



# DHW Technical Guideline

## **TG036 Commissioning New Potable Cold & Hot Water Services in Healthcare Facilities – Project Requirements for Consultants and Contractors**

### 1. Purpose

This technical guide (guide) sets out the Department of Housing and Works (DHW) requirements for ensuring that new potable water systems are appropriately sanitised and ready for use at the Handover stage on healthcare projects. While this guide is specific to healthcare projects, the requirements detailed in the Australian Standard for Plumbing and Drainage, AS/NZS 3500.1:2021 and the Plumbing Licensing Board's - Technical Note on Disinfection of Storage Tanks and Water Services (July 2019), are applicable to all projects. This guide follows these requirements, and includes additional obligations for DHW projects, which incorporate new, or additions to, potable cold and hot water systems. Where potable hot water systems are referenced, this is also applicable to potable warm water systems.

The sequence of activities, which collectively constitute the water quality assurance process on DHW's healthcare construction projects up to handover stage, and are the subject of this guide, are listed in Table 1 below.

<b>Table 1: Sequence of Activities</b>		
<b>No.</b>	<b>Description of Activity</b>	<b>Stakeholder Responsibility &amp; (Section Ref).</b>
1	Quality of the incoming water supply is tested and analysed to inform the hydraulics design.	<b>DHW</b> (ref. 2.1)
2	Pipework designs, and the associated maintenance access, promotes easy flushing, and disinfection of the systems.	<b>Consultant</b> (ref. 3.0 & 4.0)
3	Extent of the flushing and disinfection process is specified in the hydraulic services contract documentation, together with the system parameters (pipe sizes, velocities, volumes) to inform the flushing and disinfection methodology.	<b>Consultant</b> (ref. 4.0)
4	During installation, workmanship practices will be inspected.	<b>Consultant</b> (ref. 5.2)
5	A sanitisation process Specialist Subcontractor, appointed by the Contractor, will develop the Water Management Plan (WMP), covering the process and sequence for flushing and disinfection.	<b>Consultant &amp; Contractor</b> (ref. 4.0 & 5.1),
6	The WMP will be endorsed and monitored by the Consultant.	<b>Consultant</b>

		(ref. 4.0 & 5.4)
7	Disinfection process will be carried out by a sanitisation process Specialist Subcontractor under direction of the Contractor.	<b>Contractor</b> (ref. 5.0)
8	Quality of the incoming water supply is again tested and analysed, together with tests of the water supply at the distal point outlets and specified locations within the healthcare facility, for each potable cold and hot water system.	<b>Contractor</b> (ref. 2.2 & 5.6)
9	The system will be maintained in the disinfected state until handover.	<b>Contractor</b> (ref. 5.6)
10	Records of the methodology and results from the flushing and disinfection process will be provided as part of the project deliverables.	<b>Contractor &amp; Consultant</b> (ref. 5.6)

It is important to note that meeting Australian Drinking Water Guidelines 6 (ADWG) at the point of consumption is a mandatory requirement, as is the requirement to meet the Western Australian Health Facility Guidelines (WAHFG) for Engineering Services - 2021 (Guidelines for the construction, establishment, and maintenance of Public Hospitals), and requires a joint effort from **all** relevant project stakeholders.

Stakeholders noted in this document and their abbreviations include:

- Client Agency (Agency)
- Department of Housing and Works (DHW)
- Hydraulic system designer (Consultant) – note; during the Construction phase this may be persons other than the Consultant who are nominated by the Superintendent's Representative
- Sanitisation process Specialist Subcontractor (Specialist Subcontractor)
- Licenced plumbing contractor (Contractor)

The contractual arrangements for parties referenced in this guide are managed in consultant's appointments and head contracts and are therefore excluded from further discussion here.

## 2. Water quality

The standard of potable (drinking) water quality to be achieved is defined in the ADWG and is characterised by being safe, clear, and free from objectionable taste and odour.

To measure the effectiveness of the Consultant's hydraulic design, and the Contractor's installation and commissioning procedures, water quality tests will be conducted prior to design work being undertaken, and at the end of the commissioning phase, to ensure the potable cold and hot water supply meets ADWG requirements. It is acknowledged that the initial water quality test may record chlorine residuals in the system exceeding the ADWG aesthetic guideline value of 0.6mg/L, where facilities operate chlorination equipment.

## 2.1. Initial water quality test(s)

The Initial Water Quality Tests of the potable water supply to the site, or at the new point of connection to an existing system, shall be organised by DHW and sampled in accordance with:

- WA Department of Health – Drinking Water Sampling Procedure for Buildings - Commissioning
- AS/NZS 5667.1, Water Quality – Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.
- AS 5667.5, Water Quality – Sampling - Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems.
- AS 2031, Water Quality – Sampling for microbiological analysis.
- Australian Drinking Water Guidelines.
- WAHFG for Engineering Services – 2021

Should the Consultant have concerns with the condition of the existing system, samples may need to be taken from the incoming main, potable water storage tanks, and at the new point of connection. The Consultant will provide advice on this requirement.

Where the results from the initial test(s) indicate unacceptable deviation from the ADWG requirements, remedial actions will be taken, under instruction from DHW, and the tests redone until a satisfactory result is achieved.

All analysis will be conducted at a NATA accredited laboratory and the resultant Certificate of Analysis shall be made available to the Consultant and will include, at a minimum, the parameters listed in Table 2 below:

Table 2: Water Testing Parameters	
Physical Parameters	Units
pH	
Electrical Conductivity @ 20°C	µS/cm
Apparent Colour	PCU (Note i)
Turbidity	NTU (Note ii)
Temperature ( <i>measured when sample is taken</i> )	°C
Chemical Parameters	Units
Free Chlorine Residual	mg/L
Total Chlorine	mg/L
Chlorides	mg/L
Total Hardness	mg/L
Total Dissolved Solids	mg/L
Arsenic	mg/L

Antimony	mg/L
Cadmium	mg/L
Copper	mg/L
Chromium	mg/L
Iron	mg/L
Lead	mg/L
Manganese	mg/L
Mercury	mg/L
Molybdenum	mg/L
Nickel	mg/L
Phosphorus	mg/L
Silica	mg/L
Tin	mg/L
Zinc	mg/L
<b>Microbiological</b>	<b>Units</b>
E. coli	CFU/100mL (Note iii)
Total Coliforms	CFU/100mL
Legionella	CFU/mL
Heterotrophic plate count (HPC)	CFU/mL

## NOTES:

- i PCU = Platinum Cobalt Units
- ii NTU = Nephelometric Turbidity Units
- iii CFU = Colony-Forming Units

## 2.2. Commissioning phase water quality tests

At the end of the commissioning phase, the Contractor shall organise the water quality tests. These tests will be taken from the start of the systems and at the distal points on each floor level, in each building, for both the potable cold and hot water systems. In addition, the water from each potable water storage tank will be tested and the water at each of the locations listed in Table 3 below:

Table 3: Additional Sampling Points	
Facility	Additional Outlets
New Hospital and Major Regional Health Facilities	Every drinking fountain and outlet used for drinking or food preparation purposes

Alterations, additions and refurbishments to Hospitals and Regional Health Facilities	Every <u>new</u> drinking fountain and outlet used for drinking or food preparation purposes
New or refurbished Regional Nurses Station	Every drinking fountain only

All commissioning water quality tests must be conducted to the same standard as the initial test, as per Table 2 above, for full comparison purposes.

### 3. Safety planning and risk assessment

The Agency's safety regime at the workplace must be complied with fully, including inductions, safe work method statements, and permit-to-work procedures, as directed by the authority in control of the workplace and in compliance with statutory requirements.

Safety is of paramount importance. All system designs must be risk assessed through the Consultant's Safety in Design process, with risks identified and ideally mitigated. Further, where risks cannot be mitigated, the responsible person for mitigating the risks must be identified and notification provided through appropriate communications.

Risks associated with the disinfection process are numerous, including excessive temperatures from pasteurisation processes, mishandling chemicals, inadvertently supplying heavily chlorinated water to occupied premises, and overdosing the system pipework leading to premature deterioration of the system. It is due to this level of risk that DHW requires the Contractor to engage a Specialist Subcontractor to develop the Water Management Plan (WMP) and conduct the disinfection program, under direction from the Contractor.

It is also important to note that while assessing risks, large water tanks may constitute working in a confined space. While no construction activity should be undertaken unless properly assessed and executed by competent and appropriately licenced operatives, the Consultant is responsible for highlighting the possible need for such activities and the heightened level of risk, in the first instance.

Materials and chemicals used in potable water systems, including disinfectants, should be suitable for use with potable water and be compliant with the WA Department of Health's Materials, Products and Substances in Contact with Drinking Water and AS/NZS 4020:2018. The Consultant must state this requirement in their specification and the need to obtain appropriate certification from the Contractor to verify compliance.

### 4. Design phase

It is the responsibility of the Consultant to promote good water quality. Potable water systems that are difficult to maintain in a healthy condition often suffer from common deficiencies that could be eliminated, or certainly reduced, during the design phase.

As referred to in *enHealth - Guidelines for Legionella* control in the operation and maintenance of water distribution systems in health and aged care facilities, a multi-barrier approach is more likely to reduce the risk of system failure. Of the control barriers suggested to reduce the risk, the Consultant's input to the design, commissioning, and operational controls is a key component.

Therefore, the Consultant shall:

- Ensure the designs comply with all statutory requirements, Australian Standards, guidelines, and codes of practice, including *enHealth* (2015), *Guidelines for Legionella*.
- Review the analysis from the initial water quality tests to inform the water plant design.
- Understand how the existing system is configured and operates, including flow and temperature checks by the Consultant, to assess existing limitations that may need to be overcome by the new design. For additional water quality standards in public hospitals, refer to WAHFG for Engineering Services, clause 13.7 Water Conditioning, for preconditioning and monitoring of potable water before use.
- Outline a sequence of works to minimise disruption to the existing premises, where new tanks or pipework are connected into existing systems.
- Provide sufficient design advice in the tender documentation, such as system volumes, flow rates and velocities to enable all parties to make informed decisions.
- Ensure sufficient drains and valves for isolating, venting, and draining the system are provided and appropriately located to permit the system to be filled and flushed easily.
- Design for safe and easy access to the valves and drains, (Note with reference to the use of ladders – If tools are required to carry out the work, and they cannot be carried on the operative's tool belt, or if three points of contact are not possible at all times on the ladder, then a ladder cannot be assumed to be an appropriate means of access).
- Specify equipment where manufacturers can demonstrate their equipment is easily maintained and the cleaning and disinfection procedure is included in their operating and maintenance literature (e.g. point of use water heaters, ice machines, drinking fountains, water coolers, etc).
- Ensure all redundant pipework is removed.
- Be clear on the need to maintain cleanliness on site including such actions as keeping pipes capped until installed.
- Establish Hold Points to witness Contractor's installation and commissioning processes.
- Ensure the hydraulics specification requires the Contractor to engage a water sanitisation Specialist Subcontractor, and that the specification defines the requirements for the Specialist Subcontractor, to prepare the WMP for endorsement by the Consultant, and to collaborate with the Consultant to achieve the necessary outcomes. The WMP will include requirements for flushing and disinfection and the disinfection works must be carried out by the Specialist Subcontractor, under the

Contractor's direction. Refer to DMIRS's Plumbing Licensing Board's Technical Note for guidance on the content of the WMP.

- Ensure the labelling of non-potable water systems is suitably identified and cannot be reasonably mistaken for potable water. The Consultant must be included in the hydraulic specification a requirement for the Contractor to demonstrate compliance with this requirement.

While AS/NZS 3500.1 provides guidance on the flushing and disinfection process for potable water system, referencing this standard alone has proven to be insufficient instruction to the Contractor. Hence, the need for flushing and disinfection and the extent of the work, shall be assessed by the Consultant, identified in the Safety in Design risk assessment process, and the need for the activity clearly detailed in the tender documentation.

## **5. Construction phase**

### **5.1. General requirements**

It is the Contractor's responsibility to ensure the WMP is sufficiently detailed to provide the Consultant with a clear understanding of the processes, chemicals to be used, methods employed, and program of works to achieve the desired outcomes. This will enable the Consultant to endorse the WMP, and schedule inspections at agreed Hold Points.

All works must be completed by competent operatives experienced in the commissioning of potable cold and hot water pipework for commercial premises. Prior to commencing the process, the Contractor must prepare a safe work method statement (SWMS), to which all operatives should have read, understood, and signed to acknowledge their full participation in the agreed methods of execution. The SWMS must incorporate the requirements of the Agency's site-specific safety regime.

The potable water installation shall be flushed as soon as possible after pressure testing. Cold and hot water pipes shall be flushed separately.

### **5.2. Installation stage**

While the design plays a significant part in the successful sanitisation of the systems, it is understood that good management during the installation will lessen the dirt and bacterial burden inside the system, and hence oversight provided by the Consultant will increase the potential for a positive outcome.

Therefore, in addition to the above activities required during the Design Phase, during the Construction Phase the Consultant, or persons nominated by the Superintendent's Representative, shall:

- Witness at the agreed Hold Points, the Contractor's installation and commissioning processes.



It is the Contractor's responsibility to:

- Develop and have endorsed the Water Management Plan.
- Ensure that cold and hot water services are installed in accordance with the appropriate Australian Standards, ADWG, and NCC Volume 3 – Plumbing Code of Australia 2022, and the WAHFG for Engineering Services.
- Ensure all pipework sections (especially systems laid in trenches) are kept sealed and free of debris until installation.
- Provide photographic evidence of the above and that tanks were cleaned internally.

Prior to filling the system, a thorough inspection of all pipework, fittings, plant, and equipment shall be made to ensure that the system is complete and watertight.

Drains must be complete and tested to permit the required discharge from the flushing process.

### **5.3. Flushing process for potable water storage tanks**

The Contractor is responsible for developing the tank cleaning and flushing procedure in the WMP, which must comply with AS/NZS 3500.1. In addition, the Contractor must:

- Produce a safe work method statement specific to the tasks involved.
- Drain potable water storage tanks and remove all sludge and debris. All internal surfaces shall be thoroughly cleaned using high pressure water jet, sweeping, scrubbing or other similar effective means. All water, dirt, and other material accumulated in this cleaning process shall be removed from the tank.
- Fill tanks with potable water until they overflow for a period of 1 minute. If the tank is an existing tank and is connected to a live service, then the work must be undertaken using an appropriate permit system to avoid unscheduled shutdown of services.

### **5.4. Flushing process for pipework systems**

The Contractor is responsible for developing the flushing procedure in the WMP, which must comply with AS/NZS 3500.1. In addition, the Contractor must:

- Produce a safe work method statement specific to the tasks involved.
- Flush with warm water to adequately remove flux residues if necessary.
- Use potable water for the flushing procedure.
- Noting that the velocities concerned can dislodge material in older pipes, provide a 150µm particulate filter or finer on the fill-line to the new system, where necessary.
- Take necessary precautions to protect sensitive valves and equipment (e.g. point of use water heaters, WC flushing valves, thermostatic mixers, etc.) against foreign particles arising from the installation of the system.



- Remove aerators, flow strainers, flow controllers, shower heads or hand showers, and strainers already installed in valves, to increase flow, and replace on completion of the flushing process. In case of concealed thermostatic valves and other sensitive valves, the manufacturer's instructions shall be followed. Filters which cannot be removed, for instance main filters upstream, shall be backwashed or renewed after flushing.
- Open all servicing valves in the section to be flushed.
- Within the WMP define the sequence of works. Depending on the size of the installation and on the layout of the pipework, the system may be flushed in sections. Flushing shall commence at the upper storey of any building and proceed downward, storey by storey. At any particular floor level, the draw-off-points shall be fully opened starting with the point most remote from the riser or furthest downstream. After flushing the furthest downstream draw-off-point, the draw-off points shall be closed in sequence, commencing with the draw-off-point at the upstream end of any circuit.
- Ensure water velocities used for flushing are sufficient to dislodge and transport the dirt and debris likely to be found in the system. The specified minimum flushing velocity should be no less than 0.75m/s, or the design velocity plus 10%, whichever is the greater, and selected based on the largest pipe size in the system or batch to be flushed.
- Ensure the Consultant is notified in sufficient time, as defined in the WMP, to witness the agreed part of the flushing process.
- Water in the system shall be flushed a minimum of 3 times during the flushing process, or until it runs clear, whichever is the greater.
- A complete record of the flushing procedure shall be handed over as a component of the Hydraulic Operating & Maintenance Manuals.

Following successful completion of the flushing processes the systems can be disinfected.

## **5.5. Disinfection process**

The Contractor is responsible for the disinfection process and will ensure the work is undertaken by a competent Specialist Subcontractor to the requirements of AS/NZS 3500.1. In addition, the Contractor must:

- Produce a safe work method statement specific to the tasks involved. Health and safety requirements shall be rigorously adhered to for the transportation, storage, handling, and use of all hazardous disinfectants.
- Disinfection chemicals must be selected to avoid damaging the new or existing plumbing installations and associated appliances. Disconnect sensitive appliances from the system, if this cannot be guaranteed. Sensitive equipment should be

highlighted in the WMP together with the method for keeping the equipment sterile until used, which should follow the manufacturer's recommendations.

- No section of new pipework should be connected to an existing system in use, prior to completion of the disinfection process. The systems being disinfected must be fully disconnected from existing systems. Note, isolating valves do not provide a failsafe means of disconnection.
- Ensure during the whole disinfection procedure that there is no draw-off of any water, other than by the Contractor or their Specialist Subcontractor. A sufficient alternative water supply shall be provided in buildings which are in use.
- Inform all personnel by notices displayed at all draw-off points on site of the disinfection works and services that cannot be used during the process. Ensure that building occupants have been made aware, especially those working outside normal hours, such as cleaners and security guards. It shall also be ensured that no other chemicals, such as sanitary appliance cleaning materials, are added to the water containing disinfection substances until the disinfectant solution is flushed out of the system.
- Inform and obtain approval from the responsible authority, where any supply pipe within the installation is to be disinfected and there is a possibility that the disinfection substance can come into contact with the responsible authority's point of delivery. Complete isolation from the incoming service pipe may be required.
- Continuously record throughout the pipework disinfection process, the level of chlorine circulating in the water and provide this information in chart form to demonstrate the system was safely and appropriately disinfected.
- Inform and obtain approval from the responsible authority where water that has been used to disinfect an installation is to be discharged into a drain or a sewer. Their approval needs to be given before the discharge takes place. Where necessary, a neutralising agent may be required.

## **5.6. Commissioning**

At the completion of the flushing and disinfection process, all valves, cisterns, taps, pressure-relief valves shall be operated to ensure they are functioning as intended.

After disinfection, the system shall be immediately drained and flushed with potable water. Flushing shall continue until any residual disinfectant is at, or below the level supplied by the water authority to the facility and does not exceed 1.2 mg/L of free residual chlorine, whichever is the lesser.

Following the final flushing process, water sample(s) as defined in Section 2.2 above, shall be taken and analysed. This analysis is to ensure that the safe limits detailed in ADWG are not exceeded. Exceeding these limits may indicate the use of the wrong materials during construction, possible damage to the system from the disinfection process, or inadequate disinfection of the micro-organisms in the system. Where values are exceeded, this should be notified immediately to DHW.

Should analysis of the samples indicate inadequate disinfection of the system (i.e., failure of the Microbiological results against the standards set in ADWG), and all other Physical and Chemical results are within the ADWG standard, the Contractor and their Specialist Subcontractor shall propose a further disinfection remedial action plan for endorsement by the Consultant, before remedying the defect. The Contractor will conduct the necessary remedial actions and retests, until the potable cold and hot water systems are compliant. The only exception to this requirement will be, where water is supplied from an existing system and from analysis of the testing results, it is shown that the existing system is the source of the contamination. In such situations, DHW will provide further direction.

Where a system is not brought into use immediately after commissioning, it shall be flushed weekly until Handover, and must be maintained at normal water pressure while subsequent building operations, which may cause damage to the pipes, are being carried out.

A complete record detailing the whole procedure and test results shall be made and handed over to the Consultant for endorsement. The Consultant will review the Operating and Maintenance literature from the Contractor to ensure it addresses how the Agency should operate and maintain the potable water systems in a healthy condition, including future flushing and disinfection procedures.

## **6. Reference standards and codes of practice**

1. AS/NZS 3500.1:2021, Plumbing and Drainage, Part 1 Water Services.
2. AS 5667.5:2022, Water Quality – Sampling - Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems.
3. AS 2031:2012, Water Quality – Sampling for microbiological analysis.
4. AS/NZS 4020: 2018, Testing of Products for use in contact with drinking water.
5. DMIRS Plumbing Licensing Board's - Technical Note on Disinfection of Storage Tanks and Water Services (July 2019).
6. Australian Drinking Water Guidelines 6, version 3.7 or the latest endorsed by the WA Minister for Health.
7. NCC Volume 3 – Plumbing Code of Australia 2022.
8. WA Health Facility Guidelines for Engineering Services (version 2021), Guidelines for the construction, establishment and maintenance of Public Hospitals.
9. WA Department of Health's Materials, Products and Substances in Contact with Drinking Water.
10. enHealth (2015). Guidelines for Legionella control in the operation and maintenance of water distribution systems in health and aged care facilities. Australian Government, Canberra

Document Control				
ECM reference	2025/04669/036 DOC 05601391			
Effective date	November 2022			
Next revision	October 2026			
Content owner	Building and Technical Services			
Enquiries	Consult with content owner or <a href="mailto:principal.architect@dohw.wa.gov.au">principal.architect@dohw.wa.gov.au</a>			
Version	Revision date	Author	Reason	Sections
	28/10/2022	BTS	Draft Release for Review	All
V1.0	04/11/2022	BTS	Final	All
V1.1	October 2025	BTS	Update DHW	All

Document approval				
<p>This guideline was endorsed and approved for use on 6/11//2025 by:</p> <p>Dean Wood, Principal Architect</p> <p>Department of Housing and Works</p>				

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