

Engineering Guidelines for Healthcare Facilities Volume 5 – Fire and Hydraulics

Health Technical Guideline HTG-2020-005



Engineering guidelines for
healthcare facilities:
Volume 5 – Fire and hydraulics

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Contents

Introduction	7
Fire safety engineering	8
Fire services	10
Introduction	10
Scope.....	10
Minimum standards	10
Master planning	10
Design guidance	11
Water supply	12
Systems integration	12
Sustainability.....	12
Hydraulics	13
Introduction	13
Scope.....	13
Fundamentals	13
Materials	13
Plastic pipework.....	14
Availability	14
Maintenance	14
Design criteria.....	15
Water supply.....	15
Hot water supply	16
Warm water systems	17
Sanitary plumbing and drainage.....	17
Trade waste.....	19
Legacy sites with photographic and x-ray development facilities	20
Storm water drainage	20
Renal and reverse osmosis (RO) water systems	21
Biocidal treatment.....	21
Mental health	22
Natural gas and liquid petroleum gas (LPG)	22
Appendix A: Image description	23
Figure 1: Fire safety coordination and responsibility matrix	23

Introduction

These Engineering guidelines are a guide for the development of design and specification documentation for health care facilities. For glossary of terms and common abbreviations used in the guide refer to Volume 1.

A key objective for delivery of healthcare facility projects is the provision of facilities that provide for:

- achievement of optimal patient care using a model of care for the patient
- contemporary approaches to design
- practical and easy usage
- fitness for purpose
- value for money

It is expected that all projects will be delivered in line with the requirements of all relevant codes and regulations, and all designers are be aware of these obligations.

Any engineered deviations from relevant statutory requirements and other standards due to unique project circumstances need to be thoroughly and holistically assessed, proved, clearly articulated or documented, and signed off by the relevant authority.

All designers will assess the provisions of standards, such as the *Australasian health facility guidelines* (AusHFGs), and determine an appropriate application of these to their project. In new, major hospital developments, it is envisaged the requirements of AusHFGs and these guidelines will be closely adhered to, except where deviations are associated with new models of care, operational policies or procedures, or innovative approaches to the delivery of health services.

On smaller projects and projects where substantial refurbishment is envisaged, designers will critically evaluate the AusHFGs to determine their applicability and suitability to the project during planning, and deviations will be clearly articulated or documented, and signed off by the relevant authority.

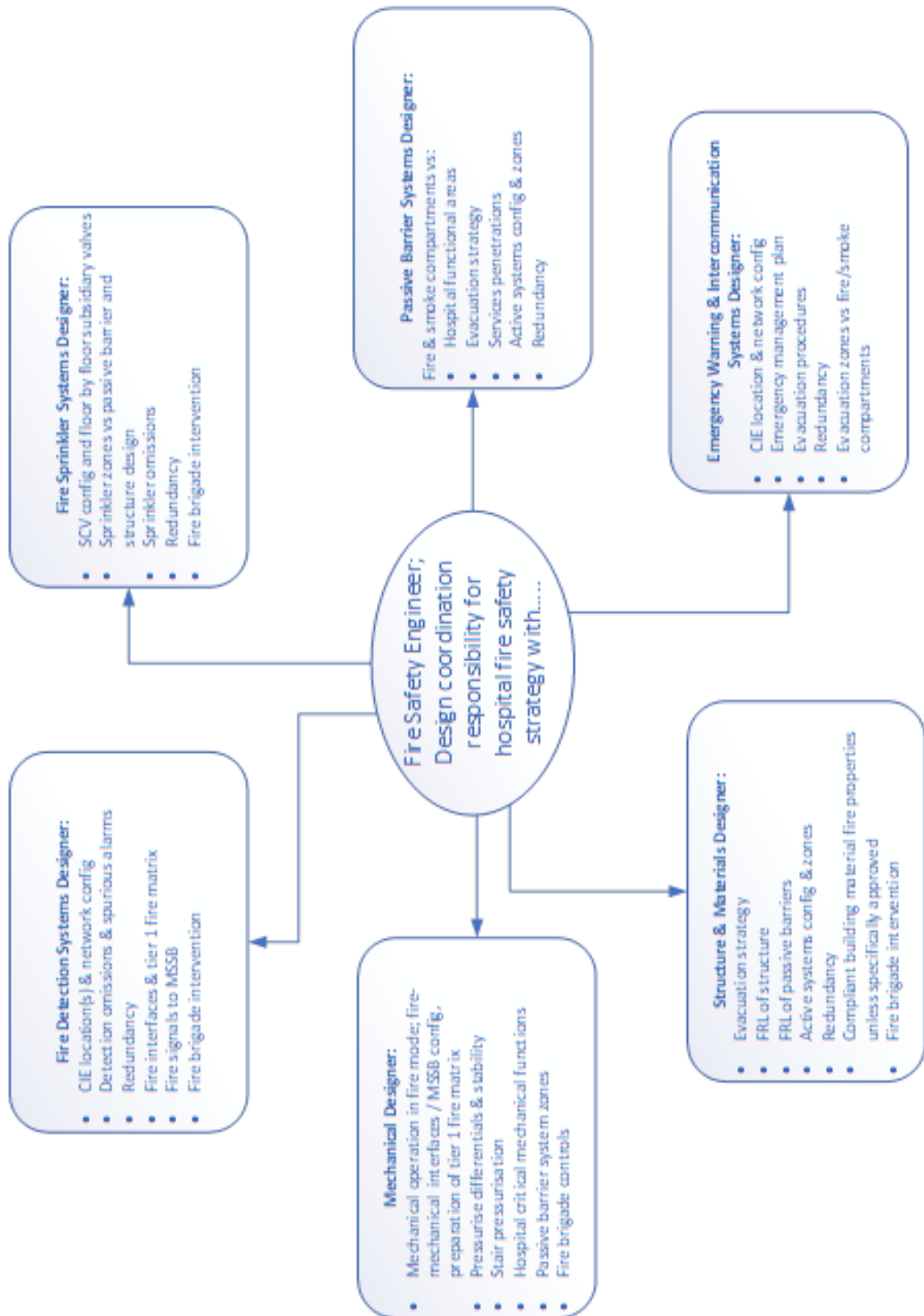
Volume 5 – Fire and Hydraulics forms part of a suite of documents in the *Engineering guidelines for healthcare facilities*. The documents in this series are:

- Volume 1 – Fundamentals
- Volume 2 – Electrical and lighting
- Volume 3 – Data, comms and security
- Volume 4 - Heating, ventilation and air-conditioning
- Volume 5 – Fire and hydraulics
- Volume 6 – Specialist healthcare engineering and provisions
- Reference table 1 – Design parameters
- Reference table 2 - Acoustic design parameters
- Reference table 3 - Required noise reductions for room adjacencies

Fire safety engineering

- 5.1 Fire safety engineering design for hospitals must be prepared in line with the processes and methodology described in the *International fire engineering guidelines* and the Department of Health and Human Services' (DHHS) *Capital development guidelines – Series 7*; in particular:
- 7.0 – Manual for first-time and infrequent users
 - 7.1 – Fire risk management policy and procedures
 - 7.2 – Fire risk management engineering guidelines
 - 7.6 – Fire risk management for hospitals.
- 5.2 Fire safety must be addressed holistically within the hospital design so that a cohesive integrated fire safety strategy is developed through the design process. As fire safety is multi-disciplinary, the fire engineer must coordinate relevant fire safety aspects with other designers, contractors and hospital management and staff to determine the hospital fire safety strategy. Figure 1 illustrates common design inputs for a hospital fire safety strategy.
- 5.3 Evacuation of large areas of a hospital presents many safety and logistic issues and should be absolutely minimised; however, it must remain as an option within the fire safety strategy. Enough design redundancies should be incorporated to enable a 'protect in place' approach for patients and staff. Nevertheless, a full building evacuation must be considered and must be feasible within the design solution; this includes a means to evacuate critical high dependency wards located above ground level to the outside.
- 5.4 Key aspects of design that are the responsibility of the fire engineer are:
- compliance with the DHHS Capital development guidelines – Series 7 and *International fire engineering guidelines*
 - performance solutions in line with the BCA, using a detailed risk assessment process and quantitative analyses where appropriate
 - integrated fire system design approach
 - design contingencies for evacuation of any ward or area and total building
 - definition of fire-mechanical system interfaces through preparation of a tier 1 fire matrix (zone by zone)
 - identification of critical hospital areas which must maintain their functional performance under fire mode conditions, for example, operating theatres, isolation rooms, CSSD sterilisation zones or PC3 laboratories
 - construction phase, commissioning and acceptance requirements for fire safety systems
 - maintenance requirements for fire safety systems
 - preparation of the fire safety handbook at project completion

Figure 1: Fire safety coordination and responsibility matrix



Fire services

Introduction

- 5.5 The design of fire systems must comply with the Building Code of Australia's Deemed-to-satisfy (BCA DTS) provisions and referenced Australian standards unless approved through a fire engineered performance solution that has been prepared in line with the Fire safety engineering section of this volume.
- 5.6 The design and performance of individual fire systems is defined by the fire engineer to achieve the required level of fire safety holistically. Individual fire service professionals or contractors are then responsible for design preparation of those individual systems. In the absence of an approved fire performance solution, compliance with BCA DTS provisions is mandatory.
- 5.7 Individual fire services designs cannot be altered or modified without approval of the responsible fire engineer.

Scope

- 5.8 The following services and systems are a part of fire services:
- fire detection systems and interfaces
 - emergency warning systems and intercom systems for emergency purposes
 - automatic fire sprinkler systems
 - mechanical smoke control systems
 - fire hydrants and fire hose reels
 - fire extinguishers and fire blankets
 - special risk systems such as gaseous fire suppression systems.

Minimum standards

- 5.9 The minimum requirements for the design of fire systems are the BCA DTS provisions and related Australian standards or as approved in the performance solution and fire engineering report.
- 5.10 All clauses outlined in the following section are in addition to statutory requirements.

Master planning

- 5.11 Fire services masterplans will be complimentary to site conditions.
- 5.12 Planning is a critical part in the strategy for fire services design for health buildings. Depending on the project size and new build versus existing refurbishments, a planning strategy will address the following issues:
- existing authorities' infrastructure regarding water mains and fire mains
 - existing internal site services relating to refurbishment and extensions
 - location of plant and equipment
 - cost and budget impacts
 - future expansion of services and master-plan analysis including bushfire risk and other potential external hazards
 - architectural and building impacts
 - maintenance access and replacement of services and plant without interruption to critical hospital services

- noise and vibration impact
 - valving and zoning of services to allow minimal disruption will maintenance be required.
 - MFB and CFA time frames and approval process will be considered.
- 5.13 Projects with clearly identified future stages and master plans will be designed so that services infrastructure has the adaptability to cater for proposed future buildings to the site without having to replace or rebuild systems. Consideration will be given to future connections to avoid disrupting hospital services.
- 5.14 In planning a new building project or refurbishment, the fire response will be considered, not only for the building in question but also for the entire site. The level of integration will be determined by the level of functional interaction required between these buildings and the hospital fire management plan and emergency procedures. Fire brigade intervention and hospital management of an emergency must form part of the design input to development of the fire safety strategy for the building and site.
- 5.15 The integration of fire systems between other hospital buildings will be achieved via the appropriate infrastructure so that the integrity and performance of fire systems is maintained.

Design guidance

- 5.16 All fire services equipment will be located to ensure adequate space to be maintained and will be able to be cleaned and replaced without disruption to the building's day to day procedures.
- 5.17 The design of fire systems will not preclude the use of innovative technologies.
- 5.18 Designs will avoid the reticulation of mains pipework under buildings. Mains pipework will offset at the perimeter of the building into a riser shaft at the perimeter of the building where practicable. Suitable valves are to be installed on all main services so that future connections can be made without disruption to existing hospital services.
- 5.19 Gaseous fire suppression systems may be installed in communications rooms, server rooms and rooms with electronic equipment in lieu of sprinkler protection in consultation with the hospital management.
- 5.20 The building management system (BMS) may be used for fire equipment monitoring purposes but shall not directly control fire equipment. Fire equipment which may be monitored includes static water tank levels and fire pumps, mechanical systems including fans and dampers,
- 5.21 Smoke detectors in ward sleeping areas and in mental health facilities will be configured so that the light-emitting diode (LED) indicator does not pole (flash) during normal operations.
- 5.22 Emergency warning systems will be configured to minimise patient trauma in patient areas. Remote display units and mimic panels in the nurses' station, together with visual indication with T3 strobe and audio annunciation with mute facilities at the mimic panel may be acceptable via a performance solution.
- 5.23 Minimum opportunity for ligature points in mental health facilities and wards.
- 5.24 Internal mains, risers and fire detection and emergency warning CIE within multi-storey buildings will incorporate a 25 per cent additional service capacity for future expansion. This requirement will be clearly shown as such on fire services drawings and schematics and then clearly labelled as such upon completion.
- 5.25 Carbon dioxide fire extinguishers will be used in patient care areas in lieu of dry chemical extinguishers.

Water supply

- 5.26 Ensure that appropriate supplies, storage and fire pump facilities are negotiated with the water authority and fire brigade early in the concept design phase and included in the scope and cost plan.
- 5.27 Ensure that the water supply flow and pressure is provided for both hydrant and sprinkler systems to operate simultaneously.

Systems integration

- 5.28 In fire mode, ensure the required fire and life safety system interfaces are detailed so that the operation of other building services are carried out under the control of the fire system. Ensure that the systems operate in concert with the agreed fire safety strategy and the emergency procedures developed by the hospital. Interfaces will be provided between the fire detection system and the following building services systems:
- mechanical ventilation used for smoke hazard management
 - general air conditioning systems
 - specialised air conditioning or ventilation systems
 - building management systems
 - security and access control systems
 - automatic door operators
 - door holders for doors in fire or smoke compartment walls and
 - elevators (lifts) to assist in controlled vertical evacuation.
- 5.29 Consider the use of the latest convergent technology in fire detection systems allowing the integration of other equipment and technologies to provide enhanced response and occupant notification. This may include the provision of graphic displays on colour monitors, text messages to pocket pagers and mobile telephones, interfaces to security and access control systems to initiate pre-programmed functions.

Sustainability

- 5.30 Water saving initiatives will be considered for the sprinkler and hydrant systems – further advice is in the *Guidelines for sustainability in capital works*. For example:
- The installation of an on-floor isolation valve for each level of the sprinkler system so that each level can be drained and isolated only. This will prevent the entire installation being drained and avoid large sections of the building being isolated and unprotected during maintenance or alterations.
 - The installation of sprinkler and hydrant system annubar flow test lines that discharge either back into the respective system storage tanks.
 - Refer also to the Victorian Building Authority's (VBA) practice note 60 on water saving options available when testing fire safety systems. This can be found under 'Practice notes' on the [VBA website's Practice notes and resources page](https://www.vba.vic.gov.au/building/resources) <https://www.vba.vic.gov.au/building/resources>.
- 5.31 More design advice is available on [Health.vic's Managing health and environmental risks of water supply page](https://www2.health.vic.gov.au/hospitals-and-health-services/planning-infrastructure/sustainability/water/managing-water-supply) <https://www2.health.vic.gov.au/hospitals-and-health-services/planning-infrastructure/sustainability/water/managing-water-supply>

Hydraulics

Introduction

- 5.32 The purpose of hydraulic services in a hospital is to provide adequate and reliable water, gas and drainage services.
- 5.33 The minimum requirements for the provision of potable water supply, hot water supply, warm water systems, sanitary plumbing and drainage, stormwater drainage and gas installations in healthcare facilities are those listed in this guideline, the National Construction Code incorporating the Plumbing Code of Australia and AS3500.
- 5.34 In addition to the minimum requirements and depending upon the type of facility and installed services, the following Regulations and Australian standards will apply:
- Plumbing (Cooling Towers) Regulations
 - Building (Cooling Tower Systems Register) Regulations
 - AS 4032 - Thermostatic mixing valves – Materials, design and performance requirements.
- 5.35 All clauses outlined in the following section will be in addition to statutory requirements.

Scope

- 5.36 Hydraulics services covered under the design guidelines comprise:
- gas services (natural and LPG)
 - sanitary drainage
 - sanitary plumbing
 - trade waste plumbing and drainage
 - trade waste pre-treatment
 - stormwater drainage systems including gravity or syphonic principles
 - rising mains and pumps
 - fixtures and fittings
 - water services (hot and cold and warm water systems)
 - fire hydrant systems and fire hose reel system
 - hydrotherapy pools
 - water recycling systems including rainwater collection and reuse systems with associated treatment systems subject to cost and benefit analysis
 - renal dialysis
 - reusable medical device reprocessing
 - helipad drainage.

Fundamentals

Materials

- 5.37 Materials will be selected that are suitable for the specific characteristics of the service being installed. This will include consideration of parameters such as temperature and concentration of wastes, corrosion, leaching and chemical attack. Any materials that come into contact with the water in a hot and cold-water installation must comply with the requirements of AS/NZS 4020.

- 5.38 The designer will carefully consider all impacting and contributing environmental factors which affect the materials used in the hydraulic systems. Materials will be selected that are suitable for both the specific environmental characteristics of the locality of the facility and the service being installed. Issues like water quality and hardness, piping materials in locations which experience temperatures below zero degrees, exposure to UV, proximity to the coast (exposure to saltwater spray) will all be considered prior to the final selection of materials.
- 5.39 Materials will be specifically suitable for:
- temperature
 - chemical waste
 - treated water systems
 - acoustics requirements specific to the location.
- 5.40 Water quality will not cause risk to patients and will be suitable for intended medical procedures.

Plastic pipework

- 5.41 Designers will consider the location of exposed plastic pipes to ensure that there is no likelihood of mechanical damage and effects of UV light otherwise suitable protection around the pipe will be necessary. Plastic piping should be adequately supported and incorporate adequate means of accommodating expansion, bearing in mind that plastic pipes have a much greater coefficient of thermal expansion than metal pipes.
- 5.42 Designers will also consider the potential risks to the systems posed by material incompatibility within the systems, such as polypropylene random copolymer pipework and copper.
- 5.43 Manufacturers tailor plastics used in pipes and fittings for specific applications and factors such as pressure, temperature and life-cycle analysis, which consider specific water qualities inclusive of oxidation levels. Manufacturers' recommendations should be strictly followed when selecting appropriate pipes and fittings for an application. Designers will not assume that a pipe or fitting suitable for one application can be used in any application. For example, water treatment systems used for the control and management of legionella may not be compatible with the proposed plastics in the pipework system, in which case the proposed plastic system must not be used. Incorrect selection may not be covered by manufacturers' warranties and may result in shortened service life and system failure.

Availability

- 5.44 Where water supply is critical it will be available all the time – refer to Volume 1 – Essential services.
- 5.45 Where main supplies are proved to be unreliable by past records, 24-hour storage for domestic consumption will be provided. The storage system will comply with the requirements of AS3500. The storage tank will be divided to allow for cleaning. The designer will critically assess the storage requirements for other supply such as cooling towers. Where loss of a service can causes unacceptable risk, service will be monitored, alarmed and provided with a back-up. Critical areas such as renal dialysis, operating unit, ICU, CSSD, acute inpatient units (one dirty utility and one bathroom), biochemistry (including pathology) and activities where relevant unacceptable risk can occur, will be defined in the project brief.

Maintenance

- 5.46 Fixed services and maintenance points will be in a manner that does not create unacceptable risk or disturbance to patients or staff, including maintenance personnel and healthcare procedures.

- 5.47 Service elements such as pipes, isolating valves operating switches and alarms will be clearly identified.
- 5.48 Fixtures will be easily cleanable. Water discharge devices such as toilet cisterns and shower roses, will be selected to enhance water conservation.

Design criteria

- 5.49 The design of water piping systems will achieve 200kPa minimum static water pressure at any outlet and a maximum water pressure of 500kPa at any outlet. The maximum velocity of water within pipework will be limited to 1.5 m/s irrespective of the piping material in the water supply system. The velocity for the circulation in hot water systems will be in the range of 0.6 to 1.0 m/s.
- 5.50 Hot and cold water services will reticulate in separate risers to general HVAC services.
- 5.51 In line with AS 3500, all dead legs will be kept to a minimum to ensure that enough water is flushed out of the pipe system at every use. For pipework 20 mm or more, the maximum allowable dead leg will be 6m to the furthest outlet or TMV. 15mm pipework will have a maximum dead leg of 3m.
- 5.52 The use of warm water systems (such as centrally generated and distributed warm water) where the hot water temperature at the start of the distribution system is less than 60°C is not encouraged. The use of thermostatic mixing valves with remote monitoring is the preferred method of delivering warm water. This provides a more reliable method of controlling legionella and will minimise the affected area in case of any issues arising.
- 5.53 Further guidance is available on the VHHSBA website. Designers should also refer to the following information on the Health.vic website:
- [Legionella risk management](https://www2.health.vic.gov.au/public-health/water/legionella-risk-management-guidelines) <https://www2.health.vic.gov.au/public-health/water/legionella-risk-management-guidelines>
 - [Guidelines for legionella control in health and aged care facilities](https://www2.health.vic.gov.au/about/publications/policiesandguidelines/guidelines-for-legionella-control-in-aged-care-facilities) <https://www2.health.vic.gov.au/about/publications/policiesandguidelines/guidelines-for-legionella-control-in-aged-care-facilities>.

Water supply

- 5.54 For all potable water systems, water will comply with National water quality management strategy – Australian drinking water guidelines. Where water does not comply with the guidelines or local guidelines, water treatment or filtration plant will be provided to maintain the integrity of the water.
- 5.55 Where the water supply is unreliable, local critical demand will be satisfied with local back-up. Duty and standby pumps will be designed and installed if the supply system includes pumping.
- 5.56 Where possible, locate reticulation pipes in the ceiling spaces, clear of mechanical equipment with droppers connected to the sanitary fixtures and equipment.
- 5.57 Avoid locating pipework over sensitive areas and inpatient areas that could be adversely affected by noise generated in water pipes. Hot and cold water pipes will be separated by enough distance to avoid heat transfer. Hydraulic services will not be located above electrical services.
- 5.58 Water supply systems will be adequately zoned and isolated to provide local safety shutdowns while maintaining maximum availability.
- 5.59 Where practicable, it is recommended that the water service be supplied from an external ring main, valved to maintain a continuity of supply in each section while maintenance is undertaken.

- 5.60 Isolation valves will be located on service lines to individual fixtures or group of fixtures. It is recommended that all valves be easily accessible adjacent to or from roof-space access walkway.
- 5.61 Pipework will be identified in line with AS 1345 – Identification of the contents of pipes, conduits and ducts. Single fixture or zone backflow prevention devices will be designed to comply with AS 3500.1 – Water supply. Vacuum breakers will be installed in hose bibs and supply nozzles used for connection of hoses or tubing in laboratories, cleaner's sinks, bedpan-flushing attachments and autopsy tables.
- 5.62 Single fixture or zone backflow prevention devices will be designed to comply with AS 3500.1 – Water supply. Appropriate devices will be installed in hose bibs and supply nozzles used for connection of hoses or tubing in laboratories, cleaner's sinks, bedpan-flushing attachments and autopsy tables to prevent contamination of the connected supply.
- 5.63 To prevent condensation, closed cell foam insulation will be installed on pipework where the dew point can be reached. Insulation will have a continuous vapour barrier.
- 5.64 All isolation valves for hydraulic services will have permanently fixed plastic or brass identification discs. Discs will be clearly permanently engraved to identify the item.
- 5.65 Water meters will be provided to all main water users, such as:
- cooling towers make-up water
 - hot water systems feed water
 - CSSD
 - kitchens
 - laundries.

Hot water supply

- 5.66 System design generally will comply with the National Construction Code incorporating the Plumbing Code of Australia and AS3500.4 Hot water supply systems.
- 5.67 All hot water pipework will be insulated – this includes all legs of cross-linked polyethylene pipework greater than 2m.
- 5.68 It is recommended that at least two hot water units (N+N) or multiple units (N+1) be installed in each main system. Remote point of use type systems may use a single unit.
- 5.69 Hot water piping is recommended to be arranged in a ring main or several ring mains and incorporate a hot water return pipe.
- 5.70 Hot water supply to areas such as dirty utilities will be separated from the remainder of the hot water system using approved back-flow preventers.
- 5.71 Central hot-water distribution systems serving patient care areas will have a flow and return to provide continuous hot water at each hot water outlet. The temperature of hot water for showers and bathing will be appropriate for comfortable use but will comply with AS 3500.4 – Hot water supply systems:
- storage and circulation temperature of not less than 60°C
 - 45°C at the outlet of sanitary fixtures used primarily for personal hygiene purposes for the aged, the sick, children or people with disabilities in healthcare and aged care buildings.
- 5.72 When the cold water supply fails, the hot water supply will be shut down automatically to avoid risk of scalding. Circulation pumping will be designed and installed with both a duty and stand-by pump. Calorifiers will be of a failsafe design.

Warm water systems

- 5.73 The use of warm water systems (centrally generated and distributed warm water) where the hot water temperature at the start of the distribution system is less than 60°C is not encouraged. The use of thermostatic mixing valves with remote monitoring is the preferred method of delivering warm water. This provides a more reliable method of controlling legionella and will minimise the affected area in case of any issues arising.
- 5.74 Thermostatic mixing valve (TMV) designs will comply to AS 4302 – Thermostatic mixing valves – Materials, design and performance requirements, and installation will comply to AS 3500.4 – Hot water supply systems. Tempering valves will not be used. TMVs will be installed at low level and, where concealed, TMVs will be identified with clear signage in a visible location to ensure servicing is carried out.
- 5.75 All new TMVs will have an inbuilt thermal flushing mode or function to allow thermal flushing without the need to re-commission the TMV after each thermal flush.
- 5.76 Designers should also refer to the following information on the Health.vic website:
- [Legionella risk management](https://www2.health.vic.gov.au/public-health/water/legionella-risk-management-guidelines) <https://www2.health.vic.gov.au/public-health/water/legionella-risk-management-guidelines>
 - [Guidelines for legionella control in health and aged care facilities](https://www2.health.vic.gov.au/about/publications/policiesandguidelines/guidelines-for-legionella-control-in-aged-care-facilities) <https://www2.health.vic.gov.au/about/publications/policiesandguidelines/guidelines-for-legionella-control-in-aged-care-facilities>.

Sanitary plumbing and drainage

- 5.77 For new projects, design teams will undertake early investigations with local supply authorities to confirm adequate sewer mains are available and reliable.
- 5.78 The designer will consult with users to determine the nature of all chemical discharges to ascertain the project requirements for trade waste retention and treatment.
- 5.79 Drainpipes will be designed and installed to comply with AS 3500.2 – Sanitary plumbing and sanitary drainage, and to suit the waste carried and the temperature of waste. Where possible, it is recommended that pipework be concealed. It is recommended that vents be interconnected in roof or ceiling spaces to reduce the number of roof penetrations.
- 5.80 Inspection and cleaning openings will be positioned external to the building fabric. Where this is not possible, inspection and cleaning openings will be positioned in ducts or within the wet areas it serves. Inspection and cleaning openings will not be positioned in ceiling spaces.
- 5.81 Access pits suitable for cleaning and pumping out are recommended in service areas rather than cleanout openings within pipes and junctions. Access pits are recommended to be located adjacent to vehicular access.
- 5.82 Gravity drain systems will be installed wherever possible. If pumping systems for the disposal of sewerage or effluent are installed, they will be installed in duplicate and will be connected to the hospital standby generator power supply. The storage volume of a pump-out system will be as AS3500 or local authorities' requirements. The systems will normally incorporate a minimum of four (4) hour storage up to 24-hour storage in the event of disruption in normal power supply, subject to a risk analysis. All level sensors will be wired to the BMS and a local audible and visual alarm be provided near the pit or outside the door if the pit is in a room. An alarm will be raised in case of power failure.
- 5.83 Mixing of chemical wastes that could result in fume emissions will take place within a vented drainage system and not at a common tundish.

- 5.84 Wastewater systems access covers, inspection openings and inspection chamber covers will not be located within high risk areas.
- 5.85 Wastewater systems will be planned to eliminate access covers, inspection openings and inspection chamber covers being located within functional areas.
- 5.86 Waste pipes are recommended to be in service areas and not pass through walls and ceiling spaces of patient rooms and treatment rooms.
- 5.87 Floor drainage grates will not be installed in the clean area of a sterile supply unit or treatment area. Floor drains are recommended to be rationalised to an absolute minimum due to their ability to harbour bacteria.
- 5.88 Floor drains or open tundishes will not be installed in operating and birthing or delivery rooms.
- 5.89 Inspection and cleaning openings should be positioned external to the building fabric. Where this is not possible, inspection and cleaning openings will be positioned in ducts or within the wet areas it serves. Inspection and cleaning openings will not be positioned in ceiling spaces.
- 5.90 Access pits suitable for cleaning and pumping out are recommended in service areas rather than cleanout openings within pipes and junctions. All access pits are to have airtight covers.
- 5.91 All level sensors will be wired to the BMS and a local audible and visual alarm provided near the pit or outside the door if the pit is in a room.
- 5.92 Drain liners serving automatic blood-cell counters will be carefully selected to eliminate the potential for undesirable chemical reactions (or explosions) between sodium azide wastes and copper, lead, brass, and solder.
- 5.93 Drainage piping is not encouraged within the ceiling or exposed in operating and delivery rooms, nurseries, food preparation areas, food serving facilities, food storage areas, computer centres and other sensitive areas. Where exposed overhead drain piping in the areas is unavoidable, special provisions will be made to protect the space below from leakage, condensation or dust particles.
- 5.94 Designers will make sure that velocities are maintained in drain runs, especially in runs with 4.5L (low flush) WCs. Nominal pipe gradients will normally need to be increased to accommodate low flows and prevent blockages occurring. Typically, this will result in the minimum gradient, as stipulated in AS3500.2, being increased to 1:40 in a DN 100 drain and 1:65 in a DN 150 drain – this will be confirmed by the system designer. In refurbishment projects, the designer will check existing drain runs and gradients to minimise the risk of retrofitted low flush appliances leading to nuisance blocking when the building is in use.

Rainwater and condensate water capture and re-use

- 5.95 It is not recommended that rainwater is used for drinking or food preparation.
- 5.96 Captured rainwater / condensate will not be used for toilet and urinal flushing in clinical areas.
- 5.97 While the installation and use of rainwater (roofwater) harvesting systems in some settings is subject to specific regulation in Victoria, the quality and acceptable uses of rainwater are not regulated. New facilities considering rainwater as an alternative water supply will ensure that the water is safe for its intended use. It is recommended that the Department of Human Services' Rainwater Use in Urban Communities—Guidelines for Non-drinking Application in Multi-residential, Commercial and Community Facilities is considered when establishing rainwater systems in HealthCare Facility.

These guidelines have been developed to help health care facilities with risk management when accessing alternative water supplies (including rainwater) for non-drinking applications and

planning for water security. The guide is underpinned by Victoria's Safe Drinking Water Act and the Australian Guidelines for Water Recycling (NRMMC, EPHC and AHMC 2006) and is intended for use in conjunction with the water management plans for health services.

- 5.98 Water reuse or recycling schemes in HealthCare Facility will be managed in a manner that is safe and sustainable. This requires the adoption of the risk-based hierarchy approach which promotes water conservation, followed by choosing the most appropriate alternative water supply with the lowest risk, and lowest use of energy and resources for each situation. The guidelines will be used alongside other critical documents and guidelines including water management plans, demand management and essential services risk management plans.
- 5.99 Where condensate capture (the recovery of water condensing on HVAC cooling coils) and re-use is planned, the condensate will be treated in the same manner as rainwater. The collection system must be a dedicated recovery pipework system and will discharge into the rainwater recovery storage tanks. From there the water will be treated in the same manner as the rainwater.
- 5.100 The condensate recovery system must be separate to any plantroom drainage, floor gully drains and the like, in the same area.
- 5.101 The quality of rainwater and the associated management controls need to be proportional to the level of exposure to rainwater - the more likely it is that rainwater will be ingested, the higher the water quality and more stringent the management controls need to be.
- 5.102 Applications of rainwater which have an increased risk of human contact and therefore increased risk of ingestion or inhaling include the following:
- High pressure washers
 - Above ground spray irrigation systems
 - Manual washdown using handheld water nozzles
 - Water features
- 5.103 Typical recommended treatment of rainwater for the above uses will include first flush diverters, suitably sized water filters and UV filtration, however the final water treatment must always take into consideration pollutants which may be deposited on the roof and ultimately into the rainwater from the surroundings.
- 5.104 Applications of rainwater which have a lower risk of human contact and therefore lower risk of ingestion or inhaling include the following:
- Subsoil irrigation
 - Toilet flushing and urinal in non-clinical areas.
 - Drip irrigation
- 5.105 Typical recommended treatment of rainwater for the above uses will include first flush diverters and suitably sized water filters, however the final water treatment must always take into consideration pollutants which may be deposited on the roof and ultimately into the rainwater from the surroundings.
- 5.106 Whilst the above rainwater reuse options are identified as a lower risk, a thorough reuse assessment process needs to be conducted for each project.

Trade waste

- 5.107 The treatment of medical and industrial wastes will be in line with the requirements of the local water supplier and other relevant regulations, statutory codes and rules.

- 5.108 Connect mechanical plant equipment drains to the sewage system plant that discharges water containing chemicals. Drains from fan coil and air handling units may discharge to sewer or stormwater.
- 5.109 Plaster traps will have easy access for emptying and cleaning. Plaster traps will be located outside the treatment room or will be accessible from outside the room. Servicing will be able to be carried out with minimum disruption.
- 5.110 All pre-treatment waste systems, such as dilution pits, arresters and strainer baskets, will be in the service or dirty zones of the department if the system cannot be installed externally.
- 5.111 Kitchen grease traps will be located and arranged to permit easy access without the need to enter food preparation or storage areas. Grease traps will be located on-site in a position accessible from outside of the building without need to interrupt any services and is easily accessible for tanker vehicle access. If the grease arrestor is located inside the building, a suitably sized and ventilated room will be provided above the arrestor to allow cleaning and to ensure objectionable odours do not escape into other areas of the health care facility. Grease arrestors will be sealed and provided with a chamber vent that extends to the roof.
- 5.112 The direct pumping of grease waste will be avoided wherever possible. Where the provision of grease waste pumping is provided for maintenance purposes of the grease arrestor, a permanent pump-out pipe link to a disposal point will be provided if no alternative exists. The pumps installed will be a positive displacement helical screw type. Traps will be stainless steel.
- 5.113 Helipad drainage systems will incorporate appropriate trade waste capture and storage.

Legacy sites with photographic and x-ray development facilities

- 5.114 Copper pipes will not be used to convey trade waste products as photographic wastes corrode copper. UPVC is the preferred material. Fixer and developer will be collected and stored for off-site treatment and disposal. Fixer and developer will not be discharged to sewer.
- 5.115 In Radiology, close attention will be given to the discharge of waste from x-ray film processing machines as only rinse water can discharge to sewer.
- 5.116 Associated chemicals are not permitted to be discharged to sewer and must be disposed off-site.

Storm water drainage

- 5.117 Storm water system design generally will comply with AS3500.3 – Stormwater drainage, as referred to in the BCA, and local authorities' by-laws that are applicable. Designers will also consider current climate change adaptation policies (refer to Volume 1 of these guidelines).
- 5.118 Roof drainage systems will be designed to handle a 1:100-year intensity, based on available Bureau of Meteorology statistics, and incorporate separate overflow relief discharge to minimise roof gutter overflow and consequent building damage and service interruptions. Designers will consider the potential effects of a changing climate and will refer to the government's climate change website (refer to Volume 1).
- 5.119 Consideration will also be given to ways of preventing leaf build up in gutters to prevent building damage and service interruption due to gutter overflow. External eaves gutters will be considered instead of internal box gutters. Where internal box gutters are designed, the designer will demonstrate an effective overflow strategy.
- 5.120 Storm water drainage grates will be cross webbed in car parks and paths and not be in wheelchair access areas or trolley areas. Pumps, if required, will be as previously specified for sewer pumps.

- 5.121 Where pits are in trafficable areas, the class or type of pit will be suitable for the proposed traffic loading.
- 5.122 Roof outlets in concrete roofs will be located to allow for visual inspection and be kept clear of any plant installed on the roof. The outlets will be provided with domed grates to allow for a higher water level will debris build up around the outlet.
- 5.123 Subsoil drainage will be provided to all retaining walls, planters and areas where potential ground water ingress could occur. Sub soil drainage will gravitate where possible to the stormwater drainage system.
- 5.124 Where subsoil drainage water is pumped, the pits will be sized to allow for the proper operation and maintenance of the pumps. Pumps will be installed in a dual or triplex configuration with at least one pump as standby.
- 5.125 All level sensors will be wired to the BMS system and a local audible and visual alarm provided near the pit or outside the door if the pit is in a room.

Renal and reverse osmosis (RO) water systems

- 5.126 Special consideration will be given to the design of the renal and RO water systems regarding the water quality requirements, pipe loop design, material and plant selection.
- 5.127 The designer will confirm with the pipe and fitting material manufacturer that the material is suitable and is ISO or Australian Standard certified with renal or RO water and that the use in these systems does not void the warranty.
- 5.128 Where fittings are manufactured to be used in renal water system, these fittings will need to have traceability of material and manufacturing process to an accepted pharmaceutical component manufacturing process.
- 5.129 The pipe loops will have minimal dead legs that do not allow for stagnant water.
- 5.130 Fittings that allow water circulation up to the isolation valve will be considered in the installation.
- 5.131 For RO water systems serving renal dialysis equipment, the design will be undertaken in collaboration with the equipment supplier to ensure system compatibility.
- 5.132 A separate RO water system will be provided to the CSSD in compliance with AS4187.
- 5.133 RO water systems generate four litres of waste water for every one litre of RO water produced. The waste water from RO systems will be captured and reclaimed for building use.

Biocidal treatment

- 5.134 Along with maintaining a temperature control regime, there will be occasions where additional biocidal treatment is required for the effective control of Legionella and other opportunistic waterborne pathogens. However, the selection of suitable treatment is complex and depends on several parameters, and the chosen biocide must be properly managed. This is particularly the case with cold water services compared with hot water services where, with the benefit of circulation, water is returned to the calorifier or water heater and is then pasteurised. Designers will take into consideration that effective concentrations of some biocides are difficult to achieve in hot water systems due to gassing off. For water intended for consumption, the biocide concentrations must not exceed prescribed concentrations for drinking water.
- 5.135 Where designs use biocides to control microbial growth in water systems, meticulous control and monitoring programs will be in place if they are to be effective. Careful consideration will be given to any equipment that is connected to the water system that may be affected by the application of a biocide (for example, renal departments, haemodialysis units and neonatal units).

- 5.136 There is no single water treatment system that is effective and appropriate in every case, and each system has both merits and limitations. The implementation of biocide control together with maintaining temperature control requires vigilance to ensure the safety of particularly vulnerable patients in healthcare premises. Dedicated treatment and supply arrangements will be required for renal and haemodialysis units or for making up infant feeds where concentrations of biocides in the water would be harmful to patients.
- 5.137 Each water treatment system will be validated and monitored to demonstrate that the correct biocide concentration is being achieved for controlling microbial growth and does not exceed prescribed or guideline values under differing flow rates and water demands. Refer to the *Australian drinking water guidelines*.
- 5.138 The frequency of biocide monitoring and verification, in addition to temperature monitoring, will depend on the treatment regimen selected. Each treatment system will have a failsafe mechanism to prevent overdosing while also ensuring that effective concentrations are maintained throughout the system. When a water system is being purged and is initially dosed, checks will be made at various system outlets to ensure that satisfactory concentrations of treatment chemicals are being achieved throughout the system. Automatic leak detection of the biocidal treatment system is also recommended for hazardous substances.
- 5.139 When deciding on a water treatment system, designers will consider the following:
- existing water supply chemistry
 - relative complexity of the technology
 - safety concerns (such as risk to processes such as dialysis)
 - bactericidal efficacy
 - viricidal efficacy
 - protozoicidal efficacy
 - by-products of possible health concern
 - residual persistence
 - contact time required
 - pH control required
 - overall process control
- 5.140 Refer to the Australian drinking water guidelines for further information.

Mental health

- 5.141 Hydraulic fixtures and fittings and special purpose equipment will be designed for psychiatric or prison use with anti-ligature designs to minimise opportunities for self-harm in patient-occupied areas of mental health units.

Natural gas and liquid petroleum gas (LPG)

- 5.142 Gas systems will comply with relevant Australian standards and local supply authority. Authority gas meter sets will be located external to the building where possible and gas distribution pressure inside a building will comply with AS5601.
- 5.143 Kitchens will be provided with appropriately labelled gas isolation valves at the main entry point for isolation in the event of fire. Isolation valves that are intended for emergency shut down will be located at a height that does not require ladder access.
- 5.144 Provision will be made for the continuity of gas supply where the facility has a post-disaster function or requires gas services for sustaining human life, in accordance with HTG-2020-001 – Fundamentals (Essential Services).

Appendix A: Image description

Figure 1: Fire safety coordination and responsibility matrix

The fire safety engineer has design coordination responsibility for the hospital fire safety strategy with the following roles.

Fire detection systems designer

- CIE locations and network configuration
- Detection omissions and spurious alarms
- Redundancy
- Fire interfaces and tier 1 fire matrix
- Fire signals to MSSB
- Fire brigade intervention

Fire sprinkler systems designer

- SCV configuration and floor-by-floor subsidiary valves
- Sprinkler zones versus passive barrier and structure design
- Sprinkler omissions
- Redundancy
- Fire brigade intervention

Mechanical designer

- Mechanical operation in fire mode, fire-mechanical interfaces or MSSB configuration, preparation of tier 1 fire matrix
- Pressure differentials and stability
- Stair pressurisation
- Hospital critical mechanical functions
- Passive barrier system zones
- Fire brigade controls

Passive barrier systems designer

- Fire and smoke compartments versus:
- Hospital functional areas
- Evacuation strategy
- Services penetrations
- Active systems configuration and zones
- Redundancy

Structure and materials designer

- Evacuation strategy
- FRL of structure
- FRL of passive barriers
- Active systems configuration and zones
- Redundancy
- Compliant building material fire properties unless specifically approved
- Fire brigade intervention

Emergency warning and inter-communication systems designer

- CIE location and network configuration
- Emergency management plan
- Evacuation procedures
- Redundancy
- Evacuation zones versus fire and smoke compartments