
Detected as <100	(2) Investigate problems (check cleanliness, maintenance procedures, biocide dosing, structural integrity) Review water treatment programs Take necessary remedial action including immediate on-line disinfection in accordance with Appendix B of AS/NZS 3666.3, and undertake control strategy (3).
Detected as <1000	Follow control strategy (2) and (3) Retest water within 3 to 7 days of plant operation after on-line disinfection (a) If not detected, return to control strategy (1) (b) If detected at <100 cfu/mL repeat control strategy (2) (c) If detected at ≥100 cfu/mL investigate problem and review water treatment program, immediately carry out system decontamination in accordance with the procedure set out in Part 1 of Schedule 3 of this Guideline, and repeat control strategy (3) or shut down and clean cooling water system.
Detected as ≥1000	(4) Inform relevant authority of result (a) Investigate problem Review water treatment program Take necessary remedial action including immediate system decontamination in accordance with Part 1 of Schedule 3 of this Guideline, and undertake control strategy (5).
	(5) Retest water within 3 to 7 days of plant operation after system disinfection (a) If not detected, return to control strategy (1) (b) If detected at <100 cfu/mL, repeat control strategy (2) (c) If detected at ≥100 cfu/mL investigate problem and review water treatment program, immediately carry out system decontamination in accordance with Part 1 of Schedule 3 of this Guideline, and repeat control strategy (5) or shut down and clean cooling water system.

NOTE: *This table is based on Table 3.1 from AS/NZS 3666.3.*

Part 2 – control strategies for the presence of *Legionella* in warm water systems

Legionella concentrations >10 cfu/mL in warm water systems require immediate decontamination. Heterotrophic colony counts in excess of 100 cfu/mL for warm water systems may indicate that maintenance practices are not satisfactory.

Decontamination of hot water or warm water systems can be achieved by:

(a) pasteurisation (see Part B of Schedule 3); or

(b) chlorination (see Part B of Schedule 3); or

(c) a decontamination procedure approved by the Minister.

Irrespective of the method used, water testing will be required to demonstrate the effectiveness of the decontamination (absence of *Legionella*). The number of samples will depend on the size and complexity of the system.

Schedule 5

Inspection guide for cooling water systems (Informative)

Introduction

This guide can be used by local authorities, owners or occupiers of premises, operators of systems and other personnel when carrying out an inspection of a cooling water system.

The aim is to ensure that cooling water systems are checked in a systematic and logical manner so that adequate steps are taken to maintain the plant and provide effective cleaning and microbial control of the associated water cooling system.

Definitions

The relevant definitions are set out in the Legionella Guideline and AS/NZS 3666.

Safety precautions

Occupational Health, Safety and Welfare legislation needs to be complied with. A suitable face mask with a particulate filter of at least Class P2 that complies with AS/NZS 1716 needs to be worn when carrying out an inspection of a cooling water system which is in service. Additional safety items may include gloves, hardhat and a harness. Appendix A of AS/NZS 3666.2 has further details relating to specific tasks and appropriate personal protective equipment.

Equipment needed during inspection

Accurate and suitable thermometer; recently calibrated pH meter and probe; recently calibrated conductivity meter and probe. DPD test kit where chlorine or bromine is used as a disinfectant.

Plant identification

For a first inspection or if there have been any changes to the operation, contractors, staff, company name/ownership or design of the system; all relevant sections of this guide need to be completed.

NOTE: *The local council may need to alter details in its register of cooling water systems.*

Acknowledgement

This guide is based on a document prepared by the NSW Department of Public Works and Services.

Site details

Job No Date

1. Site location

(a) Registered business name

(b) Address

(c) Name of premises

(d) Site address

(e) Nature of business

(f) Total number of cooling water systems at this site

2. Company contact person

(a) Name of contact

(b) Position/Title

(c) Address of contact

(d) Contact phone (business) (ah)

Fax

(e) Other contacts

3. Maintenance operator

Maintenance ☐ In-house ☐ Contractor

(a) Name

(b) Position/Title

(c) Business name

(d) Business address

(e) Phone Fax

4. Reason for inspection

☐ Annual Audit ☐ Random ☐ Investigation ☐ Maintenance

☐ Other, please specify

Date & nature of previous inspection

Maintenance/service requirements

1. Maintenance/service manual/s

Maintenance/service manual/s for the cooling water system readily available at any time at the site for inspection? ☐ Yes ☐ No

Contains:

full details, including drawings of the equipment and systems? ☐ Yes ☐ No

manufacturer's recommendations on system operation and maintenance (including water treatment)? ☐ Yes ☐ No

recommended dismantling and cleaning instructions? ☐ Yes ☐ No

shut-down procedures? ☐ Yes ☐ No

decontamination procedure? ☐ Yes ☐ No

detailed maintenance schedule? ☐ Yes ☐ No

copy of site safety policy provided by building owner/manager/occupier? ☐ Yes ☐ No

material safety data sheets for all chemicals? ☐ Yes ☐ No

equipment safety data sheets for all hazardous plant or equipment? ☐ Yes ☐ No

Does the system have any additional requirements or conditions in place as part of a Ministerial Determination or Approval (e.g. alternative maintenance program, decontamination procedure or drift eliminator requirements)? ☐ Yes ☐ No

If so, are details provided in maintenance manual? ☐ Yes ☐ No

Action undertaken

2. Maintenance log book

Maintenance log book for the cooling tower/evaporative condenser and the water treatment system is readily available at any time at the site for inspection? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

Date of the first entry Date of the last entry

Name of the organisation/person carrying out the mechanical/electrical maintenance work

Name of the organisation/person carrying out the routine water treatment work

Does log book show evidence of monthly inspections? ☐ Yes ☐ No

If ***No***, what action has been taken?

Is cooling tower cleaned 6 monthly? ☐ Yes ☐ No

If ***No***, at what frequency, why and what action has been taken?

Does log book show dates and results of any microbiological testing? ☐ Yes ☐ No

Actions taken based on results obtained from microbiological testing

Have any decontamination events been documented? ☐ Yes ☐ No

If ***Yes***, reason (e.g. cases of illness, high microbiological result)

Method of decontamination (as prescribed in Schedule 3, or as approved by the Minister) and results of subsequent samples

Has the cooling water system been shut down for greater than 7 day period? ☐ Yes ☐ No

If ***Yes*** was it cleaned and decontaminated prior to returning to service? ☐ Yes ☐ No

Comments/directions from previous inspection completed satisfactorily? ☐ Yes ☐ No

Other deficiencies: action recommended/required

NOTE: *The operator of the system is required to log actions taken to maintain the system to ensure effective cleaning and microbial control and any direction given by an authorised officer or advice provided by third party auditor.*

Plant details

1. Plant identification

Make/brand

Model No.

Application of cooling tower/evaporative condenser ☐ Air handling ☐ Process cooling

☐ Other, please specify

In service? ☐ Yes ☐ No

2. Location of cooling tower/evaporative condenser

Location ☐ Roof ☐ Ground ☐ Plant room

☐ Other, please specify

Checking proximity of cooling tower/evaporative condenser to any nearby air intake of an air conditioning system or another cooling tower discharge. Refer to system plans and site survey.

Location of cooling tower/evaporative condenser considered satisfactory? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

3. Access to cooling tower/evaporative condenser

Access for maintenance satisfactory? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

4. Features of cooling tower/evaporative condenser

Type of cooling tower ☐ Induced draft ☐ Forced draft ☐ Mixed flow

☐ Other, please specify

Number of cells in the cooling tower

Number of fans

5. Dead legs

Are there any dead legs (including secondary pumps which may be operated intermittently, unused pipe work) present? ☐ Yes ☐ No

If ***Yes***, state remedial action to disconnect or isolate dead leg

6. Return water distribution

Exposed distribution troughs? ☐ None fitted ☐ Yes ☐ No

Nozzles ☐ Good condition ☐ Missing or damaged ☐ Even water distribution

Algal growth or biofilm present? ☐ Yes ☐ No

Sampling point : clearly identified? ☐ Yes ☐ No

: appropriately located? ☐ Yes ☐ No

7. Drift eliminators

Drift eliminators fitted? ☐ Yes ☐ No

If drift eliminator/s not fitted, has this been determined by the Minister? `` ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

Can drift eliminators be easily removed for cleaning? ☐ Yes ☐ No

Possibility of sunlight entering into tower and/or basin? ☐ Yes ☐ No

If ***Yes***, what action to eliminate it?

8. Wastewater

Bleed line discharges to: ☐ Sewer/CWMS ☐ Holding pit ☐ Storm water (Contact EPA, SA Water)

Other facility

Method acceptable? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

Main drain and overflow from cooling tower/evaporative condenser discharges to: ☐ Sewer/CWMS ☐ Holding pit ☐ Storm water (Contact EPA, SA Water)

Other facility

Method acceptable? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

9. Provision for maintenance

Can fill material be cleaned and inspected in position? ☐ Yes ☐ No

Can fill material be easily removed for cleaning? ☐ Yes ☐ No

10. Shutdown & Cleaning

Can the cooling water system be shutdown and cleaned? ☐ Yes ☐ No

If the System cannot be shutdown, has an approval
for alternative cleaning procedure been issued by the Minister? ☐ Yes ☐ No

If No, state the reason and action recommended/required

If ***No***, contact Environmental Services Section, Department of Health for further advice.

Water treatment

1. Biological control

Application ☐ Manual control ☐ Automatic control

Dosing ☐ Continuous ☐ Intermittent

Dose rate Volume of water in System

Frequency and times of operation

Name and manufacturer of biocide/s used

What is manufacturer's recommended concentration of biocide?

Concentration of biocide in water

Does biocide concentration comply with manufacturer's recommendations? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

2. Corrosion control

Is corrosion control practiced? ☐ Yes ☐ No

Application method ☐ Manual ☐ Automatic

Chemical/s used ☐ Yes ☐ No

Name and manufacturer of chemical/s or process

In accordance with Manufacturer's recommendation? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

Are all chemical containers labelled and bunded? ☐ Yes ☐ No

Are Material Safety Data Sheets available on site? ☐ Yes ☐ No

3. Scale control

Is scale controlled? ☐ Yes ☐ No

Application method ☐ Manual ☐ Automatic

Chemical/s used

Name and manufacturer of chemical/s or process

In accordance with Manufacturer's recommendation ☐ Yes ☐ No

If No, state the reason and the action recommended/required

4. Bleed discharge

Bleed discharge present? ☐ Yes ☐ No

If No, state the reason and the action recommended/required

Rate of discharge

In accordance with Manufacturer's recommendation ☐ Yes ☐ No

If No, state the reason and the action recommended/required

5. Water quality

Presence of ☐ algae ☐ biofilm/slime ☐ scaling ☐ sludge ☐ rust ☐ other

Clean: Water clear. Free from visible sludge, foam, slime (including algae and fungi), rust, scale, dirt, dust and any deposit or accumulation of impurities.

Mildly dirty: Water milky. Up to 3mm of sludge in a few isolated patches on walls or floors of basin. Thin film of slime/biofilm or algae on fill or in basin (slime or algae indicated by slippery feel or colour).

Very dirty: Water murky. Extensive sludge, slime or algae, rust, scale, dirt.

Degree of cleanliness ☐ Clean ☐ Mildly dirty ☐ Very dirty

If ***not clean*** state the action recommended/required

Basin water temperature (°C) pH

Conductivity (uS/cm)

6. Cleanliness and treatment of system

Cleanliness inside the system considered satisfactory? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

Is treatment satisfactory? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

General assessment summary

Cooling water system meets the relevant requirements, including compliance with conditions of Ministerial Determination or Approval, if applicable? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

Other comments

Details of person undertaking inspection

Name Signature

Position/Title Date

Agency/Business name

Schedule 6

Inspection guide for hot water systems and warm water systems (Informative)

Introduction

This guide can be used by local authorities, owners/managers/operators and other personnel when carrying out an inspection of hot water or warm water systems.

The aim is to ensure that hot water and warm water systems are checked in a systematic and logical manner so that adequate steps are taken to maintain the plant and provide effective microbial control of the associated hot water or warm water system.

Definitions

The relevant definitions are set out in the Legionella Guideline and AS/NZS 3666.

Safety precautions

Occupational Health, Safety and Welfare legislation needs to be complied with. Suitable PPE needs to be worn when carrying out an inspection of a warm water system which is in service. Appendix A of AS/NZS 3666.2 has further details relating to specific tasks and appropriate personal protective equipment.

Equipment needed during inspection

Accurate and suitable thermometer, timer/watch.

Plant identification

For a first inspection, or if there have been any changes to the operation, contractors, staff, company name/ownership or design of the system. All relevant sections of this guide need to be completed.

***NOTE:** local council may need to alter details in their register.*

Acknowledgement

This checklist is based on a document prepared by the NSW Department of Public Works and Services.

Site details

Job No _____ Date _____

1. Site location

(a) Registered business name _____

(b) Address _____

(c) Name of premises _____

(d) Site address _____

_____

(e) Nature of business _____

(f) Total number of cooling water systems at this site _____

2. Company contact person

(a) Name of contact

(b) Position/Title

(c) Address of contact

(d) Contact phone (business) (ah)

Fax

(e) Other contacts

3. Maintenance operator

Maintenance ☐ In-house ☐ Contractor

(a) Name

(b) Position/Title

(c) Business name

(d) Business address

(e) Phone Fax

4. Reason for inspection

☐ Annual Audit ☐ Random ☐ Investigation ☐ Maintenance

☐ Other, please specify

Date & nature of previous inspection

Maintenance/service requirements

1. Maintenance/service manual/s

Maintenance/service manual/s for system readily available at any time at the site for inspection? ☐ Yes ☐ No

Contains:

full details, including drawings of the equipment and systems? ☐ Yes ☐ No

procedures for maintenance and management? ☐ Yes ☐ No

recommended cleaning methods and dismantling instructions? ☐ Yes ☐ No

operation and shut-down procedures? ☐ Yes ☐ No

approved decontamination procedure? ☐ Yes ☐ No

detailed maintenance schedule? ☐ Yes ☐ No

material safety data sheets for any associated chemicals? ☐ Yes ☐ No

equipment safety data sheets for all hazardous plant or equipment? ☐ Yes ☐ No

Does the system have any additional requirements or conditions in place as part of a Ministerial Approval (e.g. alternative maintenance program or decontamination procedure)? ☐ Yes ☐ No

If so, are details provided in maintenance manual? ☐ Yes ☐ No

Action undertaken

2. Maintenance log book

Maintenance log book for system is readily available at any time at the site for inspection? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

Date of the first entry

Date of the last entry

Name of the organisation/person carrying out the routine maintenance work

Date system was last serviced

Are there adequate temperature records for the storage, return water (in recirculating systems) and at outlets? ☐ Yes ☐ No

If ***No***, state the action recommended/required

Are all outlets flushed weekly? ☐ Yes ☐ No

If ***No***, state the action recommended/required

Is the system routinely decontaminated 6 monthly? ☐ Yes ☐ No

If ***No***, state the reason and the action recommended/required

Date for next scheduled routine maintenance inspection

Date system was last routinely decontaminated

Are results and dates of microbiological testing included? ☐ Yes ☐ No

Actions taken based on results obtained from microbiological testing

Have decontamination events been documented? ☐ Yes ☐ No

If ***Yes***, reason (e.g. routine, cases of illness, high microbiological result)

Method of decontamination and results of subsequent samples

NOTE: *The operator of the system is required to log actions taken to maintain the system to ensure effective cleaning and microbial control and any direction given by an authorised officer or advice provided by third party auditor.*

Plant details

1. Plant identification

Type of system ☐ Warm ☐ Hot

Make/brand of system

Model No.

2. Location

Location ☐ Plant room ☐ Roof ☐ Basement

☐ Other, please specify

3. Access

Is suitable access to system provided? ☐ Yes ☐ No

If ***No***, state the reason and action recommended

4. Features of system

Source of water heating ☐ Gas ☐ Electric

☐ Other, please specify

Water storage or instantaneous? ☐ Storage ☐ Instant

Presence and number of temperature control devices

Distribution system ☐ Recirculation ☐ Reticulation

On line disinfection (e.g. chlorine, UV light)

Length of longest branch main

Are there any dead legs? ☐ Yes ☐ No

If ***Yes***, how many and what remedial action is taken to disconnect or isolate?

Is there any pipe work connected (and not isolated) and not in use for periods greater than 1 week? (e.g. closed wings, wards, rooms, etc.)? ☐ Yes ☐ No

Has it been isolated and drained? ☐ Yes ☐ No

If ***No***, state what action is required

Any record of recent alterations (including repairs, replacements, upgrades) to the system? ☐ Yes ☐ No

Details

5. Temperatures

Water storage _____ °C Water returning to storage (for recirculating systems) _____ °C

Temperatures range of water at outlets (at steady state) Min _____ °C Max _____ °C

6. Flushing

Are all outlets used or flushed weekly? ☐ Yes ☐ No

If ***No***, state what action is required?

7. Decontamination of warm water systems

Is system routinely decontaminated on a 6-monthly basis? ☐ Yes ☐ No

If ***No***, state what action is required?

Is system being decontaminated with either:

hot water at 70°C at all outlet fixtures? ☐ Yes ☐ No

or

1.0-2.0 mg/L free residual chlorine detected at all outlet fixtures? ☐ Yes ☐ No

or

alternative method of decontamination approved by the Minister? ☐ Yes ☐ No

If ***No***, to any of these methods, contact the Environmental Services Section of the Department of Health.

Temperature control devices

What type of temperature control device? ☐ Thermostatic mixing valve ☐ Tempering valve

☐ Other, please specify

Are there service records for each temperature control device? ☐ Yes ☐ No

Is the device maintained as per manufacturer's recommendations,
and at intervals not exceeding 12 months? ☐ Yes ☐ No

If ***No***, state the action recommended/required

General assessment summary

Warm/hot water system meets the relevant requirements, including compliance with conditions of Ministerial Determination or Approval, if applicable? ☐ Yes ☐ No

If ***No***, state the reason and action recommended/required

Other comments

Details of person undertaking inspection

Name Signature

Position/Title Date

Agency/Business name

Acknowledgments

This Guideline was developed by a working party comprising representatives from the following organisations:

> Australian Institute of Environmental Health (SA Division)

> Local Government Association of South Australia

> The Australian Institute of Refrigeration Air Conditioning & Heating (Inc)

> Institute of Medical & Veterinary Science

> Institute of Plant Engineers

> Queen Elizabeth Hospital

> Flinders University of South Australia

> Department of Health, Communicable Disease Control Branch

> Department of Health, Environmental Services Section

The Public and Environmental Health Council and the Department of Health wish to convey their sincere appreciation to the supporting organisations for making a representative available and to the members of the working party for their valued technical contributions.

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AS/NZS 3500.0:2003. Plumbing and drainage Part 0 Glossary of terms. Standards Association of Australia, Sydney.

AS/NZS 3500.4:2003. Plumbing and drainage Part 4 Heated water services. Standards Association of Australia, Sydney.

AS/NZS 3666. Air-handling and water systems of buildings – Microbial control. Standards Association of Australia, Sydney:

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- *AS/NZS 3666.2:2002, Part 2: Operation and maintenance.*
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Appendix A

Further reading

Public and Environmental Health (Legionella) Regulations 2008, available online at: http://www.legislation.sa.gov.au

Public and Environmental Health (General) Regulations 2006, available online at http://www.legislation.sa.gov.au

Control of microbial growth in air-handling and water systems of buildings (SAA/SNZ HB 32:1995), Standards Australia and Standards New Zealand 1995. Standards Australia, NSW, Standards New Zealand, Wellington.

AS 5059:2006 Power station cooling tower water systems – Management of legionnaires' disease health risk. Standards Australia and Standards New Zealand 2006. Standards Australia, NSW, Standards New Zealand, Wellington.

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Jamie Bartram, Yves Chartier, John V Lee, Kathy Pond and Susanne Surman-Lee. Available online at: http://www.who.int/water_sanitation_health/emerging/legionella.pdf

For more information

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