Scottish Health Technical Memorandum 2027

(Part 3 of 4)

Operational management

Hot and cold water supply, storage and mains services

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Contents

1. Introduction

1.1 This part outlines the principles involved in the operational management of the hot and cold water supply, storage and distribution systems for healthcare premises. It includes cold water storage cisterns, hot water storage cylinders and heat exchangers, together with water treatment and pressurisation units, pipework systems and circulation pumps. This part will apply to all healthcare premises, but some deviation may become necessary where the differing requirements for the various water undertakings must be met. Distribution design in healthcare premises may vary, as for instance in system building hospital manuals for cold water services systems, but the principles laid down in this memorandum should be observed.

1.2 Although many of its recommendations will be applicable, this document does not set out to cover fire-fighting services, nor water supply for industrial or other specialist purposes, other than to indicate precautions that should be taken when these are used in association with other water services. The point at which a domestic activity becomes an industrial process, for example in food preparation, has not been defined, and the applicability will need to be considered in each case.

1.3 As well as complying with the recommendations outlined in this document, any work relating to the operational management of the hot and cold water services, new or extended, in any healthcare premises should also comply with:

a. the current model water byelaws of the local water authority;

b. BS 6700: 1997, the British Standard specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilage.

1.4 In 1989 new water byelaws came into effect and these are set out, along with the water industry's interpretation of these provisions, in the 'Water Supply Byelaws Guide' 1989. The WRc (Water Research Centre) operates the Evaluation and Testing Centre which provides advice on byelaws on a national basis and administers the Water Byelaws Scheme which tests and lists water fittings and materials for compliance with the byelaws. The 'Water Fittings and Materials Directory' contains information on suitable fittings and materials and is updated every six months.

1.5 It is required that any persons proposing to carry out works on cold water distribution systems liaise closely with the water authority.

1.6 Where existing facilities do not meet the standards recommended in this memorandum, management should carry out a risk assessment to establish

the extent and priority of action required for compliance. Action must then be taken to meet these recommendations.

1.7 Whilst some guidance on the water services applications mentioned below is given in this memorandum, it is not intended to cover them fully:

laundries – see Health Building Note 25; NOTE: This Health Building Note is suitable for use in Scotland subject to the amendments contained in the Management Executive Letter MEL 94/108

sterile supply departments – see Scottish Hospital Planning Note 13 issued with MEL 94/63

hydrotherapy pools – see Public Health Laboratory service booklet, 'Hygiene for Hydrotherapy Pools'.

Definitions

1.8 Definitions of terms are as those contained in BS 6100 Sections 2.7 and 3.3, BS 6700 and the Model Water Byelaws.

2. Operational considerations

2.1 There are three fundamental reasons for carrying out maintenance: legal, operational and economic.

Legal

2.2 Complying with the law is generally given the highest priority and is often seen as the minimum requirement that must be satisfied. The Model Water Byelaws prohibit the installation or use of any fitting which might cause waste, contamination or undue consumption of the water supply. There are also laws concerned with health and safety such as the Health and Safety at Work etc Act, the COSHH regulations etc. Functional testing of equipment must be carried out to ensure that it will operate when required, such as the testing of safety valves on calorifiers. Maintenance work should be carried out in an approved and safe manner.

Operational

2.3 Maintenance is undertaken to ensure the continuing, satisfactory and availability of services for staff and patients.

Economic

2.4 This maintenance work is associated with ensuring that the required efficiency is obtained from the plant and that the plant achieves its optimum economic life.

2.5 In order to decide the appropriate level of maintenance (for example scheduled, corrective or condition-based) for the different items of plant, the following questions must be addressed:

a. is the breakdown of a particular service going to prove critical during working hours or outside normal hours?;
b. how long can a breakdown of particular plant be tolerated?;
c. what cost can be justified to avoid breakdown of particular plant such as standby pumps?

2.6 The answers to the above questions will set the objectives for the maintenance policy. If response to failure is critical for certain items of plant, the maintenance organisation will require a planned strategy of calling out skilled staff to achieve an agreed response time and to minimise the interval between breakdown and the diagnosis and repair of the plant.

3. Cold water systems

Water Authorities

3.1 Three public water authorities were established under the Local Government etc (Scotland) Act 1994, to provide water supply and sewage services throughout Scotland.

They are:

The West of Scotland Water Authority

The North of Scotland Water Authority

East of Scotland Water

3.2 Water customer interests are represented by The Scottish Water and Sewage Customer Council, suite 4, Ochil House, Springkerse Business Park, Stirling FK7 7XE, Tel: 0345 413132

3.3 The Scottish Environment Protection Agency (SEPA) was established under the terms of the 1995 Environment Act to protect the Scottish environment. This section contains notes to help you understand who is responsible for what and general information.

The Water Authorities

a. Provide reliable water supplies which meet the required standards for quality.
b. Provide drains, sewage and surface water for properties.
c. Offer water and sewage services to new customers wherever they think the cost is reasonable.
d. Protect the quality of water they supply and stop water being wasted by enforcing byelaws.
e. Deal with trade effluent from business properties.
f. Use water resources effectively and manage reservoirs for leisure activities.
g. Promote conservation and improvement of the environment.
h. Empty domestic septic tanks.
i. Set charges for their services and send bills to customers direct or through the local authorities.

The Customer Council

a. Protects the interests of customers and represents their views to the Water authorities.
b. Approves charges and codes of practice.
c. Gives advice to the Secretary of State for Scotland on the standard of service provided by the Water Authorities.
d. Investigates customers' complaints.

The Scottish Environment Protection Agency (SEPA)

a. Sets standards for and monitors discharges into inland waters, estuaries and the sea.
b. Keeps a record of river flows and is involved in any new water schemes.
c. Provides flood warnings.

Local Authorities

a. Are responsible for environmental health, including monitoring the quality of public and private water supplies.
b. Oversee the safety of all large reservoirs in their area.
c. Control planning and building activities relating to altering and developing property.
d. Maintain road gullies and road drainage systems (but not public sewers.)
e. Are responsible for flood prevention in urban areas and for coast protection and dealing with oil pollution around the coast.
f. Collect domestic water and sewerage charges for the water authority along with the Council Tax.
g. Collect water charges for the water authority from businesses which do not have a water meter.
h. Collect sewerage charges for the water authority from businesses.

The Secretary of State for Scotland

a. Is responsible to Parliament for the water authorities.
b. Lays down financial responsibilities.
c. Approves Water Authorities charges and code of practice.
d. Decides certain appeals related to water and sewerage services.

Health boards

a. Are responsible for health in the community.

b. Can ask to have fluoride put in the water.

c. Investigate outbreaks of disease and give the water authority advice if water quality is seriously below standard.

Property owners

a. Maintain their private water supply pipework to the water byelaws. This may include shared pipes from the boundary stopcock to the various properties they serve. In rural areas this can involve considerable lengths of pipe and include storage tanks, valves and so on.

b. Are recommended to provide water storage for 24 hours in case there is an interruption in the supply.

c. Maintain their private drains and septic tank (if they have one).

d. Maintain streams or channels within their land.

(There may be different agreements between owners and tenants.)

Water treatment

3.4 The need for water treatment and the method of application depend on the purposes for which the water is to be used and the quantity required for each purpose. Whilst potability is not normally affected by such characteristics as hardness, colour, and (within limits) smell and/or taste, a measure of treatment may be necessary to provide a more acceptable and wholesome supply.

3.5 A supply from a water authority should not normally require any further treatment when used for healthcare premises purposes other than for processing for laundries, domestic hot water systems and steam boiler feed water, where either the degree of hardness proves excessive or exceptional softness causes corrosion. Most private supplies, however, require some measure of treatment, and in many cases the installation of pumping and treatment plant needs to be extensive to ensure a constant acceptable quality.

3.6 Chemical conditioning systems which are used in conjunction with potable water systems should be selected very carefully. Addition of any substance must not cause a breach of any requirements in the Water Supply (Water Quality) (Scotland) Regulations 1990 (as amended), and any system for introducing a substance must be listed in the current edition of the Water Fittings and Materials Directory.

3.7 Automatic water treatment systems should be fail-safe and have sufficient instrumentation to monitor their operation. Where automatic equipment is used for disinfection it should indicate any change in the amount or

concentration delivered into the water. For example, ultra-violet (UV) systems should incorporate a UV detector so that any loss of transmission can be acted upon immediately.

Metal contamination

3.8 Analytical results have shown that there can be a serious problem from lead contamination of hospital water supplies. The 1993 edition of the World Health Organisation, 'Guidelines for drinking-water quality', has lowered its guideline value for lead, from 0.05 mg/l to 0.01 mg/l. The WHO guidelines value is likely to be exceeded if lead pipes are present, or if copper pipes have been joined with solder containing lead. In general terms if hospital drinking water contains more than 0.05 mg/l of lead then remedial action should be considered.

3.9 Copper concentrations above 1 mg/l may cause staining of laundry and sanitary ware, and increase the corrosion of galvanised iron and steel fittings. Whilst the maximum allowable copper concentration in drinking water is 3.0 mg/ l most supplies will give a level at the tap of less than 1.0 mg/ l.

3.10 Water supplies to certain units such as maternity, neo-natal, paediatric, and renal dialysis units must not be contaminated by copper or heavy metals in excess of 0.05 mg/l. The aluminium content of such water supplies should also be monitored to ensure that levels are below acceptable limits.

3.11 Where the water supply is known to dissolve metals, regular sampling tests should be made at strategic sampling points to ascertain that the level of metal contamination in the water supply to the healthcare premises, plus any added during its passage through the healthcare premises distribution system, does not result in limits above the stated safe levels. This will especially apply if the healthcare premises distribution pipework includes a multiplicity of leaded solder capillary joints. In soft water areas, metal contamination can occur by simple dissolution. Pitting corrosion arising in hard water areas, as a result of deleterious carbonaceous films laid down during the manufacturing process, does not normally give rise to elevated copper levels in the water and is not nowadays a problem if third party certified tubes to BS EN 1057 are used.

Filtration

3.12 Filtration of potable water to a particle size of 0.2 microns is not uncommon, typically using "dead-end" filters or cross-flow membrane filters.

3.13 In all cases it is feasible for bacteria to colonise or "grow through" the filter material even where backwashing is a feature. It is essential for filter cartridge elements to be changed at appropriate intervals in accordance with the manufacturer's recommendations, taking into account local conditions. Filter membranes should also be chemically cleaned or replaced at the recommended periods, and care must be taken to ensure that the "vessel" or "housing" containing the filter assembly is also disinfected appropriately during filter or membrane maintenance.

NOTE: Reference should be made to SHTN 2, 'Domestic hot and cold water supplies'.

Water softening

3.14 Hard waters are sometimes unsuitable for many industrial and domestic purposes. Treatment may therefore be necessary to remove or alter the constituents to render the water suitable for particular purposes.

3.15 Base exchange softening removes permanent and temporary hardness from water. The technique uses an ion exchange process in which the calcium and magnesium ions in solution are removed and replaced by an equivalent amount of sodium ions.

3.16 Daily or frequent backwashing and periodic cleaning and disinfection (typically six-monthly) must be undertaken in accordance with the manufacturer's/ supplier's instructions which may require using chlorine (20 mg/ l). Other proprietary cleaning agents are not recommended, particularly if the softened supply water serves apparatus such as dialysis units.

3.17 Other water softening methods include physical water conditioning and magnetic water conditioning. The operation and maintenance of these systems should be in accordance with manufacturer's instructions.

3.18 Further information on water softening can be found in BSRIA Applications Guide AG 2/93, 'Water Treatment for Building Services Systems'.

Disinfection

3.19 Normally a supply from a water authority should not require disinfection, but all piping, fittings and associated services used for the conveyance of water for domestic purposes must be disinfected before being brought into use. Such piping, fittings and storage cisterns must also be disinfected on completion of works which have entailed "opening up" the system. Private water supplies must be disinfected before being used for domestic purposes. Disinfection is effected by chemical or physical agents; the method generally used is chlorination.

3.20 Disinfection using chlorine should be carried out in accordance with the guidance given in Part 4, 'Validation and verification', of this SHTM, and under the direct supervision of a nominated person.

3.21 The continuous chlorination of hot and cold water service systems to control the growth of legionellae is not recommended unless it is suspected that they are the source of cases of hospital-acquired legionella infection.

3.22 Contaminated water that is run to waste into a natural watercourse, or a drain leading to it, should be treated in accordance with the requirements of the authority responsible for land drainage and pollution control. The authority responsible for that sewer should be informed. Dechlorination can be achieved using either sulphur dioxide or sodium thiosulphate. 20g of sodium thiosulphate crystals are required to dechlorinate 500 litres of water containing 20 mg/l free chlorine.

Water storage

3.23 The quality of stored water needs to be preserved to avoid microbial contamination and other loss of quality. Special attention should be given to all cisterns, tanks or other devices used to store water. It is necessary to minimise stagnation and stratification of the stored water. A maximum of 12 hours' total on-site storage capacity is recommended. The quantity of water stored should be carefully assessed in relation to the daily requirement in order that a reasonable rate of turnover is achieved. Storage of unnecessarily large quantities of potable water will result in low rates of turnover and a consequent deterioration in the quality of water. The storage capacity should be reduced where it is known or established that it is excessive and where it is practicable to do so; an example would be where there are two cisterns in parallel, one of which can be left empty and blanked-off (pipe sections should be removed). Alternatively, the steady water level in the cisterns should be lowered; this can be achieved easily if the float controlling the water supply has a thumbscrew adjustment as prescribed in BS 1212: Part 1. The design capacity should not allow for future extensions. Pipework connections to and from the storage systems should be arranged to encourage good circulation within the system.

3.24 Delayed action float operated valves may help to ensure that stagnation is reduced.

3.25 Storage cisterns should be located to minimise heat gains. To restrict microbiological growth it is important that the temperature of stored water is kept as low as practicable, and should not be more than 20°C.

3.26 Every cistern must be provided with a properly-fitting cover and any pipe open to the atmosphere, for example the overflow, must be properly screened as required by the water byelaws. A sketch illustrating general potable water storage cistern requirements is contained in Figure 1.

3.27 All cold water storage cisterns and cold feed cisterns must be regularly examined-those containing less than 1000 l at least every 12 months and those containing more than 1000 l at least every six months, paying particular attention to the presence of foreign objects, biological material and excessive corrosion. On completion of the examinations the cisterns should be cleaned and any remedial work carried out. Before the cisterns and system are put back into use they should be disinfected in accordance with the procedure detailed in Part 4,'Validation and verification', of this SHTM.

3.28 Any chemicals used in the cleaning or maintenance of cisterns must be of a type considered acceptable for potable water use.

3.29 Where potable water has been stored in an inadequately protected cistern a water analysis should be considered. In multiple cistern installations a check should be carried out for stagnant water, usually apparent by odour or a dusty surface. If this is found to be the case the cisterns should be flushed out and the inlet and outlet connections rearranged so that flow is sequential and the problem does not recur.

3.30 Cistern insulation should be checked to ensure that it is in good condition and adequately positioned.

3.31 Float operated valves should be checked to ensure that they are securely fixed and set to achieve a correct water level in accordance with the water byelaws.

3.32 Overflow/warning pipes should be checked to ensure that they do not rise in level and they are clear and correctly routed to give an obvious visual alarm of an overflow condition. A weatherproof label fixed adjacent to the warning pipe, identifying the tank and its location together with the person/department to be contacted in the event of a discharge, would contribute to a quick and accurate defect report which could then be acted upon, so minimising water wastage.

3.33 A schematic drawing, illustrating piping and valve arrangements for break tank operation during normal running and maintenance periods is included in Figure 2 of this part.

Pressurisation/supply pumps

3.34 Where two or more pumps are installed for pressurising systems, automatic control should be provided to sequence the pumps to ensure that each pump is regularly brought into service (at least daily) as the main duty or lead pump, in order to minimise any danger of stagnation.

3.35 The maintenance carried out on this type of equipment should be in accordance with the manufacturer's recommendations.

Figure 1: General potable water storage cistern requirements

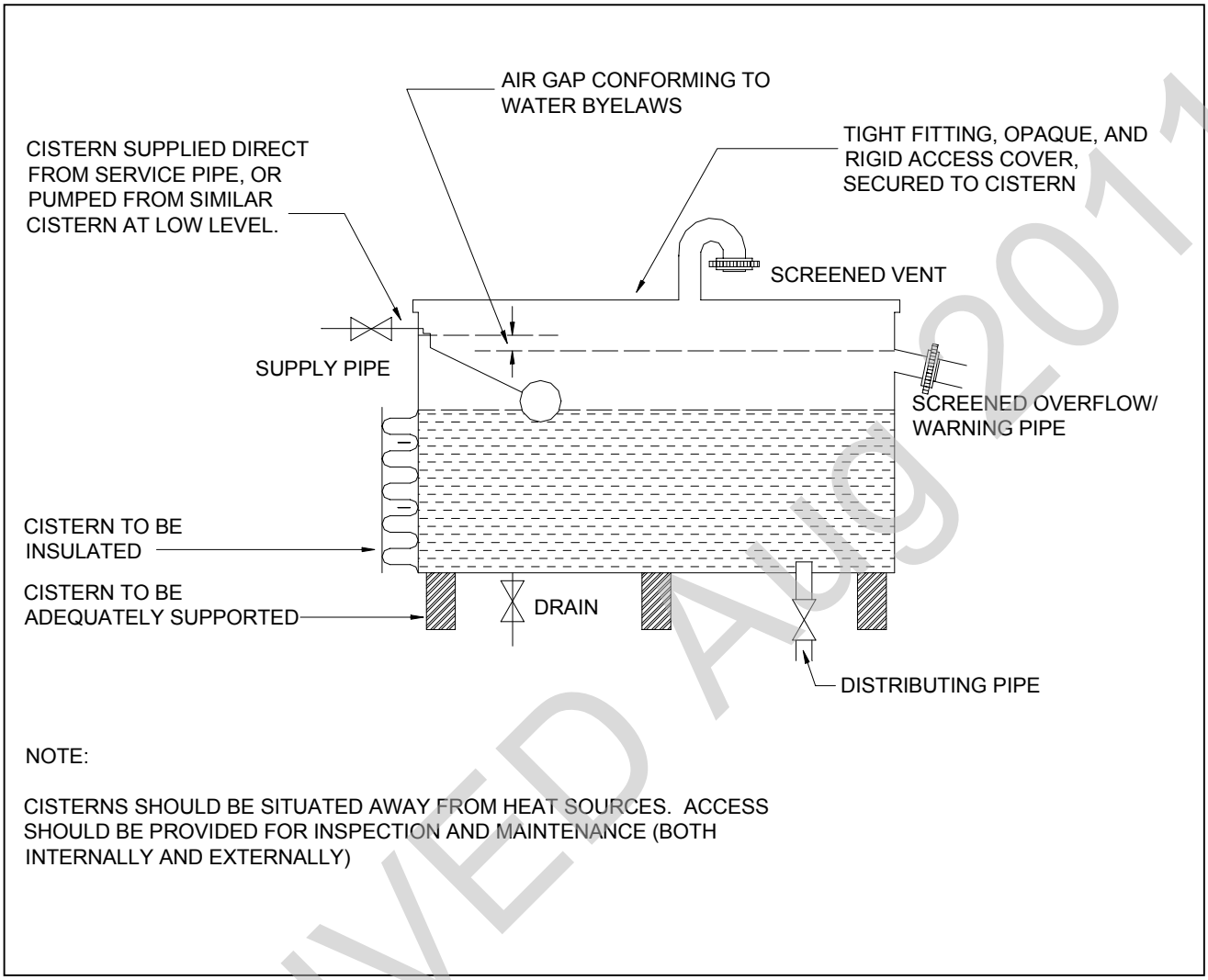
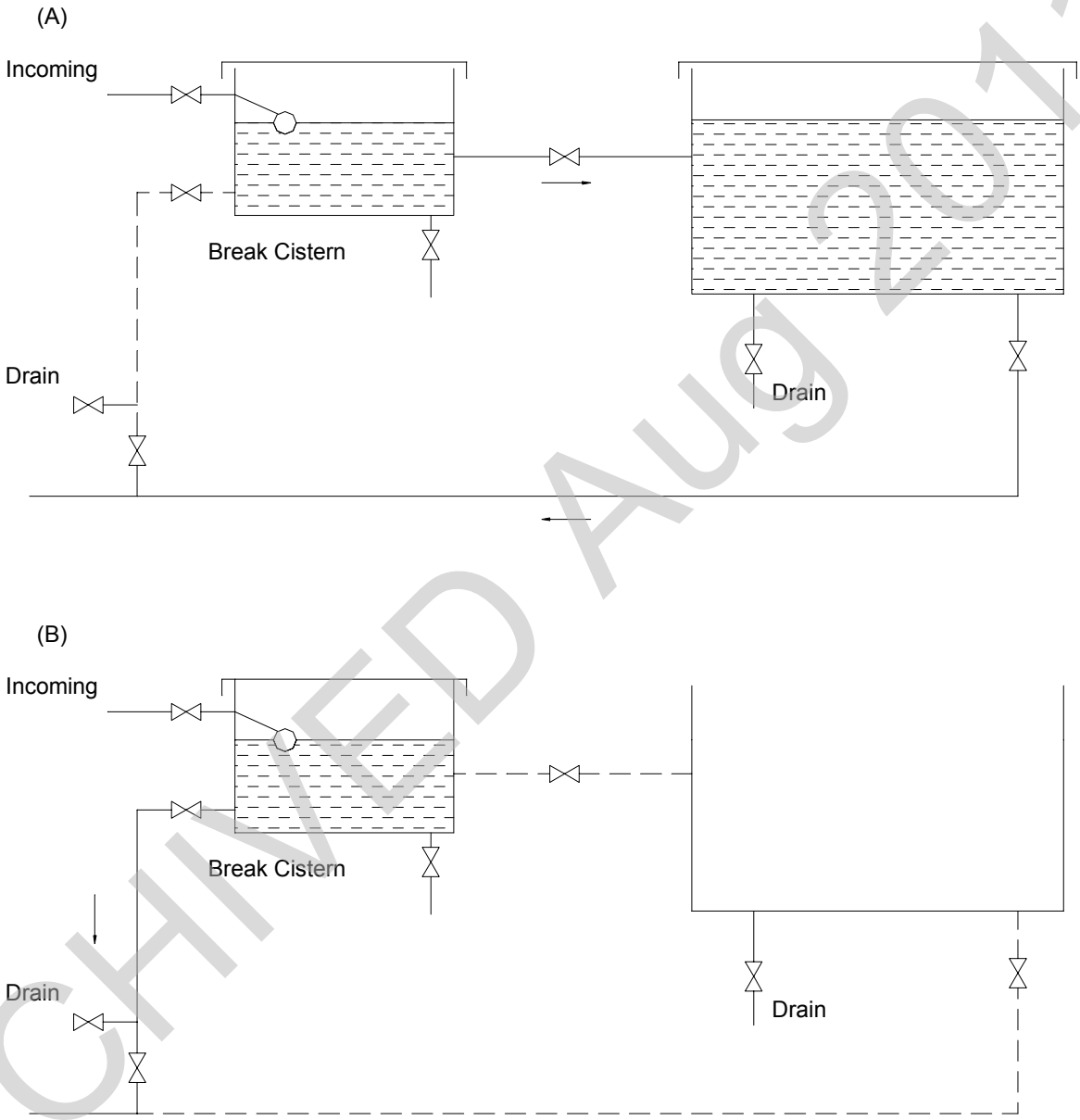


Figure 2: Piping and valve arrangements for break tank operation (A) Normal running, (B) During maintenance



Note: Break tank can be maintained during run down of main tank from full.

Distribution pipework

3.36 System schematic drawings with valves numbered and labelled will reduce confusion and save time in trying to identify appropriate isolating valves and other system components. The schematic should be mounted in a frame and displayed in the appropriate plantroom.

The following checks and actions should be carried out to show that:

a. the system components show no sign of leakage or corrosion;

b. the system insulation is in good condition;

c. the system filters have been changed and/or cleaned in accordance with manufacturer's recommendations. Regularly check and clean strainers;

d. all isolating valves have periodically been worked through their full range of travel;

e. emergency deluge showers and eye baths are regularly (weekly) flushed to prevent stagnation of the water in pipework serving this equipment;

f. every water outlet complies with the backflow protection requirements of the water byelaws;

g. system drawings are updated to record any changes to the system.

3.37 A schematic drawing illustrating a hot and cold water services distribution system is included in Figure 3 of this volume.

Temperature control

3.38 The temperature of water stored in cisterns should be maintained below 20°C, as far as is practicable, to minimise bacterial growth. Storage installations should be insulated and protected from thermal gains.

3.39 The temperature of the cold water service should be checked at least twice a year. Tests should include:

a. measuring the incoming water temperature at the main water meter;

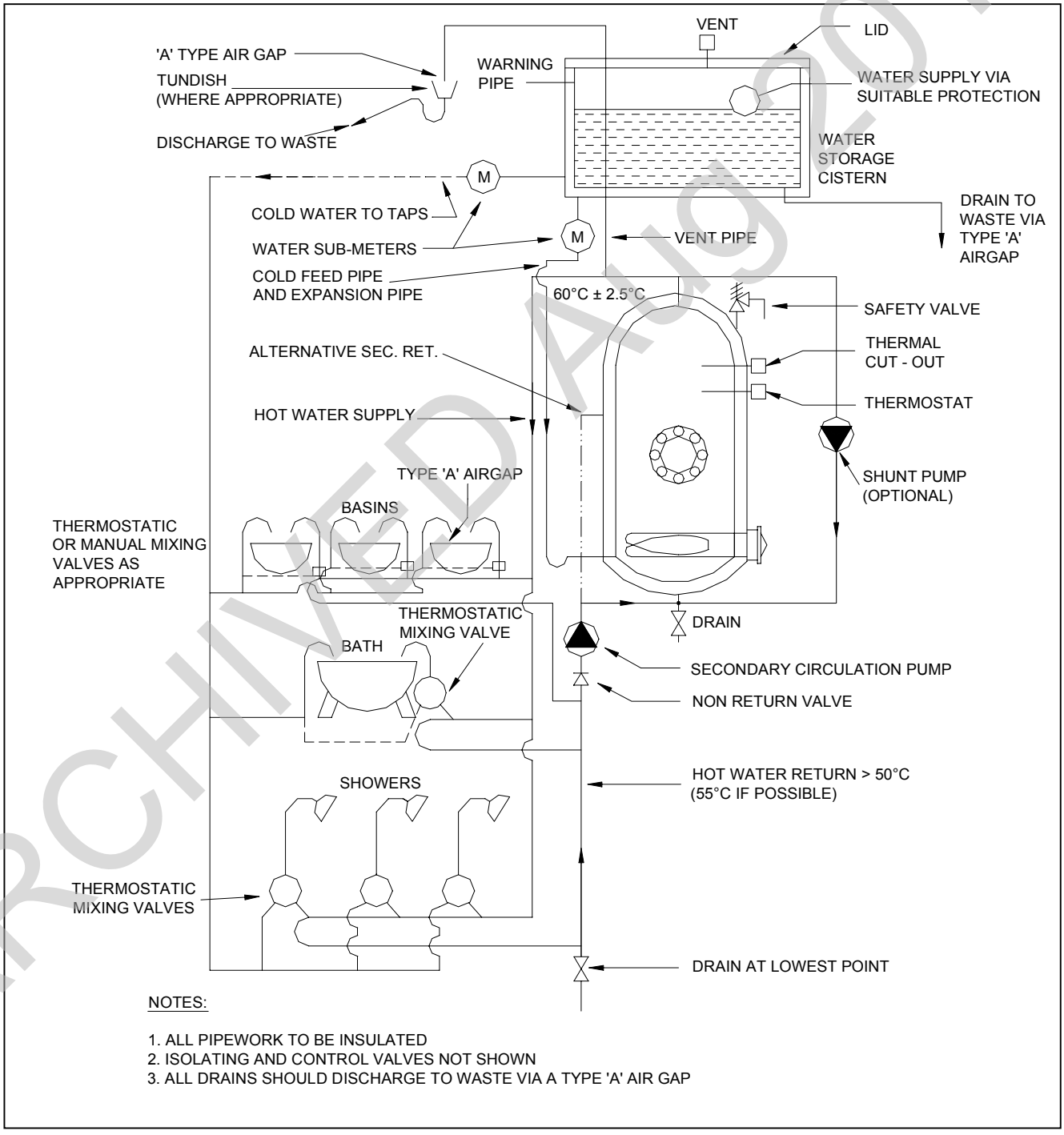
b. testing the inlet, outlet and surface water temperatures of cisterns and cold water feed/header tanks for the hot water calorifiers. The temperature should not be greater than 2°C above that measured at (a);

c. at cold water draw-off points a temperature of not greater than 2°C above the temperature measured in the storage cistern should be reached within one minute of running the water.

Metering

3.40 Where water meters are installed in below-ground meter chambers, ensure the chambers are kept clean of debris and water; this will enable quick and accurate reading of the meters.

Figure 3: Schematic hot and cold services distribution



3.41 Periodically check that meters are actually working and giving accurate readings.

3.42 Meters, other than the water authority's meters, should be removed at such intervals as recommended by the manufacturers for cleaning and renewal of worn parts and should be tested for accuracy and recalibrated prior to replacement.

Monitoring

3.43 Read meters on a regular basis (monthly) and monitor consumptions; a bar graph will highlight unusually large consumption, which can then be investigated, (e.g. underground leakage).

3.44 Check the consumption on the utility bill against that indicated by the regular meter readings, and investigate discrepancies.

3.45 Regularly check system components for signs of leakage; a tap left dripping can waste in excess of 14,000 litres of water each year.

3.46 Regular analysis of water samples at six-monthly intervals should be carried out wherever bulk drinking water storage exceeds 1000 l and is supplied from the water undertaker. Supplies taken from local boreholes etc. should be tested to comply with the requirement of the Private Water Supply (Scotland) Regulations 1992. Additional checks/analysis should be carried out after any repairs or modifications to the system. The results of all analysis should be kept and recorded.

4. Hot water systems

Hot water calorifiers

4.1 Calorifiers should be subjected to regular cleaning and maintenance procedures which include the following:

a. quarterly draining to minimise the accumulation of sludge. This frequency may be extended to annual if, during inspection, it is found that there is little accumulation of debris;

b. whenever dismantled, for statutory inspection or every year in the case of water/water calorifiers, calorifiers should be thoroughly cleaned to remove sludge and loose debris (it is not essential to remove all scale);

c. whenever a calorifier is taken out of service, or its flow temperature falls below 45°C for any reason, it should be refilled, drained, refilled again and the entire contents brought up to and held at the nominal operating temperature of 60°C for at least one hour. A calorifier shunt pump will significantly reduce the heat-up time. The calorifier should remain isolated until the procedure is completed. When bringing calorifiers back on line, it is important that service valves are opened slowly to avoid any disturbance of sedimented debris. Calorifiers which are to be taken out of service for more than a few days should be drained and should not be refilled until ready for return to service. The drain valve should be left open throughout the period the calorifier is out of use;

d. users are reminded that if a calorifier is colonised by legionellae and is then drained and opened for maintenance purposes, there can be a risk of infection to maintenance personnel;

e. where it is known or established that gross over-capacity exists in a calorifier, and where it is practicable to do so, it should be removed;

f. a schedule of approximate calorifier emptying times is included as Table 1.

Hot water circulating pumps

4.2 Circulating pumps should be of adequate performance to ensure a minimum available temperature at draw-off points at 55°C and an absolute minimum of 50°C for the control of, for example legionellae.

4.3 In circumstances where it is impracticable to remove pumps (that is, when leaving the standby pump available for immediate connection into the HWS circulating system), the pumps should be switched daily to ensure that any standby or back-up pump is regularly brought into service as the main duty or lead pump. It may be more effective to utilise an auto-changeover system, in which case more frequent switching would be appropriate.

4.4 It is not permissible to shut down the pumped circulation system. To do so will lead to the loss of the required system temperatures.

Table 1: Emptying times for calorifiers (approx)

Calorifier type	Diameter/ length ratio	Capacity litres (gallons)	Drain valve sizes mm (inch)		
			25 (1.0)	38 (1.5)	50 (2.0)
Horizontal	1:2.5	13,500 (3,000)	3hr 00 min	1hr 20 min	45 min
		9,000 (2,000)	2hr 10 min	1hr 00 min	30 min
		4,500 (1,000)	1hr 10 min	30 min	20 min
		2,250 (500)	39 min	17 min	10 min
		1,800 (400)	32 min	14 min	8 min
		1,400 (300)	25 min	11 min	6 min
Vertical	1:1.5	13,500 (3,000)	2hr 45 min	1hr 15 min	40 min
		9,000 (2,000)	2hr 00 min	55 min	30 min
		4,500 (1,000)	1hr 10 min	30 min	20 min
		2,250 (500)	38 min	17 min	9 min
		1,800 (400)	31 min	14 min	8 min
		1,400 (300)	25 min	11 min	6 min

Times assume no hose and simple gate valve.

Notes: 1. Ball type valve(s) should be specified to avoid “clogging”.

2. The drain from the gully should be of sufficient size to take the flow from the calorifier drain.

Trace heating

4.5 Electrical trace heating should be checked routinely (at least annually) to ensure that it maintains the water temperature above 50°C. Care should be taken to ensure there are no cool spots.

Showers

4.6 Hyperchlorination of shower heads and angle valve strainers has only a short-lived effect on legionellae. Automatic drain valves are ineffective in maintaining a reduction in the number of legionellae in shower water. Regular flushing of showers reduces legionellae. The most effective management of showers will be achieved by the removal of unnecessary ones and the regular use of others.

Temperature control

4.7 During a period of low ambient temperature, check the temperatures of the outflow from the HWS calorifier to establish that the temperature is above 60°C and that the temperature at the return connection is not less than 55°C. The most distant draw-off point on the system should be checked to ensure that the temperature reaches a steady state value between 60°C and 50°C within one minute of running the water at full flow. Appropriate remedial action should be taken where necessary.

4.8 Although the Health and Safety Executive in HS(G)70 recommends spot checks, this guidance requires a temperature excursion limit of less than 20 minutes. There should be no more than two excursions in any 24-hour period; therefore, continuous monitoring is recommended.

4.9 Where there is a building management system, it could be used to monitor temperatures within the system. Refer to SHTM 2005; *Building Management Systems*.

4.10 It is essential to check the temperature settings and operation of all water mixing devices routinely, at least half-yearly. Other maintenance should be strictly in accordance with the manufacturer's instructions. The local water quality will influence the maintenance frequency for any installation. A relatively small piece of debris may restrict the operation of the temperature control and fail-safe mechanisms.

4.11 Recommendations regarding safe water and surface temperatures given in Scottish Health Guidance Note, '"Safe" hot water and surface temperatures', apply to all ward accommodation, residents' rooms and those areas to which patients, residents and visitors have free access (including public areas). Until the recommended precautions are put into effect, staff should be made aware of the potential danger and take the necessary steps to protect patients, residents and visitors. Areas which do not meet these recommendations should be identified, and plans to comply as soon as reasonably practicable should be devised.

Thermostatic Mixing Valves for baths and showers should comply with the standards of the Model Engineering Specification (MES) DO8 Thermostatic mixing Valves (Healthcare premises).

5. Other operational considerations

Hydrotherapy pools, whirlpool baths and spas

5.1 Hydrotherapy pools, whirlpool baths and whirlpool spas provide conditions which potentially favour the growth of legionellae. While there have been no reported cases of legionellae infection implicating hydrotherapy pools, there have been several outbreaks associated with spa pools or whirlpools. These are particularly vulnerable because of the small volume of water in circulation and the multi-occupancy (typically three to six persons) makes an outbreak more likely. Careful maintenance and chemical treatment is essential to maintain water quality. A log must be kept of the treatment, filter cleaning and the results of tests for pH, free residual halogen and other treatment parameters.

5.2 Spa baths and whirlpool baths which provide a single fill for each individual use do not appear to present the same hazard. There remains concern, however, about retention of water in these systems; an International Standard to cover this subject is proposed.

5.3 Regular cleaning and periodic disinfection in accordance with manufacturer's instructions is recommended.

5.4 The Swimming Pool and Allied Trades Association (SPATA) will provide advice on the operation of whirlpool spas.

5.5 All staff who operate/maintain this type of equipment should receive adequate training to ensure that appropriate safety procedures and effective water treatment regimes are adopted.

5.6 Advice on the operation of hydrotherapy pools is contained in the following documents: Chemical Disinfection in Hospitals, second edition 1993 ISBN 0901144347; 'Hygiene for spa pools – Guidance for their safe operation – The report of the Public Health Laboratory Service – Spa pools Working Party', 1994; 'The Scottish Office, Department of Health Advisory Group on Infection'; 'Scottish Infection Manual – Guidance on core Standards for the control of infection in hospitals, healthcare premises and at the community interface'.

5.7 Maintenance for this equipment should be carried out in accordance with the manufacturer's recommendations.

Temporary closure of wards/departments

5.8 During temporary closure of wards or departments, a procedure for flushing the hot and cold water service systems should be instituted. This should

include opening all taps for a period of three minutes and flushing WC cisterns, etc. on a weekly cycle. Alternatively, when this is impracticable, the disinfection procedure recommended for new installations may be carried out immediately prior to occupation.

NOTE: Further guidance is given in Scottish Hospital Technical Note 2; *Domestic Hot and Cold Water Systems for Scottish Healthcare Premises*.

Ice-making machines, water coolers and drinks-vending machines

5.9 Maintenance for this equipment should be carried out in accordance with the manufacturer's recommendations.

5.10 The equipment should be positioned so that the warm air exhaust does not impinge directly on taps or hoses supplying cold water.

5.11 Ensure that the water supply to this equipment is taken from a potable supply. Where equipment is hand filled, there should be clear instructions on the water used. This should be from the mains supply and collected and decanted into the equipment from a clean vessel, and in a hygienic manner. The Control of Infection Officer should be consulted for local guidance.

5.12 Ice should not be allowed to stagnate in an ice-making machine's storage bin, but should be changed frequently.

6. Water economy

Leaks

6.1 Monitor consumption; if it increases for no readily identifiable reason, this may indicate a leak. Underground leaks may be identified by:

a. wet or soggy patches of ground;

b. areas of grass that are greener or growing stronger and more quickly than the remainder;

c. water in stop valve chambers.

Cistern flushing

6.2 Ensure that the amount of water used as a result of flushing cisterns complies with the water byelaws.

Other economy measures

6.3 There are a number of other economy measures which may be implemented; these include:

a. the fitting of flow restrictors to hand-basin taps, or fitting spray taps (these should only be installed following a Risk Assessment of the actions proposed);

b. proximity detectors and timing devices controlling the flushing of urinals;

c. consider in conjunction with nursing staff, replacing baths with showers where this is a practicable proposition – showers use significantly less water than baths;

d. minimise dead-legs on the hot service to hand-basins. The cold water in these sections is usually run off to drain while waiting for the hot water to arrive;

e. ensure that baths and sinks are fitted with waste plugs to discourage wasteful run-off;

f. ensure that systems are adequately frost-protected and well-maintained;

g. use posters, etc. to raise awareness of the need for water economy and discourage wasteful practices such as leaving taps running.

7. Emergency action

7.1 Contingency plans should be available in the event of the following:

a. a power failure affecting distribution/circulating pumps;

b. a mains water failure which could endure beyond the period offered by the storage capacity.

7.2 The following section extracted from SHTM 2040 indicates the course of action to be followed if an outbreak of legionnaires' disease is suspected.

7.3 The nominated person will usually be informed of a suspected case of legionnaires' disease possibly associated with healthcare premises by either the infection control team or the local Consultant in Communicable Disease Control (CCDC). If a case is suspected, the hospital outbreak team will normally work to the guidance given in the Scottish Infection Manual. It is essential that systems are not drained or disinfected before samples have been taken. The nominated person's role is an important one-guiding the team to the various water systems within the building and, in particular, to the points from which samples can be taken. Easy access to these sampling points is essential.

7.4 The investigation will concentrate upon all potential sources of legionella infection, including:

a. the domestic hot and cold water distribution system including cold water storage systems;

b. wet spray cooling-water systems;

c. showers or spray-washing equipment;

d. drainage systems and traps;

e. spas, whirlpool baths or therapy pools;

f. humidifiers in ventilation systems;

g. cooling coils in air-conditioning systems;

h. fountains and sprinklers.

7.5 To assist in such investigations, the nominated person must be able to provide details of all associated equipment, including all documentation. He/she must assist by advising the investigating team on the extent of servicing on the site, and by locating taps and sample points.

7.6 The nominated person must also identify the locations of any medical equipment used for dental care, respiratory therapy and within haemodialysis units, etc.

7.7 Off-site information will also be required, such as whether there have been any local excavation or earthmoving works, alterations to water supply systems or drainage systems, or any other factors which may have a bearing on the site.

7.8 The address and telephone number of the nearest weather station will be required – this is likely to be a local airport, university or college department.

7.9 The team is responsible for identifying the cause of infection, and will advise on cleaning, disinfection, any modifications, and long-term control measures.

8. Protection of staff

8.1 All works carried out shall be subject to the legislation, regulation and guidance appropriate to the hot and cold water supply, storage and mains services. The following may be applicable:

a. the Health and Safety at Work etc Act;
b. the Management of Health and Safety at Work Regulations;
c. the Control of Substances Hazardous to Health (COSHH) Regulations;
d. the Water Supply (Water Quality) (Scotland) Regulations 1990;
e. the Public Health (Notification of Infectious Diseases) (Scotland)Regulations;
f. the Provision and Use of Work Equipment Regulations;
g. the Scottish Infection Manual;
h. SHTN 4, 'Model Safety Permit-to-Work Systems'.

9. Responsibilities of maintenance personnel and designated staff functions

Management

9.1 Management is defined as the owner, occupier, employer, general manager, chief executive or other person who is ultimately accountable for the safe operation of healthcare premises.

9.2 A person intending to fulfil any of the staff functions specified below should be able to prove that they possess sufficient skills, knowledge and experience so as to be able to perform safely the designated tasks.

Infection control officer

9.3 Infection control officer-or consultant microbiologist if not the same person, nominated by the management to advise on monitoring infection control policy and for the maintenance of water quality.

9.4 Additionally the policy should be acceptable to the control of infection committee and any amendment to that policy must be agreed by the committee.

Nominated person

9.5 A nominated person (water), possessing adequate professional knowledge and with appropriate training, should be nominated in writing by management to devise and manage the necessary procedures to ensure that the quality of water in healthcare premises is maintained. The person will be required to liaise closely with other professionals in various disciplines. In addition, the person should possess a thorough knowledge of the control of legionellae and would ideally be a chartered engineer.

9.6 This person's role, in association with the infection control officer and maintenance staff, involves:

a. advising on the potential areas of risk and identifying where systems do not comply with this guidance;

b. liaising with the water authorities and environmental health departments and advising on the continuing procedures necessary to ensure acceptable water quality;

c. monitoring the implementation and efficacy of those procedures;

d. approving and identifying any changes to those procedures;

e. ensuring that equipment which is to be permanently connected to the water supply is properly installed;

f. ensuring that adequate operating and maintenance instructions exist and adequate records are kept.

9.7 Implementation of an effective maintenance policy must incorporate the creation of fully detailed operating and maintenance documentation and the introduction of a logbook system. The "nominated person" should appoint a deputy to whom delegated responsibilities may be given. The deputy should act for the nominated person on all occasions when the nominated person is unavailable.

9.8 The nominated person should be fully conversant with the design principles and requirements of water systems and should be fully briefed in respect of the cause and effect of water borne organism, for example Legionella pneumophila. The appointment of an engineer as the nominated person is appropriate in that the responsibility can extend to the operation and maintenance of associated plant. It is recognised that the nominated person cannot be a specialist on all matters and must be supported by specialists in specific subjects such as water treatment and microbiology, but he/she must undertake responsibility for calling upon and co-ordinating the activities of such specialists.

Maintenance technician

9.9 A person who, in the opinion of the nominated person has sufficient technical knowledge and the experience necessary to carry out maintenance and routine testing of the water, storage and distribution system.

Tradesperson

9.10 A person who is appointed in writing by the nominated person to carry out, under the control of the maintenance technician, work on the water, storage and distribution system.

Installer

9.11 A person or organisation responsible for the provision of the water, storage and distribution system.

Contractor

9.12 The person or organisation designated by management to be responsible for the supply and installation of hot and cold water services, and for the conduct of the installation checks and tests.

Contract supervising officer

9.13 The person authorised by the hospital authority to witness tests and checks under the terms of contract. He/she should have specialist knowledge, training and experience of hot and cold water supply, storage and mains services and SHTM 2027.

10. Record-keeping

10.1 Management should ensure that an accurate record of all assets relating to the hot and cold water distribution systems is set up and regularly maintained. They must also ensure that records of all maintenance, inspection and testing activities are kept up-to-date and properly stored. Further information is available in SHTN 1, 'Post commissioning documentation for health buildings in Scotland'.

10.2 Planned preventive maintenance will help to ensure that systems perform correctly, and an essential element of this process is the maintenance of accurate records.

10.3 Maintenance records are normally required for the following purposes:

a. verification of maintenance for local accountability;
b. verification of maintenance for statutory obligations;
c. as a means of monitoring the maintenance policy and its effectiveness;
d. as a means of observing performance trends, helping fault diagnosis and initiating corrective action where necessary;
e. as an aid to financial planning.

10.4 When alterations to plant or systems are implemented the record drawings and any schematic drawings should be updated to reflect the modifications carried out.

10.5 An asset register for the engineering services would provide a structure for recording, retrieving and analysing information.

10.6 The following are some of the significant applications of an asset register:

a. as a plant inventory;
b. to provide a basis for identifying plant details;
c. to provide a basis for recording the maintenance requirements;
d. to provide a basis for recording/extracting information associated with the maintenance of an asset;
e. to provide a basis for an accountant to establish the provision that needs to be made for plant replacement;
f. for insurance purposes.

10.7 Further information on the monitoring of performance and effectiveness in carrying out maintenance tasks can be found in CIBSE guide OOM - 'Guide to ownership, operation and maintenance of building services'.

References

NOTE*:*
Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

Publication ID	***Title***	***Publisher***	***Date***	***Notes***
Acts and Regulations				
	The Building (Scotland) Act	HMSO	1959	
	Clean Air Act	HMSO	1993	
	Electricity Act	HMSO	1989	
	Food Safety Act	HMSO	1990	
	Health and Safety at Work etc Act	HMSO	1974	
	Registered Establishments (Scotland) Act	HMSO	1998	
	The Water (Scotland) Act	HMSO	1980	
	Water Resources Act	HMSO	1991	
SI 2179 & 187	The Building Standards (Scotland) Regulations (as amended)	HMSO	1990	
	The Building Standards (Scotland) Regulations: Technical Standards Guidance	HMSO	1998	
SI 1460	Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP2)	HMSO	1997	
SI 3140	Construction (Design and Management) Regulations	HMSO	1994	
SI 437	Control of Substances Hazardous to Health Regulations (COSHH)	HMSO	1999	
SI 635	Electricity at Work Regulations	HMSO	1989	
SI 1057	Electricity Supply Regulations (as amended)	HMSO	1988 (amd 1998)	
SI 2372	Electromagnetic Compatibility Regulations (as amended)	HMSO	1992	
SI 1763	Food Safety (General Food Hygiene) Regulations	HMSO	1995	
SI 2200	Food Safety (Temperature Control) Regulations	HMSO	1995	
SI 2451	Gas Safety (Installation and Use) Regulations	HMSO	1998	

Publication ID	Title	Publisher	Date	Notes
SI 917	Health & Safety (First Aid) Regulations	HMSO	1981	
SI 682	Health & Safety (Information for Employees) Regulations	HMSO	1989	
SI 2792	Health and Safety (Display Screen Equipment) Regulations	HMSO	1992	
SI 341	Health and Safety (Safety Signs and Signals) Regulations	HMSO	1996	
SI 1380	Health and Safety (Training for Employment) Regulations	HMSO	1990	
SI 2307	Lifting Operations and Lifting Equipment Regulations (LOLER)	HMSO	1998	
SI 3242	Management of Health and Safety at Work Regulations	HMSO	1999	
SI 2793	Manual Handling Operations Regulations	HMSO	1992	
SI 1790	Noise at Work Regulations	HMSO	1989	
SI 3139	Personal Protective Equipment (EC Directive) Regulations (as amended)	HMSO	1992	
SI 2966	Personal Protective Equipment at Work (PPE) Regulations	HMSO	1992	
SI 574	Private Water Supplies (Scotland) Regulations	HMSO	1992	
SI 2306	Provision and Use of Work Equipment Regulations (PUWER)	HMSO	1998	
SI 1550	Public Health (Notification of Infectious Diseases (Scotland) (Amendment)) Regulations	HMSO	1989	
SI 3163	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)	HMSO	1995	
SI 1333 (S129	Water Supply (Water Quality) (Scotland) (Amendment) Regulations	HMSO	1991	
SI 119 (S11)	Water Supply (Water Quality) (Scotland) Regulations	HMSO	1990	
SI 3004	Workplace (Health, Safety and Welfare) Regulations	HMSO	1992	
British Standards				
BS 864	**Capillary and compression tube fittings of copper and copper alloy**	BSI Standards		
BS 1212	**Float operator valves** **Part 1:** Specification for piston type float operated valves (copper alloy body) (excluding floats)	BSI Standards	1990	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS 1710	**Specification and identification of pipelines**	BSI Standards	1984 (1991)	AMD 612 10/85
BS 2486	**Treatment of water for steam boilers and water heaters**	BSI Standards	1997	
BS 3505	**Specification for unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water**	BSI Standards	1986	AMD 6130, 11/88
BS 3506	**Specification for unplasticized PVC pipe industrial uses**	BSI Standards	1969	AMD 1152, 9/73; AMD 1777, 7/5
BS 5886	**Methods for field pressure testing of asbestos-cement pipelines**	BSI Standards	1980	
BS 6100	**Glossary of building and civil engineering terms**	BSI Standards		
	Section 2.7: Public Health. Environmental Engineering		1992	
	Section 3.3: Sanitation		1992	
BS 6700	**Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages**	BSI Standards	1997	
BS 6920	**Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water**	BSI Standards		
BS 7206	**Specification for unvented hot water storage package and units**	BSI Standards	1990	
BS 7491	**Glass fibre reinforced plastic cisterns for cold water storage**	BSI Standards		
	Part 1: Specification for one-piece cisterns of capacity up to 500L		1991	AMD 7382, 12/92
	Part 2: Specification for one-piece cisterns of nominal capacity from 500L to 25000L		1992	
BS 7671	**The requirements for wiring installations** *(The IEE wiring regulations)*	BSI Standards	2001	16th edition
BS 8007	**Code of practice for design of concrete structures for retaining aqueous liquids**	BSI Standards	1987	

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
BS EN 1057	**Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications**	BSI Standards	1996	
CP 312	**Code of practice for plastics pipework (thermoplastic material). Parts 1 to 3**	BSI Standards	1973	
CP 2010-2	**Code of practice for pipelines. Design and construction of steel pipelines in land**	BSI Standards	1970	
Scottish Health Technical Guidance				
SHTM 2005	Building management systems	P&EFEx	2001	CD-ROM
SHTM 2011	Emergency electrical services	P&EFEx	2001	CD-ROM
SHTM 2020	Electrical safety code for low voltage systems (Escode – LV)	P&EFEx	2001	CD-ROM
SHTM 2023	Access and accommodation for engineering services	P&EFEx	2001	CD-ROM
SHTM 2040	The control of legionellae in healthcare premises – a code of practice	P&EFEx	2001	CD-ROM
SHGN	The Pressure Systems and Transportable Gas Containers Regulations 1989	P&EFEx	2001	CD-ROM
SHGN	'Safe' hot water and surface temperatures	P&EFEx	2001	CD-ROM
SHPN 1	Health service building in Scotland	HMSO	1991	
SHPN 2	Hospital briefing and operational policy	HMSO	1993	
SHPN 13	Sterile services department	HMSO		MEL 94/63
SHTN 1	Post commissioning documentation for health buildings in Scotland	HMSO	1993	
SHTN 2	Domestic hot and cold water systems for Scottish Health Care Premises	P&EFEx	2001	CD-ROM
SHTN 4	General Purposes Estates and Functions Model Safety Permit-to-Work Systems	EEF	1997	
	Strategic guide to water and sewerage policy for General Managers and Chief Executives	HMSO	1993	
Scottish Infection Manual	Guidance on core standards for the infection of hospitals, healthcare premises and at the community interface	HMSO	1998	
	NHS in Scotland – PROCODE	P&EFEx	2001	Version 1.1

Publication ID	*Title*	*Publisher*	*Date*	*Notes*
NHS in Scotland Firecode				
SHTM 81	Fire precautions in new hospitals	P&EFEx	1999	CD-ROM
SHTM 82	Alarm and detection systems	P&EFEx	1999	CD-ROM
SHTM 83	Fire safety in healthcare premises: general fire precautions	P&EFEx	1999	CD-ROM
SHTM 84	Fire safety in NHS residential care properties	P&EFEx	1999	CD-ROM
SHTM 85	Fire precautions in existing hospitals	P&EFEx	1999	CD-ROM
SHTM 86	Fire risk assessment in hospitals	P&EFEx	1999	CD-ROM
SHTM 87	Textiles and furniture	P&EFEx	1999	CD-ROM
SFPN 3	Escape bed lifts	P&EFEx	1999	CD-ROM
SFPN 4	Hospital main kitchens	P&EFEx	1999	CD-ROM
SFPN 5	Commercial enterprises on hospital premises	P&EFEx	1999	CD-ROM
SFPN 6	Arson prevention and control in NHS healthcare premises	P&EFEx	1999	CD-ROM
SFPN 7	Fire precautions in patient hotels	P&EFEx	1999	CD-ROM
SFPN 10	Laboratories on hospital premises	P&EFEx	1999	CD-ROM
UK Health Technical Guidance				
CP 312	Code of practice for plastic pipework (thermoplastic material)		1973	
EH 40	HSE Occupational Exposure limits	HSE	Annual	
MES	Model Engineering Specifications	NHS Estates	1997	As required
	Strategic guide to water and sewerage policy for general managers and chief executives	NHS Estates	1993	
Chartered Institute of Building Service Engineers (CIBSE)				
	Environmental design; guide A	CIBSE	1999	
	Installation and equipment data; guide B	CIBSE	1986	
	Reference data; guide C	CIBSE	2001	(expected)
	Water distribution; commissioning code series W	CIBSE	1994	
TM 13	Minimising the risk of Legionnaires' disease	CIBSE	2000	
OOM	Guide to ownership, operation and maintenance of building services	CIBSE	2000	

Publication ID	Title	Publisher	Date	Notes
Miscellaneous References				
	Model Water Byelaws: Dept. of the Environment	HMSO	1986	
	The microbiology of water: part 1	HMSO	1994	
	Untapped savings: water services in the NHS	HMSO	1993	
ISBN 0117530107	The bacteriological examination of water supplies: methods for the examination of waters and associated materials (Report 71)	HMSO	1982	
ISBN 0901144347	Chemical disinfection in hospitals	HMSO	1993	2nd edition
HS(G)70	The control of legionellosis including legionnaire's disease	HMSO	1993	
	Pre-commission cleaning of water systems	BSRIA	1991	
TN 14/92	Decisions in maintenance	BSRIA		
AG 2/93	Hejab, M. *Water treatment for building services systems application guide*	BSRIA	1993	
AG 1/87	Armstrong, J. H. *Operating and maintenance manuals for building services installations application guide*	BSRIA	1990	
AG 4/94	Guide to legionellosis – temperature measurements for hot and cold water services	BSRIA		
	Water supply byelaws guide	Water Research Centre	1989	
	Guidelines for drinking water quality: recommendations	WHO, HMSO	1993	
	Water fittings and materials directory	Water Research Centre		Published every 6 months
	Dadswell, J. V. *Hygiene for hydrotherapy pools*	Public Health Laboratory Service	1990	
	Water supplies and water consumption (engineering datasheet DY 1)	DHSS	1973	
	Water supplies: conservation (engineering datasheet DY 3)	DHSS	1973	
	The prevention or control of legionellosis (including legionnaires' disease): approved code of practice	HMSO	1991	

Publication ID	Title	Publisher	Date	Notes
	Standards for commercial spas: installation, chemical and water treatment	Swimming Pool and Allied Trade Association	1989	
	Hygiene for hydrotherapy pools: report of a working party on hygiene for hydrotherapy pools	Hospital Infection Research Laboratories	1986	