UNIVERSITY OF LEICESTER

Estates and Digital Services (EDS)
(including water assets directly under its control)

WATER SAFETY PLAN

Book 3 of 3 - Design, Installation and Commissioning

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Not to be read in isolation of other WSP Books 1 and 2

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HYDROP

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i. DISTRIBUTION CONTROL

This EDS Water Safety Plan (WSP) - 'Design, Installation and Commissioning' has a controlled circulation and should not be copied without the permission of the Director of Asset Management and Compliance.

All WSP books are under control of the Building Services Engineer (Water), who instructs any required changes to the current approved document. The current copy of the WSP is to be uploaded upon instruction of the Building Services Engineer (Water) to the University of Leicester EDS intranet where it can be accessed by all parties.

Where changes are requested by persons other than the Building Services Engineer (Water), draft changes are issued to the originator of the change, and the Building Services Engineer (Water) for approval. If after a week no comments are returned, the changes are incorporated into a final copy to be issued as above.

The WSP should not be printed, or stored in other locations than the approved location to ensure the version used is the latest approved version.

ii. MANAGEMENT INFRASTRUCTURE

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Roles and Responsibilities as described in the University's current Water Safety Policy which constitute the 'Operational Water Management Team' for Estates and Campus Services.

1. INTRODUCTION AND AIM

This WSP - 'Design, Installation and Commissioning' provides the detailed instruction, specification and infrastructure for the implementation of the EDS WSP requirements when delivering the design, installation and commissioning of new-builds and major refurbishments.

This document will be complied with by all the EDS employees and by all appointed contractors, in whatsoever capacity, with or without contractual agreements.

Where this document states a Mechanical services contractor, Main Contractor or Sub-Contractor, this means that the specified work must be included within the scheme, it is the Mechanical services contractor's responsibility to ensure the project costs include for the same irrespective of which party procures the works.

All WSP books are under control of the Building Services Engineer (Water), who instructs any required changes to the current approved document. The current copy of the WSP is to be uploaded upon instruction of the Building Services Engineer (Water) to the University of Leicester EDS intranet where it can be accessed by all parties.

Where changes are requested by persons other than the Building Services Engineer (Water), draft changes are issued to the originator of the change, and the Building Services Engineer (Water) for approval. If after a week no comments are returned, the changes are incorporated into a final copy to be issued as above.

This WSP book shall not be used in isolation, and should be issued and read in conjunction with EDS's Water Safety Plan "Book 1 of 3 General Considerations" and "Book 2 of 3 Processes, Procedures and Permits" documents.

The WSP should not be printed, or stored in other locations than the approved location to ensure the version used is the latest approved version.

2. INSTALLATION AND COMMISSIONING OF NEW-BUILD AND REFURBISHED FACILITIES

2.1 Process Management:

The design, installation and commissioning of all new-builds and refurbishment works shall be carried out in accordance with the requirements of this Water Safety Plan.

2.2 Legislation, Standards and Guidance:

As well as complying with the recommendations outlined in this document, the design, installation, commissioning and hand-over of the hot and cold water services, new, extended or refurbished, in any EDS premises should also comply with:

a. The Water Regulations Advisory Scheme's (WRAS) 'Water Regulations Guide', and any other requirements of the local water undertaker;
b. The Water Supply (Water fittings) Regulations 1999.
c. The Water Supply (Water Quality) Regulations 2016.
d. The Construction (Design and Management) Regulations 2015.
e. HSE Legionnaires' disease The control of legionella bacteria in water systems. Approved Code of Practice and guidance on regulations: L8 (Fourth edition) Published 2013
f. HSE Legionnaires' disease: Technical guidance Part1: The control of legionella bacteria in evaporative cooling systems: HSG274 Part 1 Published 2024
g. HSE Legionnaires' disease Part 2: The control of legionella bacteria in hot and cold water systems: HSG274 Part 2 Published 2024
h. HSE Legionnaires' disease: Technical guidance Part 3: The control of legionella bacteria in other risk systems: HSG274 Part 3 Published 2024
i. BS 1710 – 2014 - Specification for identification of pipeline services.
j. BS 8551-2015 Provision and management of temporary water supplies and distribution networks. This document provides complimentary guidance to BS EN 806. It is a guide to the design, installation, testing, operation and maintenance of services supplying water for domestic use within buildings and their curtilages.
k. BS EN 806-1:2000 Specifications for installations inside buildings conveying water for human consumption -General.
l. BS EN 806-2:2005 Specifications for installations inside buildings conveying water for human consumption – Design.
m. BS EN 806-3:2006 Specifications for installations inside buildings conveying water for human consumption - Pipe sizing. Simplified method.
n. BS EN 806-4:2010 Specifications for installations inside buildings conveying water for human consumption – Installation.
o. BS EN 806-5:2012 Specification for installations inside buildings conveying water for human consumption - Operation and maintenance.
p. BS 8551:2017 Provision and management of temporary water supplies and distribution networks.
q. BSI PD 855468-2015 Guide to the flushing and disinfection of services supplying water.
r. BS 7592:2022 – Sampling for Legionella bacteria in water systems – Code of practice.
s. BS 8580-1:2019 – Water Quality – Risk assessments for Legionella Control – Code of Practice.

2.3 Pre-construction works:

Prior to isolating the existing services to make disconnections of existing equipment and plant, or to make new connections, the Mechanical services contractor shall provide 7 days notice in writing to the Client of any isolations that are required throughout the works.

All works carried out to water systems must be recorded using either Permit No. 1: Permit for Release into Use of new installations of small sized pipework installation projects and associated components or Permit 2 - Notification of Area Handover and Permit to Occupy. Permit No.1 is to be used for all small projects where control of the systems is with the contractor for less than 1 day, and all parts are to be dip-disinfected. For all other cases, Permit No. 2 is to be used.

In line with Water Regulations, any installations carried out in Commercial premises are required to have Water Undertaker approval for works to commence or must be undertaken by Water Undertaker approved competent persons through the WaterSafe scheme. A recognised benefit to using an Approved Contractor (including sector installers) is they can carry out some work without the need to provide advanced notification to the water undertaker and their work will be certified upon completion. A “work completed” certificate issued by a WaterSafe recognised plumber provides a defence for property owners who are challenged by a water undertaker enforcing the Water Supply (Water Fittings) Regulations 1999 or during legal proceedings.

The mechanical contractor shall carry out the following assessments or activities and record the results and issue to the University appointed project manager and to the University Building Services Engineer (Water):

a. Prior to isolating the existing services to make disconnections of existing equipment and plant, or to make new connections, the Mechanical Contractor shall provide 7 days’ notice in writing to the Client of any isolations that are required throughout the works.
b. Consider the impact of these works on adjoining/neighbouring system which will remain 'live' during these works and implement all necessary remedial and on-going actions designed to control any risk caused by the planned works. These actions shall be communicated to and agreed by University appointed Project Manager and the University Building Services Engineer (Water) prior to commencement of works.
c. Each project which incorporates 'live' facilities, is completed as quickly as possible and keep the number and frequency of connections to systems supplying 'live' facilities as low and infrequent as practicable.
d. Where pre-handover sampling is requested by the contractor, or UoL as a part of this WSP, the sample points and procedure are agreed before work commences, and any samples are taken.

2.4 Installation Verification:

The installation shall be regularly verified during installation to ensure that it is being carried out in accordance with the requirements detailed above and as specified in the relevant scheme design specifications and contractual agreements. This shall normally be undertaken by the appointed Clerk of Works or if such an appointment is not made then alternatively by the scheme Project Manager. In either case the University Building Services Engineer (water) shall be asked to assist the inspections, and the Project Manager shall record the completion of these checks using the Permits noted above.

The Mechanical services contractor shall provide dedicated clean storage container(s) to store all domestic water pipework and fittings in an orderly manner. All other components for the mechanical installation shall be stored in a separate container. The container shall also be used for ‘dip-disinfection’ and storing the disinfected components before installation. The container SHALL NOT be used for storing tools, personal equipment, bracketry etc (Domestic water pipework, fittings and brassware only).

The shelving for these areas shall be easily cleanable by spraying with disinfectant and wiping down with a clean disposable cloth, i.e. melamine or similar.

The Mechanical services contractor shall ensure that disinfectant and clean disposable cloths are stored within the container at all times.

The Mechanical services contractor shall be responsible for ensuring all components are clean from point of delivery to installation.

Component parts that come in their own individual packaging shall remain in this until the time to either install or disinfected these prior to fitting. Should components be delivered in dirty packaging, there will be a

requirement to clean the packaging prior to storage in order to prevent the contamination of individual components.

All pipework shall be stored with stop ends intact at all times.

Contamination from third parties also working on site during construction, typically, electricians, plasterers, joiners etc. shall be prevented. These trades could unknowingly contaminate the installation. For pipework storage, a hand pushfit (plastic or copper) stop end is sufficient and shall be fitted to all pipework in storage and within the installation. A sheet of plastic held in place with sticky tape is **NOT** acceptable. The Mechanical services contractor shall be responsible to ensure this does not occur.

On site, at no point shall a pipework end be left open to contamination when not being worked on, should this be found the installation shall be written off and replaced at the Mechanical services contractor's cost and without compromising to the program.

For low level installation works, the Mechanical services contractor shall provide a clean tray to lay the components in prior to installation. Typically, connecting up a kitchen sink, WC etc.

During installation on site, all pipework shall be supported off the ground with a pipe support.

Any pipework, components etc. seen laying on the floor shall be scrapped at the Mechanical services contractor's cost.

The Mechanical services contractor shall allow for temporary connection complete with double check valves once chlorinated and test for legionellae, and daily flushing of the water services until a clean result has been obtained, only then may the new service be connected on to the main hot and cold water services serving the area.

It must be ensured that all fittings and fixtures are fitted in a timely manner and no retrospective equipment is to be installed as this will cause dead legs on the system until the installation is complete. It is important to highlight that until the hot flow and return services are connected to the main system there will be no circulation. It is therefore essential that procedures are put in place to ensure that the hot return services are flushed.

All terminal fittings shall be disinfected in accordance with procedures included in WSP Book 2, and for which RAMS shall also be provided to the Project Manager for approval. All works carried out to water systems must be recorded using either Permit No. 1: Permit for Release into Use of new installations of small sized pipework installation projects and associated components or Permit 2 - Notification of Area Handover and Permit to Occupy. Permit No.1 is to be used for all small projects where control of the systems is with the contractor for less than 1 day, and all parts are to be dip-disinfected. For all other cases, Permit No. 2 is to be used.

Where sampling is required as specified in this WSP Book, until the post disinfection sample results are received back, the new pipework is not to be connected/opened up to the existing system. It is important to highlight that should the services be contaminated this contamination would then be distributed to other parts of the system.

Where isolation valves are installed, these shall be installed as close to the 'Tee' as possible. Although this does not usually affect the day to day running of the services it must be noted that should there ever be a requirement to isolate the services from these isolation valves, this would inadvertently create dead-legs. It is therefore recommended that where isolation valves and/or stopcocks are installed i.e. at each branch off, that these are located as close to mains run/Tee as possible. It must be highlighted however, that the position of the valves must not compromise any future maintenance requirements.

It must be ensured that the isolation valves on the hot flow and return are positioned so that circulation is not affected should the outlet need to be isolated.

Upon completion of all works, all assets must be appropriately labelled using approved identification process. At this stage, all sampling locations and designated sentinel outlets must be designated and reported in the hand-over documentation.

The installation shall be regularly verified to ensure that that each installation stage is fully compliant with all requirements stipulated above and be confirmed compliant with design and specification. This shall normally be coordinated with the appointed Clerk of Works or if such an appointment is not made then alternatively with the scheme Project Manager. In either case the University Building Services Engineer (water) shall be asked to assist the inspections and certificate signatures.

2.5 Pre-Commissioning and System Filling (Wetting)

The purpose of pre-commissioning is to ensure that the system is in a satisfactory and safe condition before final filling and setting to work. Final inspection must be carried out by a team including the Project Manager, University Building Services Engineer (water), Mechanical services contractor, System Designer, Water Systems Operational Responsible Person, Installer and any other relevant stakeholders.

The final inspection should aim to ensure that the system is complete, correctly installed and ready for the commencement of commissioning. This will avoid abortive time on behalf of the commissioning specialist. On large or complex projects, a commissioning specialist shall be engaged during the commissioning process.

Filling shall also comply with the requirements of the Water Supply (Water Fittings) Regulations 1999 for the prevention of backflow.

In a new development the water supply infrastructure for the premises is also likely to be new, with installation and disinfection immediately prior to use. In a re-development the water supply infrastructure could be in poor condition, oversized, underused, etc. If the development is large the supply might have been isolated during the build process and could remain stagnant until pressure testing is required. Any dead legs shall be suitably flushed to prevent stagnation during all stages. The local water supplier should be consulted and a plan agreed for the provision of water for initial filling, flushing and disinfection. The Mechanical services contractor needs to ensure that all connections made to the existing water systems during the construction process meet the requirements of the Water Fittings Regulations. Any pipework which remains after construction shall not include blind ends, or redundant connections.

It is critical that the first water entering the system is clean and fit for use. Flushing, sampling and, where required, disinfection of the incoming supply should be carried out immediately prior to first fill of the water system(s) for pressure testing.

Prior to making a connection to existing pipework for extensions or refurbishment, the existing water quality must be confirmed as satisfactory. If the water quality is not satisfactory then remedial works should be carried out on the existing system before connection of the new pipework as a contract variation. Where the building is not to be flushed and disinfected as a whole then the new pipework should be filled and flushed through a double-check valve or other appropriate backflow prevention device.

Filling of the system shall not be carried out without the written authorisation of the Project Manager with assistance from the University Building Services Engineer (water) . Authorisation shall be logged in Permit 2 by the Project Manager. In order to allow for this authorisation, the Mechanical services contractor shall provide a detailed method statement and risk assessment for the process including suitable certification that the water source to be used is microbiologically 'clean' (within the acceptable microbiological contamination parameters detailed elsewhere in this document). No connection shall be carried out without this authorisation.

To ensure effective venting, fill slowly from the bottom upward thus forcing the air to high points for venting to atmosphere. Careful consideration should be given to the setting of valves and air vents before and during filling to avoid airlocks and excessive spillage, particularly where the fill water is treated. Care should be taken not to exceed the working pressure of the system when filling from a high pressure source. When the whole system is filled, disconnect the filling source, open the permanent supply connections and adjust the feed tank water levels.

If water turnover is anticipated initially to be low it might be advisable to bypass or reduce the volume of cold water storage cisterns until the building is ready for occupation. This ensures that flushing during low-use periods draws directly on the incoming supply rather than intermediate storage. If bypassing storage is being considered, the water undertaker should be consulted to ensure conformity to The Water Fittings Regulations [4], [5] and [6] and that no adverse impacts occur.

If a building is to be completed and occupied in stages, the design of the water system should take this into account. Allowance should be made to fill, pressure-test, commission, disinfect and bring into use sections independently without compromising other sections.

When a hot water system (HWS) has been filled and tested it should not then be allowed to stagnate or maintain temperatures between 20°C and 50°C. An HWS incorporating a circulatory system should be operated circulating at operational temperatures continuously after commissioning. Low volume (<15L) point-of-use water heaters should achieve a temperature of 50°C to 60°C at the outlet.

Prior to filling and pressure testing the newly installed pipework, a minimum of 7 days notice shall be given to the Project Manager of the intention to pressure test. It must be ensured that this notification is submitted with a risk assessment and method statement for the proposed methodology to be used. Please note pressure testing with water is not a preferred methodology as this process has been found to significantly contribute to the level of bacterial contamination of a system at hand-over. The preferred method is for sectional test to be pneumatic with final system test to be hydraulic at which point the system must remain full of water and then be flushed in accordance with the requirements of this document.

Note: All distribution pipework and associated storage vessels shall be liberally purged to remove debris associated with the installation process, prior to final connections and end-of-line fittings installation.

2.6 Commissioning:

Correct commissioning is vitally important for the satisfactory operation of the hot and cold water systems. The Mechanical Services Contractor shall draft a fully detailed commissioning method statement which fully aligns with this Water safety plan. This document should detail all individual process, sequencing and timeframes and show how activities align with the main contractors finishing programme (as an example water sampling cannot be undertaken until decorating finished are completed otherwise contamination can occur).

The Contractors commissioning method statement will then need to be submitted to the scheme designers (if appointed) and the University Building Services Engineer (Water) for comment.

This Commissioning Method Statement should specify fully and clearly the extent of the commissioning and the objectives which must be achieved, and should include:

a. full design data on temperatures, chemical levels, water flow rates and pressures;
b. plant and equipment data;
c. number commissioning procedures for thermostatic mixing valves;
d. drawings and schematics;
e. sentinel monitoring points for commissioning
f. asset list
g. microbiological activity levels;
h. a list of test certificates to be provided;
i. water quality (Legionella) risk Assessment to BS 8580:2019 – Water Quality – Risk assessments for Legionella Control – Code of Practice.

The Principal Designer and/or Services Consultant Designer shall prepare for inclusion in the contract documents a list of tests and measurements that are to be taken and recorded by the Mechanical services contractor. These shall be witnessed by the University appointed Project Manager and the University Building Services Engineer (Water) on his/her behalf, and if approved, he/she will circulate the results in accordance with the client's

instructions. The installation, on completion, shall be operated by the Mechanical Services Contractor as a whole, and subjected to functional or performance tests as specified by the Designer and as detailed within this WSP.

The commissioning strategy document shall be prepared by the Mechanical Services Contractor and submitted to the University appointed Project Manager and the University Building Services Engineer (Water) for review before being issued in final form. Typical schedules of checks and performance tests shall be included in the commissioning manual together with record sheets. If performance is not acceptable, the matter should be dealt with in accordance with the contract requirements. The commissioning strategy document should include procedures in line with the WSP book 2 included with this document. Where these procedures cannot be complied with, alternative detailed procedures should be included for approval.

The University appointed Project Manager and the University Building Services Engineer (Water), who shall countersign any relevant test record documents, shall witness commissioning and testing, with the assistance of the appointed Clerk of Works. "As installed" record drawings, schematic diagrams, operating and maintenance instructions must be supplied at the time of handover. Certified records of pressure testing and disinfection shall also be made available. The whole commissioning procedure shall be witnessed by the Clerk of Works if appointed or otherwise the Project Manager with assistance from the University Building Services Engineer (Water), although the involvement of specialists or manufacturers may be required for specific items of plant. Valid calibration certificates shall be submitted and checked for all measuring equipment to be used by the commissioning engineers prior to commencement of commissioning. The commissioning should be carried out in a logical and methodical manner.

The installation, on completion, shall be operated by the Mechanical Services Contractor as a whole, and subjected to specified functional or performance tests. Once the system meets the design intent, the final completion record sheet(s) shall be completed. In the event of performance not being acceptable, the matter should be dealt with in accordance with the contract requirements.

It is essential that a full report of all commissioning and testing activities is compiled and handed over to be incorporated within the operation and maintenance manuals. These commissioning and testing records will be required so that subsequent maintenance and periodic checks can be made to ensure that the installation continues to operate as intended.

In the absence of a scheme Clerk of Works, when required to do so, the University appointed Project Manager and the University Building Services Engineer (water), with assistance from the Authorising Engineer (Water), as required, shall verify and ratify the commissioning process (or stage thereof) and confirm that it is found to be compliant with all requirements stipulated above.

2.7 Hand-Over:

Hand-over of all new-builds and refurbishments must not be carried out until all of the requirements detailed in the relevant processes described above and below are satisfied and the appropriate process Permits completed, signed and issued in line with the instructions in the Permits.

2.8 System disinfection:

Following system filling, the system should be disinfected as soon as practicable, and as close to hand over as possible.

The required water quality shall be achieved by the use of shot-dosing of a suitable disinfecting agent, the levels of which must be maintained within the recommended limits for achieving disinfection as specified within BS EN 806-4:2010 and BSI PD 855468:2015 prior to hand-over. Advice may be found in HSG274 Part 2 and in accordance to procedures included within the WSP book 2. These can be obtained on request from the University appointed project manager and the University Building Services Engineer (water)

Proprietary solutions of disinfectant should be used in accordance with the manufacturers' instructions. The COSHH Regulations require that the risks from using the disinfectant for each task be assessed to ensure that the control procedures adopted are suitable for the particular application. Disinfection should not be undertaken

before materials, for example linings in cisterns, have fully cured. Advice should be sought from equipment manufacturers to ensure that proposed disinfection chemicals will not adversely affect performance of all parts of the system. No heat source should be applied during the disinfection procedure, including final flushing. The disinfection must be carried out as close to hand-over (and occupation) as practicable.

A disinfection method statement should be provided to the University appointed Project Manager and the University Building Services Engineer (Water) for approval, which should be included within the Commissioning Plan.

Disinfection Requirements – method to be provided in Commissioning Plan	
Incoming Mains (MCWS)	Method for Mains disinfection for new mains supplies
Water Storage Tanks/Hot water Generation Vessels	Method of disinfection for tanks and calorifiers
Outlet Fittings	Method of disinfection of end fittings including confirmation that all taps, shower heads, TMVs, associated strainers and aerators have been dip-disinfected prior to final connection.
Distribution System and all outlets	Method of disinfection, to include: • Injection/dosing point • Points to be tested • Method of flushing hot water services (when no heat is present) • Chemical MSDS, and COSHH assessment • Method of injection
	Confirmation that suitable water samples (where noted required) have been collected and submitted for microbiological analysis not earlier than 48hrs following disinfection.

2.9 System Flushing:

Once disinfected, systems should not be drained unless full disinfection is to be carried out prior to building occupancy and use. Allowing water in newly installed plumbing to stagnate can result in water borne bacteria (biofilm) growing and proliferating in the storage vessels and peripheral parts of the domestic water system. To reduce the risk of this, flushing must take place to introduce fresh water throughout the system.

Due to the requirement to sample, and have sample results returned before handover, a minimum of 3 weeks will be required following disinfection until the area or building can be handed over. Where this period is extended, the time between disinfection and handover will be a maximum of 30 days. Where 30 days is exceeded, the agreed handover sampling must be repeated in addition to the previously agreed sample set.

In the period between disinfection, and handover, the system and outlets shall be flushed to mimic normal usage. This should be planned to run fresh water through the system each day. This shall include as a minimum:

Flushing Requirements After Disinfection	
Water Storage Tanks	Run at lowest possible level during period.
Incoming Mains - daily	Take temperature of mains after flushing for 2 minutes
Water Storage Tanks - daily	On a daily frequency, drain the tanks, and refill with fresh water, take temperature of stored water.
Sentinel cold outlets – daily	Flush cold for 3 minutes, take temperature of cold to ensure sentinel is within 2C of tank or mains source temperature. If not within 2C of tank/mains at 2 minutes, continue flushing until it is. Record time taken and final temperature.
All outlets, other connection points and dead legs – daily rotational.	Rotationally flush all points ensuring both hot and cold feed are run, cold is to be flushed until within 2C of tank or source temperature, Hot (or TMV blended) to be run for 20 seconds. 40% of all outlets should be flushed each week day. Where hot water system is not run at temperature, the procedure for ensuring flushing of all dead legs should be described and provided in the Commissioning Plan.

All flushing processes and tasks must be suitably and sufficiently recorded by using Certificate of Conformity Usage Evaluation and Flushing.

2.10 Temperature/supplementary bacterial control dosing Profiles:

These tests shall be performed prior to contractual handover and bringing the system into use and reported on Certificate of Conformity No. 11 Water Storage Tank Temperature Profile and Certificate of Conformity No. 12 Domestic Hot and Cold Water Source and Distribution ClO2/Temp. Profile. Separate thermostatic measuring and recording equipment should be used, that is, independent of any building management system. It will be necessary to have systems fully operational and to simulate typical draw-off of water. Once disinfection has taken place, it is essential to put in place measures to ensure that hot and cold water temperatures are maintained.

Once disinfection has taken place, it is essential to put in place measures to ensure that hot and cold water temperatures are maintained.

Where surface temperatures are taken on copper pipe, no adjustment for pipe loss shall be allowed, and the temperature shall be recorded as read.

These tests shall be performed prior to contractual handover and bringing the system into use. Separate thermostatic measuring and recording equipment must be used, that is, independent of any building management system. It will be necessary to have systems fully operational. The majority of tests will require simulation of typical draw-off of water, the method of this draw off should be provided by the Design Consultants for inclusion in the Commissioning Plan. Water temperatures to be recorded three times equally spaced over 24 hours, under simulated design usage requirements, to demonstrate that the recommended temperatures are being achieved. Temperature measurement equipment shall be suitably calibrated via UKAS calibration and accredited to ISO 17025 and calibration certificate made available. Allowance for seasonal variation should be allowed within the commissioning plan – design performance figures shall be given for Summer and Winter conditions.

Temperature Monitoring Requirements – Cold Water Systems All tests to be carried out under simulated design conditions.	
Incoming MCWS at meter	Measure and record temperature at water meter. To be used as datum for cold water system measurements.
Cold Water Storage	Measure and record the Incoming water temperature at the inlet valve. Temperature not to be more than 2°C higher than Incoming MCWS at meter temperature.
	Measure and record the stored water. Temperature not to exceed 20°C. Temperature also not to be more than 2°C higher than Incoming MCWS at meter temperature.
Cold Water Distribution	At the furthest designated sentinel points monitor the cold water through 2 minutes of running the outlet. Final temperature at 2 minutes of running not to be more than 2°C higher than incoming MCWS at meter temperature. Monitor temperature during the 2 minute flush, if over 25°C at any time during the 2 minutes, the peak temperature should be reported to investigate unsuitable heat gain in the cold water distribution system. Where TMV is fitted to the outlet, the temperature is to be monitored at the inlet to the TMV.
Temperature Monitoring Requirements – Recirculating Hot Water Systems All tests to be carried out under no demand conditions, with at least 2 hours with no system usage.	
Hot Water Generation and Storage	Each Vessel - Measure and record the flow temperature using a contact thermometer. Temperature to be taken from flow pipework as close to the Hot Water Generator or vessel as possible. Temperature to exceed 60°C on all vessels
	Combined flow temperature - measure and record the combined flow temperature using a contact thermometer. Temperature to be taken from flow pipework as close to the header outlet as possible. Temperature to exceed 60°C. This combined flow temperature is to be used as the Datum reading for all flow temperatures.

	Measure and record the return temperature using a contact thermometer. Temperature to be taken from return pipework as close to the Hot Water Generator as possible. Temperature to be maximum 5ºC less than lowest tertiary return temperature recorded.
	Isolate Cold Feed and open drain point and measure and record temperature. Temperature to exceed 60ºC.
	If Vessel is designed not to achieve 60C throughout the time in use, the vessel temperature including the bottom shall be designed to be raised to 60ºC for 1 hour per day. Isolate Cold Feed and open drain point and measure and record temperature at start and end of scheduled hour. Temperature to exceed 60ºC.
Recirculating HWS Flow Distribution – No more than 5ºC loss will be allowed between combined flow header and the connection point to outlets.	Measure and record the temperature on the recirculating pipework at the connection point to each outlet, or dead leg connection. These are known as the Tertiary Loops on large systems. The temperature at each connection point shall be within 5ºC of the combined flow temperature (Datum point above).
Recirculating HWS Return Distribution – No more than 5ºC loss will be allowed between the connection to outlet points and the hot water generator return connections.	Measure and record the temperature on the recirculating pipework before each connection to the return header. The temperature shall be within 5C of the highest tertiary loop measurement.
Temperature Monitoring Requirements – Non-Recirculating Hot Water Systems All tests to be carried out under no demand conditions, with at least 2 hours with no system usage.	
Non-Recirculating Hot Water Distribution Low Volume storage heaters of volumes 1-100L	At the Sentinel furthest outlet measure the outlet temperature and time taken to steady temperature and record the outlet temperature; where the sentinel outlet is TMV fed, the measurement shall be taken from the inlet to the TMV. Temperature to exceed 55ºC within 10 seconds of opening the outlet.
Instantaneous Water Heaters without storage and with less than 2m dead leg to outlet.	Measure outlet temperature and flow rate at set full flow. Flow rate to be 3.5-4.5L per minute at 39-41ºC
General facilities	
Blended outlets	HWS to the TMV minimum 55ºC within 10 seconds
	CWS to TMV absolute maximum 25ºC at all times
	Outlet 39 - 41ºC for showers
	Outlet 39 - 41ºC for basins
	Outlet 42 - 44ºC for baths
	All Thermostatically mixed outlets to comply with TMV3 scheme approval. All outlet temperatures to reach required temperature within 10 seconds of being opened, compliance with D03 requirements shall be noted where temperatures over the maximum temperature are found on first flush of the outlet.
	The TMV should also be subject to failsafe check as a part of the commissioning of all TMVs, in line with manufacturer recommendations, and Procedure for service in this WSP.
All BMS temperature monitoring points	Where BMS monitoring is fitted, collect the readings of all BMS temperature sensors throughout the tests above, and for at least 24 hours afterwards, with record points at least every 15 minutes.

2.11 Microbiological Analysis:

Sampling shall only be considered under the following circumstances:

a. Following significant failure of the agreed control regime for buildings under EDS control.
b. Following recommendation by independent Legionella Risk Assessment.
c. As a part of commissioning assurance for project or capital work where they meet the conditions set out below.

Conditions under which sampling must be undertaken for projects and capital work:

a. Projects which include sectional pipe testing with drain down between the testing.
b. Commissioning of any new domestic water systems.
c. Returning to use of any system which has been drained down, or disused for more than 4 weeks.
d. Returning to use of any system where suitable control methods and testing have not been in place in line with Book 1 of this WSP.
e. Any new building acquisition.
f. A significant extension to a pre-existing water system.

Microbiological Sampling must be carried out in accordance with:

a. BS EN ISO 5667-1:2006 BS 6068-6.1:2006 - Water quality Sampling - Part 1: Guidance on the design of sampling programmes and sampling techniques.
b. BS ISO 5667-24:2016 Water quality - Sampling Part 24: Guidance on the auditing of water quality sampling.
c. BS 7592:2008 - Sampling for Legionella bacteria in water systems – Code of practice.
d. BS 8554:2015 Code of practice for the sampling and monitoring of hot and cold water services in buildings.
e. LEG 25 – 'Microbiological Sample Collection Protocol', found in Section 4 Ad-hoc Risk Management and Control Processes.

Sampling will be carried out by the appointed and UoL approved water hygiene contractor only, who will arrange the collection of the samples. No sampling is to be carried out by other contractors, or sub-contractors. Suitable notice of sampling date, order and instruction for sampling visit shall be provided to the approved water hygiene contractor at least 14 days before the planned sampling date. Sampling for projects shall be carried out between 48 hours and 7 days from the completion of system disinfections.

Sampling details, where sampling is determined required, the below samples shall be taken:	
Incoming MCWS	Disinfected outlet post-flush TVC@37/TVC@22/ecoli/coliforms
Cold Water Storage Drain (each tank)	Disinfected outlet post-flush TVC@37/TVC@22/ecoli/coliforms
Hot Water Generation and Storage (each vessel)	Disinfected outlet post flush Legionella
	Disinfected outlet post-flush TVC@37/TVC@22/ecoli/coliforms
Designated Sentinel outlets (all designated outlets on each hot and cold system)	Pre-flush Legionella
	Disinfected outlet post-flush TVC@37/TVC@22/ecoli/coliforms
	Disinfected outlet post-flush Legionella
Additional representative samples	Mixer showers – minimum of 12% of all mixer showers fitted – blended pre-flush Legionella sample
	Thermostatic mixer taps – minimum of 12% of all TMV taps fitted – blended pre-flush Legionella to be taken
	Mixer taps – minimum of 12% of all mixer taps fitted – blended pre-flush Legionella to be taken
	Electric showers 12% of all electric showers fitted – blended pre-flush Legionella to be taken
	Point of use heaters – furthest outlet from each point of use heater to be taken pre-flush Legionella
Note: an outlet is designated within the count if it is a separate hot tap, separate cold tap, a mixer tap, a thermostatically mixed tap, a mixer shower, or electric shower. When working out required samples, all fractions are to be rounded up, i.e. if there is only one shower, this shower must be taken. If there are 13 showers, 2 showers must be taken. If an outlet designated for sampling is a shower, mixer outlet, or Thermostatic Mixer tap, the outlet shall be sampled blended. If an outlet designated for sampling is separate hot or cold, separate hot and cold samples are required. Samples to be collected **no earlier than 48 hours** following disinfection.	

Whenever sampling is planned, a sampling plan shall be issued to the Building Services Engineer (Water) at least 14 days before sampling is scheduled. The Sampling plan shall be accompanied by a design drawing showing sample locations.

Where projects are being carried out on buildings already under an EDS control regime, and sampling is determined to be required for the project, sampling must be carried out before work starts to determine levels in the systems before work commences. This shall include sampling post disinfection post flush for Legionella and post disinfection post flush for TVC@37, TVC@22, ecoli and coliforms from the connection point to the supply system.

Results will be received by the University appointed project manager and the University Building Services Engineer (water) the same day as receipt of results by the approved sampling contractor, the building cannot be handed over, or occupied until the results are received. Note – Legionella tests can take 14 days from submission to the laboratory to result.

Domestic water microbiological analysis sample results - level of contamination key:

Analysis Sample	Reported Results	Result Interpretation
Aerobic count TVC@37 and TVC@22	None Detected- 1000cfu/ml	Pass
	>1,000cfu/ml	Fail
Legionella sp.	None Detected	Negative - Pass
	1cfu/l - 1,000cfu/l	Significant - Fail
	>1,000cfu/l	Highly Significant - Fail
Coliforms and *E. coli*	None Detected	Negative - Pass
	>0cfu/100ml	Highly Significant - Fail

Where out of specification samples are found, a remedial action plan shall be proposed before works are carried out, to be approved by the Building Services Engineer (Water).

2.12 Asset List:

A full and complete asset list must be provided to the Head of Compliance, Building Services Engineer (Water), and UoL appointed risk assessor one month prior to handover in order to ensure risk assessment can be scheduled before handover, and PPM can be suitably arranged once successful completion and handover has taken place.

2.13 Occupation:

Occupation of all new-builds and refurbishments must not be carried out until Handover has been completed, including completion and issue of the relevant permits.

3. WATER SYSTEM/PLANT DESIGN AND INSTALLATION

3.1 Supplies From a Water Undertaker:

The following factors must be taken into consideration by the design team in the initial stages of the design:

a. The water undertaker's requirements.
b. The estimated daily consumption and the maximum flow.
c. The location of the available supply.
d. The quality and pressure required.
e. The cold water storage capacity required.
f. The likelihood of there being any contaminated land on site.
g. The proposed method of storage.
h. The minimum and maximum pressures available at the service connection.
i. Details of the physical, chemical and microbiological characteristics of the water supply and scope of any possible variations in such characteristics.

3.2 Primary Water Supplies:

a. All water supplied to University must comply with current legislation on water quality.
b. Primary Water Supplies feeding all domestic purposes shall be regarded as wholesome if the Water Supply complies with the requirements of 'The Water Supply (Water Quality) Regulations 2016'.
c. Where water supply testing is required as a part of the commissioning process, results shall also be interpreted in line with the University's 'Biological Contamination Measured Parameters'.

No connection to any part of the University's Estates Primary water supply shall not be made without the written authorisation of University Estates.

3.3 Water Treatment and Conditioning Requirements:

a. The need for water treatment and/or conditioning, and the treatment processes used shall depend on the purposes for which the water is to be used and the quantity required for each purpose.
b. Where water treatment or conditioning is installed, the commissioning records must include details of settings of the equipment, dosing rates and requirements for testing.

3.4 General Design and Installation Considerations:

Domestic water systems and associated equipment which utilise water and can affect the water supply, the atmosphere and the user, shall be properly designed and installed and be subjected to the following regimen:

a. All designs must be in accordance with all relevant and current Guidelines and British Standards detailed in this document. The designer should meet all statutory mandatory and good practice design requirements including those provided (but not limited to) Building Regulations and all relevant CIBSE documentation.
b. Where changes to existing water systems are planned, the entire system should be surveyed and the design of the old and proposed new components recalculated to determine the validity of current and proposed demand, including flow rates, pressure and temperature loss, to validate the current and proposed water systems. Where systems are being extended, the calculations should also show the suitability of current hot water generation, and requirement for recirculation, or booster pump upgrade.
c. All systems shall be designed to use temperature as the primary biological control measure. All cold water in the storage and distribution system is to be stored and distributed at <20C at all times. All Hot Water is to be stored at >60C. Where recirculation of hot water is utilised, all flow pipework between hot water generation and outlets shall be within 5C of flow header temperature at all times; return pipework from the outlet connection shall also have no more than 5C loss anywhere in the system between the connection to the outlet, and the return back to the hot water generator.

d. The systems shall be carefully designed to, where practicable, eliminate or minimise aerosol production and avoid excessive water retention. They must also be designed to be readily drained, cleaned, and where necessary, suitably disinfected.
e. For design purposes – small systems, up to 10 items of sanitary ware pipework shall be sized using BS EN 806 sizing method and larger systems shall be sized using BS8558 Appendix C.
f. No materials used in construction shall include those that are known to harbour or provide nutrient for bacteria. Plastic pipe-work shall not be used - rigid copper is the required material and this shall include all final connections to end-of-line fittings. Any materials that come into contact with the water shall comply with the requirements of the Water Supply (Water Fittings) Regulations 1999 and have been assessed for compliance with the Water Supply (Water Fittings) Regulations 1999. Requirements are listed on the Water Regs UK website. All fittings shall be WRAS approved.
g. All dedicated laboratory sink water installations shall be completely separated, by employing category 5 backflow prevention through dedicated break tank(s), from other water installations, such as hand-wash basins, located in a laboratory environment but not used for laboratory work.
h. Care should be taken with laboratory outlets as some (usually a small number) may require higher than normal flow delivery.
i. Designers shall ensure that the existing plant i.e. pumps, calorifiers etc, are capable of coping with all proposed changes to the system.
j. Where hot and cold pipes are installed in ceiling voids and risers they shall be independently supported from each other and the hot water pipes shall be installed above the cold water pipes (never install hot water pipes below cold water pipes to minimise heat transfer). All pipework supports shall be fully insulated with full thickness insert supports with exception to final runs on wall surfaces.
k. Electrical mains fed custom flush PIR type flow controllers should be provided to all urinal installations. Battery powered controllers are not permitted.
l. Where practicable simple occupancy detection activated water shut off arrangements should be considered for grouped toilet zones. Battery operated equipment should not be used.
m. The designer should avoid specifying RPZ back flow prevention valves as these are expensive, require written permission from the local water company and will pose an unreasonable burden upon the University to maintain and meet published guidance. Other simpler water category isolation techniques should be used.
n. Scalding control shall be as required by scalding risk assessment. Thermostatic failsafe temperature limiting shall be required for all buildings in the following circumstances:
    - Nurseries and Creches – all hot outlets
    - Disabled or accessible toilets – all hot outlets
    - Showers
    - As required by building regulations, including all baths

    Outside these locations, TMVs shall only be fitted following a risk assessment. Where scalding protection is shown by the risk assessment to be required, it shall be achieved by the installation of Thermostatic Mixing Valves (TMVs) and/or Thermostatic Mixing Taps (TMTs). Where installed, all thermostatic mixing valves (TMVs) and thermostatic mixing taps (TMTs) must be TMV3 Approved Scheme units and installed in accordance with all relevant and current Guidelines, British Standards and 'Best-practices' and in such a way as to allow full access necessary to facilitate their easy and safe maintenance. Where scalding assessment has not required fitting of thermostatic temperature limiting, and outlets are likely to reach scalding temperatures, outlets should be signed as required to notify scalding risk.
o. For all outlets which require water temperature suitable for washing or handwashing, mechanical type mixers are to be used. “mix to a stop” mechanical type mixers are to be specified for all handwash locations. The units shall be commissioned in line with manufacturer recommendations, the outlet temperature shall be set in line with TMV outlet temperatures (see above) at commissioning.
p. No flexible hoses shall be fitted to any outlets on new buildings or refurbishments commissioned by or on behalf of University.
q. Where flexible hoses are required, for example to allow connection of otherwise unmovable items such as washing machines, dishwashers or water coolers, the supply shall be fitted with a separate double check valve at the connection Tee.
r. All plant and distribution pipe-work (where accessible) shall be clearly labelled and adequately insulated.
s. All systems should be provided with appropriate pressure/temperature relief facilities.

t. Designers and Mechanical services contractors shall consider the impact of these works on adjoining/neighbouring system which will remain 'live' during these works and implement all necessary remedial and on-going actions designed to control any risk caused by the planned works. These considerations must include but not be limited to:
    1. The creation of dead-legs caused by the isolation of supplies in areas comprising of the project, and how these can be eliminated/mitigated.
    2. The introduction of necessary flushing to ensure that any areas which will remain infrequently used during the duration of the project are not allowed to develop localised bacterial contamination which can be introduced to 'live' areas.
    3. Any back-flow prevention required to ensure that 'live' areas are not affected by operations in the areas comprising of the project.

3.5 Cold Water Storage:

a. Water storage should be considered by the designer on a risk based approach in consultation with EDS's Projects and Planning department and Reactive Maintenance department together with the end user representative. The total volume of water should be minimised to ensure good daily water turn over to minimise the risk of water stagnation and high-water temperatures, the actual required storage capacity shall be agreed during the design phase.
b. The designer should liaise with the local water company to understand the mains water pressure profiles in the area that is being developed. It is not unusual for the water pressure at night to exceed 10 Bar(g) when demand is low. Conversely the design of the water service networks within the building should take account of the 'guaranteed' water pressure from the water company's main which can be as low as 1 to 1.5 Bar(g). These items impact upon pipework sizing, rating and pressure testing - see Section 3.4 above.
c. In order to avoid the potential for major flooding and large imposed structural loading where large amounts of water storage is necessary this should be located at ground level and boosted accordingly to meet the peak and base demand profiles of usage.
d. The configuration of the water storage and booster equipment should enable the tanks to be cleaned or taken out of use without loss of service to the building served. Therefore, two tanks should be provided as a minimum. Tank inter connecting pipe work designs should follow current good practice. The preferred configuration is for the tanks to be connected in parallel utilising slow open and close valves operating in tandem at all times, operated via height adjustable water level probes. This will allow both tanks to fill in parallel and equally, with both valves operating simultaneously when either probe calls for water. Where booster pump sets are required these should be duty, assist and standby arrangements.
e. Booster set electrical power supplies shall be taken from the buildings essential power supply where this is available.
f. All drain tundishes from open vents and overflows should be visible feeding into gullies with a maintained air gap and visible warning pipe. They should also include robust permanent location labelling to identify the source.
g. The water tanks should be designed to allow fully adjustable water levels all to aid reduced demand management for Legionella and contamination prevention.
h. All tanks should be pre-insulated type. However, if tapered profile sectional tanks are used care must be taken in specifying the resultant thermal performance characteristics. It may be necessary to specify additional demountable insulation jackets to maintain low water temperatures. Ideally the U value of the tank insulation should be 0.4 W/m2K or better (depending upon location, room construction and ventilation solutions employed). The u value should be calculated in accordance with the methodologies described within the CIBSE guide.
i. Cold water storage tanks shall be constructed from non-deleterious materials which must be WRAS approved.
j. Cold water storage tanks shall be designed and installed in accordance with the current Water Supply (Water Fittings) Regulations 1999, installed in appropriate and suitable locations to allow easy and safe access to facilitate inspection and maintenance.
k. Sectional Cold Water Storage tanks shall be designed with external assembly flanges and self-draining profiles, since this arrangement facilitates easy cleaning of internal surfaces.
l. Hollow supports shall not be fitted.

m. Externally located cold water storage tanks shall be avoided where practicable. Where installed, they shall be suitably protected from environmental conditions, particularly the local high ambient temperatures.
n. Cold water storage tanks shall be protected from ambient heat gain, the ingress of light, insects and birds by installing suitably screened overflows and warning pipes.
o. All tank and booster rooms should be frost protected and suitably ventilated to prevent over-heating and minimising heat gains to the stored water.
p. All associated pipework and valves shall be adequately insulated and clearly labelled to identify their purpose.
q. On large tank installations (of greater than 10,000 litres total volume stored e.g. two 5000 litres tanks), consideration should be given to auto dump cycle measures (when the upper water temperature limit is exceeded for an agreed period of time). Water circulation, to minimise thermal plane stagnation, shall also be considered.
r. Each feed to each tank shall be fitted with a water meter in order to allow for confirmation of equal and uniform usage from all tanks in the configuration.
s. Various arrangements of pumping systems are indicated in BS 8558:2015. Where booster pumps are to be installed, a break cistern will be required between the mains supply pipe and the pumps. This is required in order to comply with the Water Supply (Water Fittings) Regulations 1999 with regard to prevention of backflow. Control of the pump(s) should be fully automatic in operation and controlled by pressure sensors which will vary speed of pump to maintain constant pressure. Where two or more pumps are installed, the design flow should be achieved with one pump stationary (or out of service). Automatic control should be provided to cyclically and sequentially control all pumps to ensure that each is regularly brought into service.
t. Stored water must be designed to be maintain a temperature of <20^{o}C, and <2^{o}C from the supply.
u. Where existing tanks are to be retained as part of a refurbishment or extension scheme, where indicated and when it is deemed necessary and practicable, these shall be upgraded, refurbished, modified or replaced so that they may comply with current Water Supply (Water Fittings) Regulations 1999. Following these works, each tank shall be cleaned and disinfected in accordance with BS 8558:2015 and HSG274 prior to it being allowed back into service.

3.6 Hot Water Generation and Storage:

a. Hot water generation and storage units shall be installed in appropriate and suitable locations to allow easy and safe access to facilitate inspection and maintenance.
b. Where more than one hot water generation unit is used, they shall be connected in parallel and capable of maintaining maximum demand service when one unit is taken off-line, taking care to ensure that the flow can be balanced so that the water temperature from all the units exceeds 60°C at all times.
c. The operating storage capacity and heater output (see item 3.6 ii. Above) must be sufficient to ensure that the outflow temperature, at continuous design flow from Calorifier or Plate Heat Exchangers, should not be less than 60°C at any time. This applies to both circulating and non-circulating hot water systems.
d. Plate heat exchangers shall, where practicable, be installed without buffers vessels. Where buffer vessels are used, they shall not receive the CWS feed directly but via the plate heat exchanger.
e. Measures should be taken to prevent warm water entering the cold-feed.
f. The practice of terminating the open vent over the Water Storage Tank shall be prohibited. The vent must be arranged to discharge over a separate tundish arrangement, with a visible Type A air gap, sited at a level that takes account of the hydrostatic head of the system. The Calorifier or Plate Heat Exchangers should be provided with a suitable safety valve of appropriate size and vacuum release arrangement.
g. Where water quality indicates the need, cathodic protection from galvanic action by means of sacrificial anodes shall be provided.
h. Calorifiers greater than 150 litre capacity shall be fitted with a de-stratification pump, in order to avoid temperature stratification of the stored water. Some semi-storage/high-efficiency calorifiers are supplied with an integral pump that circulates water in the calorifier. De-stratification pumps shall not be fitted to this type of units.
i. A single circulating pump shall be installed in the return. A spare, sealed, replacement pump shall be available for installation when required.
j. All Calorifiers shall have flow and return temperature indicator gauges fitted.
k. A suitably sized drain shall be connected to the base of each Calorifier.

l. Hot water services should be controlled independently of the heating system. Wherever possible the storage of large amounts of hot water shall be avoided. The University preference is to utilise instantaneous centralised hot water generation with minimal secondary hot water system content. The Building Management System must have the ability to control the temperature of the hot water system, view all valve positions on the primary heating side of the system and provide continuous monitoring of the hot water systems flow and return temperatures. Probes shall be provided at the ends of the systems to ensure system flow and returns temperature are being maintained. Local temperature gauges should be provided to all hot water generation plant and circulation systems. Hot water services should be provided by one of the following alternatives:
   - The use of hybrid secondary domestic hot water instantaneous plate heat exchangers (PHE) is preferred. The plate heat exchangers shall either be served by primary LTHW thermal storage, or Domestic Hot Water storage on the secondary side shall be provided. This will ensure the systems cope with peak demand and avoiding primary plant over sizing, whilst ensuring DHW temperatures to be maintained at 60°C
   - Plate heat exchangers (PHE) should be installed with each sized to provide 100% of the design load.
   - Local instantaneous gas fired water heaters are also acceptable. These heaters shall be designed to ensure 100% of the design load is maintained in the event of a unit failure.
   - All hot water systems incorporating storage shall have destratification pumps, except for small domestic cylinders in residences.
   - In all instances full redundant standby shall be provided eg 2 x100% or 3x50% etc.

m. Calorifiers and all other recirculating hot water generation units shall be designed to maintain the following temperature profiles at all times:
   - "Stored" and "Flow" at ≥60.0°C at all times

n. Units which incorporate recirculation shall be capable of being subjected to regular check for "Flow" and "Return" temperature monitoring via a BMS system.

o. Low Volume Storage Water Heaters to 100 litres, and instantaneous heaters of more than 2m from heater to outlet (including combination boilers), shall be allowed to operate so that the furthest outlet from each unit is ≥55°C at a maximum of 20 seconds running – measured at the point of supply to direct-supplied outlets or to thermostatically controlled valves and/or taps.

p. Where instantaneous water heaters (without storage) are fitted, and they are limited to 2m total pipework length from the unit to the outlet, the outlet temperature may be set to generate "comfort" temperature of 39-41C. The units should be designed to generate at least 4L per minute@39-41 °C with incoming water temperature of 10°C. Where the outlets are also not thermostatically limited, and subject to varied incoming temperature, the outlets may also require signage for scalding risk.

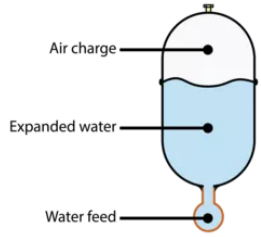
3.7 Expansion and Pressurisation Vessels:

a. Expansion vessels shall be located on the cold feed rather than on the hot water side of the system.

b. The vessel should be sized correctly for the system and be designed to ensure an adequate turnover of water within it.

c. Expansion vessels, where required for water heaters >15 L storage shall be of flow through type, and WRAS approved.

d. If flow through vessels cannot be sourced for water heaters of stored volume <15L, WRAS approved single entry vessels may be used to a maximum volume of 2L total vessel volume. The expansion vessel should be bottom fed and upright, the connecting pipework to the vessel be rising continuously and be kept to a minimum (see figure below).



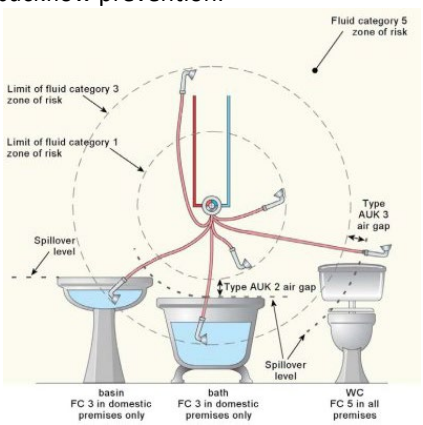
3.8 Hot and Cold Water Distribution Systems:

a. The design and installation of the hot and cold water distribution system shall comply with the Water Supply (Water Fittings) Regulations 1999 and BS 8558:2015.
b. Hot water service flow and return circulation should be provided as close to the outlets as practicable. Pipe distribution designs are to be configured such that high flow outlets are down stream of little used outlets. On circulating systems, non-circulating dead legs shall not exceed 0.5 litre to the outlet in accordance with BS8558:2015 so although the 'traditional' dead leg limit of 2 metres, for 15mm copper pipe, is compliant with this requirement all larger pipe dead legs will need to be shorter to achieve the 0.5 litre limit in the British Standard. Under no circumstances will dead legs of over 2m be allowed.
c. The design of the pipework shall ensure that there is no possibility of a cross-connection between installations conveying potable water and an installation containing non-potable water or water supplied from a private source (untreated). There shall be no possibility of backflow towards the source of supply from any tank, cistern or appliance, whether by back siphonage or otherwise.
d. The selection of water outlets is important. This choice should be based on a risk assessment of scalding issues, and should be capable to receiving point-of-use (POU) filters without contravening Water Regulations compliance and it is important to ensure that they are easy to use and practical for the existing space.
e. All cold distribution pipework, mains and tank down feeds shall be located in such a way as to minimise heat gains from their environment. Pipework shall not be routed through hot ducts or run adjacent to heat sources, such as radiators.
f. All pipework shall be insulated, except for any exposed final connections to facilities, and should be arranged to eliminate or minimise dead-legs.
g. As far as possible, the objective shall be to design the cold water systems to ensure that the inlet, outlet and surface water temperatures of cold water storage tanks are not greater than 2°C above that measured at the main water meter. Also, at cold water draw-off points, a temperature of not greater than 2°C above the temperature measured in the source Cold water storage tanks shall be reached within two minutes of flushing.
h. Traditional flow and return solutions are acceptable provided the return regulation devices or temperature maintaining valves are appropriately selected. Lock shield valves shall not be used for regulating the domestic hot water return legs.
i. Self regulating trace heating tape systems are to be avoided wherever possible. Where pipework is designed to be routed outside the thermal envelope of the building, rerouting the pipework should first be considered before trace heating can be sanctioned. Where determined required, any trace heating system shall be designed so that the water in the distribution pipe is not warmed to more than 10 ^{o}C
j. Consideration of zoned looped systems to minimise the number of regulating valves should be given by the designer and discussed with the University.
k. Where hot water balancing valves are to be fitted, for new builds or additions to current systems, all balancing valves shall be of the same type and function. Thermostatic and manual balancing valves shall not be fitted to the same systems.
l. Where balancing valves are to be fitted to obtain hot water system balance, thermostatic balancing valves shall not be fitted to new systems. Any balancing valves to be fitted should be double regulating valves.
m. Stagnation shall be avoided. Hot and cold water services shall be sized to provide sufficient flow at draw-off points. The aim shall be to promote turnover of water by means of the design of the distribution circuitry, adequate usage and avoidance of 'disused' areas.
n. All catering equipment, water coolers, ice making machines, shall be supplied directly from the incoming mains.
o. All supplies to drinking water systems shall be of wholesome quality. The supply shall not be softened to less than 70ppm of total hardness. Additionally, it shall be established that the usage is sufficient to avoid deterioration in water quality, for example, that the inlet water temperature does not exceed 20^{O}C and that the outlet does not remain unused.
p. The domestic hot water system shall not be used for heating purposes. This includes all radiators, towel rails, etc, whatever the pipework configuration.
q. Central 'common blending' systems shall not be used, since the length of distribution pipework containing water in the temperature range that supports bacterial growth and proliferation would far exceed the maximum permissible lengths mentioned below.
r. The pipe-work length from the TMV to the outlet shall be as short as practicable, but not >2 metres, in order to maintain lengths of pipe-work carrying blended water to minimum.
s. All TMVs and TMTs shall be fitted with strainers, isolation valves and check valves.

t. All TMVs and valves shall be accessible for working with 2 hands and tools, and all fittings able to be removed and replaced.
u. Fire and domestic supplies shall not share the same line.

3.9 Showers and TMV:

a. All shower TMVs must be easily and safely accessible to allow for maintenance.
b. Central “common blending” shower-block systems shall not be used and all pipe-work length from the TMV to the shower-head shall be restricted to a maximum of two metres.
c. TMV’s should be installed with appropriate valve and drain cock arrangements so as to enable the pipe work to be flushed without clogging the TMV’s during the initial pre-commissioning flushing activities. TMV’s should be class TMV3. Thermostatic mixing valves should only be installed where there is an enhanced risk of scalding injury and in line with the UOL management strategy. A risk assessment shall be carried out to determine if TMV’s are required on a project, it is the university preference to use a standard mechanical Monoblock mixer tap as opposed to a TMV. Where TMV’s are used the blended outlet must not exceed 2 metres in length.
d. Constraining the outlet of a flexible shower hose, so preventing it from being placed below the spill-over level of the shower tray or bath, or reaching the WC, by means of a retaining ring is an acceptable means of backflow prevention.



Robust factory applied retaining rings of the design which do not allow the shower hose to be removed are a recognised method of maintaining an AUK3 air gap acceptable in all types of premises. For further information please refer to WRAS information note ‘Prevention of the risk of backflow in the design of domestic bathrooms’.

3.10 Tactile/Sensor control Taps:

a. All new tactile/sensor control taps installed shall be capable of being programmable to enable automatic flushing of these outlets to be implemented. The units must be capable of automatic flushing of at least 30 seconds.
b. The mechanical parts of these units shall be accessible for easy maintenance.
c. Tap design should allow for a pasteurisation cycle to be carried out.
d. These units shall not be fitted or installed with flexible rubber hoses.

3.11 Aerators and Flow straighteners:

a. Devices such as aerators and flow straighteners fitted to taps shall be removed and replaced with non-obstructed fittings designed to prevent water from being retained in the tap.
b. Owing to their high surface-area-to-volume ratio and location at the tap outlet, certain designs of flow straighteners may present a greater surface area for colonisation and support the growth of organisms. Therefore, when selecting new taps, where possible flow straighteners should be avoided/not included.

3.12 Water Dispensers/Water Coolers:

a. The installation of Water Dispensers/Water Coolers shall only be approved following formal completion of and authorisation of Permit No. 2 'Permit for the Installation of new Water Dispensers / Water Coolers' found in Section 6 Permits and Notifications.
b. The selection and installation of Water Dispensers/Water Coolers shall be in accordance with LEG 36 - 'Management of Water Dispensers/Water Coolers'

3.13 Ice Making Machines:

Installation of ice making machines shall only be approved following formal completion of and authorisation by Permit for the Installation of new Ice Making Machine

3.14 Greywater and Rain Water Harvesting Systems:

a. Greywater systems shall comply with BS 8525-1:2010 - Greywater systems – Part 1: Code of practice.
b. Rainwater harvesting systems shall be installed and maintained in compliance with BS 8515:2009 - Rainwater harvesting systems - Code of Practice.

3.15 Temporary Water Supplies:

The University, or others on its behalf, when providing and managing temporary water supplies, in accordance with BS 8551:2015 - Provision and management of temporary water supplies (not including provisions for statutory emergencies).

3.16 Adiabatic Coolers, Cooling Towers and Evaporative Condensers:

None of these units shall be designed and installed. If found installed, they shall be removed.

3.17 Irrigation Systems:

a. Any proposal to install an irrigation system shall have the design verified by Authorising Engineer – Water, and EDS Responsible Person – Water. The design shall include a detailed control scheme.
b. All irrigation systems shall have a Legionella risk assessment carried out on the system as a part of the commissioning process.
c. Irrigation systems shall not use untreated water or untreated grey water.
d. Where installed, and fed from domestic cold water systems, suitable backflow protection shall be fitted.
e. Irrigation systems shall be designed to ensure no aerosol is produced in use.
f. Irrigation systems shall be installed to include a fluid category 5 break achieved through compliant break tank, or tundish.

3.18 Design Components:

Components will only be allowed to be fitted in line with approved component list included in MS04.

3.19 Design Verification:

In order to ensure that all designs are developed in accordance with the requirements detailed above, all designs, before offered for Tender, the University appointed project manager and the University Building Services Engineer (water), with assistance, where required, from the Authorising Engineer (Water), shall scrutinise each design for compliance, suitability and correctness of specification.

The Principal Designer shall verify and ratify each design and confirm that it is suitable for tendering purposes.

Under tender conditions, a review shall be undertaken when all the Tenders are received. All changes to a design shall be managed through the 'Projects Change' protocols and recorded as such. The Principal Designer shall manage these changes to the designs of a project.

3.20 Water Butts:

Water Butts shall not be allowed to be fitted without authority from EDS. Where essential to University Business, each Water Butt shall be fitted only following approval from EDS in line with Permit No.6 and conditions listed below:

a. Water Butts shall only be fitted by EDS approved contractors.

b. Water Butts shall be subject to an annual Visual Inspection, Cleaning and Disinfection in line with Procedure LEG 38. Arrangement of this service shall be the responsibility of the Academic Department in which the Water Butt is to be fitted. Records of servicing are to be made available for EDS inspection, and a copy provided to the Building Services Engineer (Water) on an annual basis.
c. The Water Butt shall not be fitted with a hose attachment.
d. The Water Butt shall not be fitted with a pump attachment
e. The water stored in the Water Butt shall only be used by watering using Watering cans without spray nozzles (roses) to minimise aerosols in use.
f. Water butts shall be signed appropriately in a visible location “Water is only to be used in watering cans without rose attachments fitted. No hoses are to be fitted to Water Butts. Only to be used by trained staff”.
g. Water Butt use shall be included in the Legionella Risk Assessment for the site.
h. Staff shall only be allowed to use the Water Butts when trained in the use without generating aerosols, and in line with the requirements of this WSP. Training shall be recorded and made available for EDS audit when required.

3.21 Closed System Connections:

a. Heating and chilled water closed systems may be pressurised by means of a traditional pressurisation unit directly connected to a potable water supply system. The pressurisation unit to be complete with pumps(s), expansion vessel, controls and safety interlocks and a makeup fill tank with ball valve or other device giving air gap separation between the system and potable make up supply.
b. The potable supply to the pressurisation unit must be considered as a “dead leg” under normal running and as such must be loop connected to a main with good normal flow and use to prevent stagnation. The tee connection must be a short as possible with an isolation valve. The dead leg should be fitted with a double check valve as close to the Tee as practicable.
c. A pressurisation unit bypass quick fill system will be allowed in order to fill the system quickly following a drain down. This should consist of a “tee” connection from the looped potable main with isolating valve and double check valve normally capped off.
d. A suitable WRAS approved pressure rated hose should be provided loose. In an emergency quick fill situation, this hose can be connected to the non-return valve on the potable supply and used to connect to a suitable valved connection on the heating or cooling system to give a quick fill from empty system. After use the hose must be disconnected and the two connections capped off.
e. The hose should be stored locally for emergency use and flushed prior to connection and use.

3.22 Water Features:

All Water Features shall have the design and control regime approved by Building Services Engineer (Water), and Authorising Engineer at design and handover stage. This includes Water Features where the water supply is manually, mains, domestic, or Greywater supplied. Design, maintenance and control regimes together with proposed drawings shall be provided for approval.

Certificate of Conformity

Distribution Water Services Disinfection

No	Tasks	Date	System	Comments	Signature of operative (all boxes to be completed)
1	RAMs approved by (contact name and number)				
2	System Volume:				
3	Method of disinfection:				
4	Disinfectant used:				
5	pH of source water				
6	Volume of disinfectant used:				
7	Disinfectant level at the tank (tank or injection tank if injection only)				
8	Initial disinfectant level at outlets - maximum/minimum, and time at start of disinfection				
9	After 1 hour level at outlets - maximum/minimum, and time at end of period				
11	Post disinfection level at outlets - maximum/minimum				
12	TMV/TMT strainers and all other strainers, aerators and flow straighteners cleaned, disinfected and replaced/renewed				
13	Any refurbishment, improvements carried out during this disinfection:				
14	Further upgrading, refurbishment, improvements works required				

Comments – record all outlets tested, results and times below.

Task carried out by (Print Names)	

Document control: Project work – copy to project file and email to Building Services Engineer (Water). Any defects to be reported to University appointed project manager and the University Building Services Engineer (water) by email.
Approved contractor – document to be uploaded to Zetasafe by engineer, and any defects entered into Zetasafe as manual defects.

Certificate of Conformity

Usage Evaluation and Flushing

Department:	
Location:	
Area:	
Process Responsible Person (name):	
Start date (Monday):	

Has Usage Evaluation been carried out?	**Yes**		**No**	
If No; why Not?				
If Yes; have any outlets been identified as infrequently used?	**Yes**		**No**	

If Yes; list locations and date of flushing, sign in each box to show :

Room/Outlet:	Mon (date below)	Tue (date below)	Wed (date below)	Thu (date below)	Fri (date below)	Sat (date below)	Sun (date below)	Comments

Have any outlets/facilities been identified as redundant and requiring removal?	**Yes**		**No**	
Tasks carried out by (Print all Names)				

Document control: Project work – copy to project file and email to Building Services Engineer (Water). Any defects to be reported to University appointed project manager and the University Building Services Engineer (water) by email.
Approved contractor – document to be uploaded to Zetasafe by engineer, and any defects entered into Zetasafe as manual defects.
EDS Engineers – document to be uploaded to Zetasafe by engineer, and any defects entered into Zetasafe as manual defects.

Certificate of Conformity

Small Sized Component Disinfection and Fitting

Note - Maximum 2m length of pipes and fittings otherwise newly fitted section shall be soak/injection disinfected when fitted.

No	Tasks	Date		Signature of operative (all boxes to be completed)
1	Parts disinfected (list all)			

No	Tasks	Task Detail	Comments	Signature of operative (all boxes to be completed)
2	Method of disinfection:			
3	Disinfectant used:			
4	Volume of water in soaking vessel			
5	Volume of disinfectant used:			
6	Disinfectant level at the start of disinfection and time.			
6	Disinfectant level at the end of disinfection, and time.			
7	All fittings drip dried			
8	All fittings fitted within 12 hours, and area back in service, or on flushing regime (note time completed)			
9	All tools disinfected before fitting process?			
10	All legs flushed through following fitting?			

Comments – record all testing and times below.

Task carried out by (Print Names)	

Document control: Project work – copy to project file and email to Building Services Engineer (Water). Any defects to be reported to University appointed project manager and the University Building Services Engineer (water) by email.
Approved contractor – document to be uploaded to Zetasafe by engineer, and any defects entered into Zetasafe as manual defects.

Water Quality Management & Control Log-Book

Certificate of Conformity

1. Note: This certificate is only to be used for project work, routine monitoring and maintenance is to be logged on the EDS logbook – Zetasafe.

Domestic Hot and Cold Water Source and Distribution ClO2/Temp Profile

Date	Time	Building/Area/Room	Type of outlet	Condition	ClO2 Levels (mg/l)	Distribution HWS (°C)				Distribution Cold (°C)			Signature
						Direct fed Outlet temp. (non recirculating systems only)	Time to steady temp.	Return loop temperature (recirculating systems)	Source Unit temp	Peak cold temp.	Temp at 2 minutes	Tank Temp (remote from valve)	
University appointed project manager and the University Building Services Engineer (water) Signature												Date of check	

UNIVERSITY OF LEICESTER	Water Quality Management & Control
Permit No.	1 - Permit for release into use of new installations of small sized pipework installation projects and associated components.
Task:	This Permit to be used where the area is under control of the contractor for less than one day, the additions are to be less than 2m in total length, and no additional facilities are to be added to the system. In all other cases, Permit 2 should be completed.
Permit to be completed by:	Project Manager
Document Control	Upon completion, a copy of this, and all associated documents to be copied to: a. Project file/O&M manual b. Building Services Engineer (Water)

Brief description of works undertaken

Has the work been completed?	Yes		No		When	
Work carried out by:						
Pipework and fittings disinfected in line with LEG26 and Certificate received?	Yes		No		When	

Have all necessary works been carried out?	Yes	No	N/A	Comments
TMV/TMTs commissioned correctly & set at correct temp?				
Strainers/aerators been cleaned and disinfected?				
Shower heads/hoses been cleaned and disinfected?				
Are all direct-supplied outlet CWS temps within specification?				
Are all direct-supplied outlet HWS temps within specification?				
Are all blended outlet temps within specification?				

*Has biological analysis been carried out?

* **Microbiological sampling before and after this type of works shall not be carried out unless expressly requested by the Health, Safety and Compliance Officer Estates and Campus Services Where microbiological sample has been carried out, submit the results with this permit.**

Yes | No

All actions have been undertaken and installation ready for use? Yes | No

Date for release for use:

Additional Notes

Signed (Project Manager): Date:

UNIVERSITY OF LEICESTER	Water Quality Management & Control
Permit No.	2 - Notification of Area Handover and Permit to Occupy.
Task:	This process is to be used for all projects where water systems are to change from Faculty, or EDS control to Projects, for more than 1 day, or system disinfection is required for parts more than 2m in total length.
Permit to be completed by:	Project Manager
Document Control	Upon completion, a copy of this, and all associated documents to be copied to: a. file/O&M manual b. Building Services Engineer (Water)

SECTION 1

This section to be completed by the Project Manager

Notification submitted by			Date	
Scheme Reference:				
Facility for closure:				
Is all of the facility proposed for closure?	Yes/No		Specify if No	
Date for proposed closure			Date for proposed reoccupation	
Reason for proposed closure				
Will use of the facility change following re-opening?	Yes/No		Specify	
Description of water system works to be carried out				

1. ***If facility is to permanently close, inform Building Services Engineer (Water), and Health, Safety and Compliance Officer Estates Services by email at this stage then go to section 2.***

SECTION 2

This section to be completed by the Project Manager

Water System Flushing Responsibility	Frequency		Start Date		To be carried out by	
IS the facility to be isolated and drained?	Yes/No		Date		To be carried out by	

Use Certificate no.9 to log all flushing activity, Go to section 3.

SECTION 3

This section to be completed by the Project Manager

Is facility subject to Microbiological sampling in line with requirements of WSP Book 3, section 3.11?	Yes	No

2. ***If No, go to section 4.***

If Yes; in what locations?	HWS		CWS		Blend-ed		When to sample		TVCC	*Legionella*	*Pseudomonas aeruginosa*	Sample Result (complete after results returned)
Location and asset (attach drawings showing locations)	Pre	Post	Pre	Post	Pre	Post	Before works	48 hours after				

Are biological samples to be collected by approved water sampling contractor?	Yes/No		Contractor	
			Dates of planned sampling	

Send copy of form at this stage to Building Services Engineer (Water), then go to section 4.

SECTION 4

This section to be completed by the Project Manager during the project, and signed prior to occupation

Facility/Phase proposed for occupation at this time:	

Commissioning Plan received and approved?	Yes	No	N/A
Are the works in the Section/Area complete?	Yes	No	N/A
Is the domestic water installation complete and in line with the project design?	Yes	No	N/A
Has written approval been given for filling the system?	Yes	No	N/A
Have all material and fittings WRAS certificates been received? (attach fittings list)	Yes	No	N/A
Are all bacterial control measures employed operating within recommended and agreed parameters (attach worksheets)	Yes	No	N/A
Has the system been flushed in line with WSP? (attach records)	Yes	No	N/A
Has the project been Risk Assessed prior to hand-over?	Yes	No	N/A
If Yes, have any faults/short-falls been identified?	Yes	No	N/A
If Yes, have all these faults been rectified?	Yes	No	N/A

Has the system and fittings been disinfected in accordance with WSP? (attach certificates)	Yes	No	N/A
Have bacteriological samples been taken in line with WSP Book 3? (attach certificates)	Yes	No	N/A
Are all results within acceptable parameters?	Yes	No	N/A
Have amended as fitted drawings been received? (attach copy)	Yes	No	N/A
Have TMTs/TMVs been commissioned in line with WSP requirements? (attach commissioning worksheets)	Yes	No	N/A

Date of occupation:		Occupied by:	
Signed (Project Manager):		Date:	

Project complete, send copy of form to Building Services Engineer (Water) together with documentation noted, and copy to project file.

SECTION 5

This section to be completed by the Building Services Engineer (water) for their copy only

Is risk assessment still valid?	Yes	No	Completed
Does PPM regime require amendment?	Yes	No	Completed
Does asset list require amendment?	Yes	No	Completed
Have amended drawings been uploaded?	Yes	No	N/A
Have outstanding defects been uploaded to defects list?	Yes	No	N/A

Signed Building Services Engineer (Water):		Date:	

2. When complete, file in EDS Water Safety file.