MS04 Domestic H&CWS

UNIVERSITY OF LEICESTER

Document Control

Rev	Date	By	Comments
B	Oct '17	J. Hoare	Technical Review Update
C	Dec 17	UoL	
D	July '19	J. Hoare	Technical Review Update
E	Mar'20	J. Hoare	March 2020 Issue
F	April 2020	A. Singleton	General update to tracker and other minors.
G	Feb 2021	A. Singleton	Commissioning added
H	March 2021	A Singleton	Time and temperature checks on mixing valves
I	April 2021	A Singleton	Alignment with WSP
J	Nov 2022	A Singleton	Local outlet isolation valves specified, clause on water use efficiency added

Design Guidance

1. This Guidance Document shall be read in conjunction with the latest revisions of the University Water Management Safety Plans (WSP) as below. Where there are discrepancies between this document and the WSP the University clarification shall be obtained from the University before proceeding.
    a. Water Safety Plan Book 1 of 3 General Considerations
    b. Water safety Plan Book 2 of 3 Processes and Procedures
    c. Water safety Plan Book 3 of 3 Design, Installation and Commissioning
2. The designers should ensure that the contracting installer always compiles a water safety commissioning plan at project outset. This will then be commented upon by the University to ensure that the design and installation methodology is in accordance with, and includes the full requirements of, the water safety plan.
3. Reference should also be made to the detailed University's mechanical technical specification. Where there are discrepancies between this document and the University standards clarification shall be obtained from the University before proceeding.
4. The designs should comply with
    a. HSG274 and HSE ACoP 'L8'Legionella prevention design guidelines and any published addendums.
    b. All statutory mandatory and good practice design requirements including those provided (but not limited to) Building Regulations and all relevant CIBSE documentation.
    c. The current Water Regulations and ensure that their designs also meet the recommendations and requirements of the latest published Water Regulations Advisory Scheme.
    d. All guidance and regulations regarding water usage efficiency and consumption minimisation.
5. It should be noted that the following disinfection, flushing and sampling is required and is detailed in the University Water Safety Plan (WSP) which shall be adhered to in every respect. The designers should include the WSP within the tender documents.
    a. Disinfection, flushing and cleaning of the system should follow the University's Water Management Plan and the practice described in BS6700. Ample time will need to be allowed within the construction programme for the same.
    b. Sampling and monitoring of water services quality on larger new build projects shall be fully in accordance with BS8552 and in line with the University of Leicester's Water Management Plan.
    c. Sampling and monitoring on small works projects shall not be undertaken on the system prior to or after works have been undertaken.
6. It should be noted that the following commissioning processes are required (most of which are costly and onerous) and are detailed in the University Water Safety Plan (WSP) Book 3 "Design Installation and

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Commissioning", Section 3 "installation and commissioning of new build and refurbished facilities" which shall be adhered to in every respect. The designers should include the WSP within the tender documents.

a. Sectional testing should be avoided but where absolutely necessary the system should not be drained after test filling as this will lead to issues with bacterial/biofilm growth.
b. A complete temperature profile of the network from incoming supply, tank storage and temperatures around the network will be needed.
c. Continued outlet flushing will be required following any disinfection and this will require all outlets flushed to the frequency as given in the WSP and this must continue until handover to the client.
d. Water hygiene quality sampling is required on larger projects as detailed in the WSP. The sampling MUST not be undertaken until the building is in a clean state and decorations have been completed. Satisfactory sampling results will be required before handover will be given. Any failed results will require a repeat disinfection of the system and repeat sampling.
e. The sampling time analysis time required will normally be a little above two weeks and programme time shall be allowed accordingly.

7. Where a project is of a refurbishment nature, as against a new build, the designer shall always refer to the buildings existing water hygiene survey prior to any design work commencing.
   a. Any remedial hygiene works recommended within the project area by the existing hygiene survey shall be included within the project works.
   b. Note that in order to fully complete item (a) above some work may need to be undertaken outside of the project boundary.
   c. If no existing survey exists then the designer shall undertake a full water hygiene survey within the project boundary to establish what hygiene improvement works need to be undertaken and these shall be included within the project.
   d. Any remedial works established as being required from the above shall be reported to the University Estates who will then confirm actions required which may extend outside of the project boundary.
8. The designers shall
   a. Before tender. Provide one full set of design documents for the water systems to the University who will then ask their Water Hygiene Authorised Engineers to comment on the same as regards good practice and compliance. Any comments issued following the same must be taken into account within the final tender documentation.
   b. During construction. Ensure that the Water hygiene Authorised engineers visit site during commissioning and comment on the installation as regards good design, installation, practice and performance. Any comments issued must be acted upon.
   c. During commissioning. Ensure that the water hygiene Authorised Engineers comment on all handover documentation including commissioning performance details.
9. The University would always prefer to have a degree of storage provided to protect against short term interruptions to the incoming mains supply. Where storage is included then it must be on the basis of around 8 hours use capacity to cover a normal occupied working day.
   a. Where storage is provided then it must be on the basis of N+1 to allow for maintenance. The total volume stored equating to the 8 hours requirement.
   b. When one tank is out of use then the stored volume will only equate to 4 hours.
   c. 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 but should be around 8 hours of heaviest building occupation which would normally be one daytime period.
   d. Where large volumes of water are required, and in order to avoid the potential for major flooding and large imposed structural loading, consider locating it at ground level and boosting accordingly.

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e. Where storage tanks or where any other wet plant is located at roof level and there is a potential risk of flooding, bunded enclosures shall be provided. The bunded enclosure shall be provided with sufficient gullies / drains to prevent major flooding of a building.
f. 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.
g. Tank inter connecting pipe work designs should follow details at the rear of this document. The required configuration is for the tanks to be connected in parallel utilising motorised valves to ensure slow open and close (to prevent water hammer) operated via water level probes. This will allow both tanks fill in parallel and equally.
h. The water level probes shall be analogue capacitance types designed to allow fully adjustable water level vis the BMS system. Thus if tanks are specified slightly over capacity or demand is lower than expected at periods then the water levels can be remotely adjusted.
i. The water tanks should be designed to allow fully adjustable water levels all to aid reduced demand management for Legionella and contamination prevention (refer to typical tank arrangement)
j. Where single water storage tanks are utilised, by exception only and with agreement, a delayed action type valve can be used. These shall be Keraflo Aylesbury type valves which are fully height adjustable. Care shall be taken to avoid water hammer.
k. All tundishes should be visible feeding into gullies with a maintained air gap and visible warning pipe and include robust permanent location labelling to identify the source.
l. 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.
m. All water tank temperatures should be monitored by the BMS and alarms raised when an upper limit temperature is exceeded (typically 20 degrees Centigrade but should reference the incoming mains temperature). The temperature probes shall be located such that they measure water temperature and give a representative figure readout of the same at all water level settings.
n. 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 and future cooling unit connections.
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.

10. Booster sets.
a. Where booster sets are used and are serving a building height greater than 10 metres surge arrestors shall be provided at the top of all hot and cold water services in risers.
b. The arrestors are required to dampen the impact of water hammer at uncontrolled booster pump start up and to prevent a vacuum forming in riser pipework when a pump stops and riser water drains.
c. The arrestors shall be installed immediately after a local isolation valve and the isolation valve shall be installed as close to the tee piece as physically possible.
d. These are required in addition to configuring the booster set controls which must include (all installations) a routine that operates after a loss of electrical power to the booster set. This routine shall ensure that pump start up duty is limited to prevent ‘over pressure’ shock waves damaging the distribution pipework.

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e. If a building has, or is to have, essential standby generation then the booster sets should be connected to the same.
f. Boosters should always be served by inlet break tanks and direct connections to mains supplies are prohibited.
g. Inlet break tanks should always be elevated to provide sufficient positive suction head to avoid cavitation at the booster pump inlet.
h. Booster pumps should normally be run, run and jockey in configuration. Pumps should all be variable speed drive and controls should be configured to provide a constant outlet pressure under varying demand.
i. All booster expansion vessels should be full flow through in design.

11. Systems shall be installed using traditional copper pipework and fittings as per the University standard specification. Fittings up to 54mm shall be soldered and those 67mm and above shall be brazed.
    a. Steel, thin wall steel, stainless steel or plastic pipework systems must not be used.
    b. Pressfit, pushfit, clamped or compression fittings and systems must not be used.
    c. Phenolic foam insulation must not be used on copper pipework services.
    d. All materials selected should be Water Research Advisory Scheme (WRAS) approved.
    e. All pipe connections to outlets should be 'rigid copper' i.e. no flexible connections between pipe work and appliances will be allowed.
12. Note that wherever there are laboratories these must be served by a totally separate segregated pipe system with a category 5 break between the laboratory service and any other system.
    a. The laboratory water systems and the general domestic water systems must be separate systems as above.
    b. All laboratories should have a wash hand basin by the exit door. These need to be served from the general domestic systems. Laboratory sinks need to be served from the laboratory systems.
13. All systems should be fully potable in terms of quality. Drinking water shall generally be via a direct mains fed piped service.
14. Life cycle cost appraisals must be undertaken in respect of the preferred hot water generation solution, centralised versus decentralised, hot storage against plate generation, electrical versus gas, heat generation plant etc, to allow decisions to be taken as to the best overall choice in life cycle terms. This is to include energy, carbon, capital and maintenance costs. Refer to GD series for further Guidance.
15. If centralised hot water is the design solution then it will be generated at a minimum of 60c and as such is a scalding risk. Hot water outlets on these systems shall therefore be as follows.
    a. Bath hot taps and all wash basins in assisted toilets will be complete with either separate hot and cold taps and the hot tap shall be served from a local failsafe thermostatic mixing valve (TMV) or a single monobloc thermostatic mixer tap.
    b. All showers shall have failsafe TMVs.
    c. In all other general areas or circumstances a risk assessment shall be undertaken with the client. Where there is not a proven case for a failsafe device (as above) then the normal provision will be a washbasin with a mechanically temperature restricted monobloc tap.
    d. Any 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.
    e. TMV's should be class TMV3 as defined in the latest HTM documentation. Thermostatic mixing valves should only be installed where there is an enhanced risk of scalding injury and in line with the UOL management strategy as detailed above
    f. Where TMV's are used the blended outlet must be kept to a minimum and not exceed 2 metres in length.
16. Where two pipe flow and return systems are used for the domestic hot water then

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a. A single circulating pump must always be installed on the return immediately prior to the centralised hot water generation. The pump must have a non return valve to prevent backflow.
b. The secondary circulation pump flow rate shall be designed to limit temperature drop to 5c on the flow (to the furthest outlet) and 5c on the return (back to the central generation). That is to say with water at 60c in central storage the temperatures at any outlets shall not fall below 55c. The returns to the central storage shall not be below 50c or 5c lower than the furthest outlet whichever is the greater.
c. The ends of each hot water circuit, including the ends of any branch circuit, shall be provided with BMS immersion sensors to continually monitor water temperatures at these "sentinel" points.
d. On every branch circuit, or sub circuit, self-acting temperature maintaining valves shall be installed. The valves shall be selected to pass the required total flow when fully open and shall be designed to maintain a pre-set DHWS return temperature of 55°C.
e. Systems should be designed with reference to HSE ACoP L8 and BS8558 with regard to permitted periods of draw off to achieve equilibrium temperatures for cold and hot water outlets
f. The design must ensure that cold water at an outlet should always achieve 20ºC or less within 2 minutes of the outlet being opened and hot water at an outlet should exceed 55ºC within one minute of being opened. (These requirements exceed HSE and BS standards for the hot water temperature by 5C).
g. 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. Dead legs are to be avoided. On circulating systems, non-circulating dead legs shall not exceed 0.5 litre to the outlet in accordance with BS8558 so although the 'traditional' dead leg limit of 3 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.
h. Temperature maintaining valves are to be installed on each return leg and are to be appropriately selected. Lock shield valves shall not be used for regulating the domestic hot water return legs. Temperature maintaining valves are preferred as they automatically compensate and self-balance circuits when initially installed and also if circuits are modified at a later date. Thermostatic circulating valves shall have integral facility to fully open at increased temperatures to allow for regular system pasteurisation.
i. Consideration of zoned looped systems to minimise the number of regulating valves should be given by the designer and discussed with the University. This solution should incorporate thermostatic self-regulating return water control valves.

17. For design purposes small systems, up to 10 items of sanitary ware, shall be sized using the BS EN 806 sizing method and larger systems shall be sized using BS8558 Appendix C.
18. Water saving regulation devices, such as flow restrictor isolation valves, shall be provided at each terminal outlet to minimise water consumption.
19. Where hot and cold pipes are installed in ceiling voids and risers they shall be independently supported from each other and where practical 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 exception to final runs on wall surfaces
20. Electrical mains fed custom flush PIR type flow controllers should be provided to all urinal installations. This also applies to WC's where remote operated flush controls are used. Battery devices are strictly prohibited.
21. Where practicable simple occupancy detection activated water shut off arrangements should be considered for grouped toilet zones. Occupancy detection system controllers and solenoid valves shall be fully compliant to achieve the relevant BREEAM credit (even if the particular project is not intended to be BREEAM rated). Battery devices are strictly prohibited.
22. Cleaning, flushing and disinfection and works prior to handover.

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a. The designer will be required to ensure that the contractor does not fill and subsequently drain pipework for sectional testing as this encourages internal contamination.
b. Water sampling is not to be undertaken on very small refurbishment projects but will be required on all major and new build Projects as per the WSP.
c. Disinfection processes, flushing, cleaning, sampling and chemicals shall be as per the Universities Water Safety Plan (WSP). Permits to work will be required.
d. The WSP specifies approved contractors for this work. No other water hygiene contractors will be allowed.
e. All flushing, disinfection and sampling on completion of a project shall be carried out the University incumbent water hygiene specialist. No other contractor will be considered.
f. Flushing, cleansing and disinfection should take place as near to practical completion of a project as possible whilst always allowing sufficient time for all pre-handover potable water quality testing and subsequent laboratory results (including legionella) to be received. Handover will not be given until satisfactory results are received.
g. During the period between completing the flushing, cleansing and disinfection processes and handover the designer shall ensure the contractor maintains the water installations in accordance with the University's Water Management plan and ACoP L8.
h. In the above period, between disinfection and handover, the designer shall ensure the contractor manages the system and water quality to avoid stagnation. The contractor will be required to regularly flush every outlet in the building (and record that this has taken place) in accordance with the above WSP guidance and standards. This shall be 40% of the outlets every day on a rotational basis resulting in every outlet having two flushes per week.
i. Water sampling shall be undertaken as detailed in book 3 of the Water Safety Plan. A sampling plan, together with design layout drawings, shall be drafted and sent to the University water safety engineer at least 10 days prior to sampling for agreement. The sampling plan shall be in accordance with the Water safety Plan.
j. The flushing and disinfection of any TMVs is very complex and requires accurate sequential works. Please refer to the WSP for details.
k. It is essential to encourage draw off to simulate normal usage. The WSP gives specific details of pre-handover flushing temperature flush checks and procedures in WSP book 3.
l. During pre-handover flushing, as detailed above, then it may be necessary for the contractor to reduce the tank water stored volumes to ensure that the tank volume is turned over every day.
m. The contractor shall keep records of this flushing regime including details of the frequency of flushing of every outlet and the times taken to comply with temperatures detailed within previous clauses.

23. Commissioning required prior to handover. All results to be fully documented. Further details may be found within the WSP.
    a. In addition to the commissioning checks and setting to work described within the main contract specifications and elsewhere the designer will be required to ensure that the following commissioning checks and balancing are undertaken prior to handover.
    b. Balance the hot water secondary system such that, under no draw off conditions (for example very early morning where there has been no draw off for at least 2 hours) the flow pipe temperature drop from the hot water generator to furthest point outlet does not exceed 5c at any point on the network.
    c. Balance the hot water secondary system such that, under no draw off conditions (for example very early morning where there has been no draw off for at least 2 hours) the return pipe temperature drop from the furthest point outlet back to the hot water generator does not exceed 5c at any point on the network.

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d. Set all thermostatic valve to the required discharge temperature as per the WSP. Test their fail safe performance by shutting off cold water supply to the TMV and ensure fail safe operation as per the manufacturers requirements.
e. Set all mechanical mixer taps to the required discharge temperature as per the WSP.
f. Perform all time and temperature checks at all outlets and record results as per the WSP. Take corrective actions for any readings falling outside of the required parameters to ensure every outlet complies with the WSP performance requirements.
g. Where there are TMVs or TMTs fitted then the hot temperature measurement, for time and temperature checks, must be taken on the hot inlet to the valve by a probe surface temperature measuring device.
h. Where mixing taps, either mechanical or thermostatic are fitted, and set to a lower temperature than the circulation system then the time and temperature measurement for the hot water must be undertaken on the hot pipe immediately prior to the mixing device itself.

24. The appointed consultant shall ensure that handover documents include Legionella prevention maintenance and good housekeeping guidance and that they have been compiled in accordance with the University Water Safety Plan. Examples include quarterly shower and head unit cleaning regimes, TMV testing and inspections, disinfection results etc. All documentation should be in accordance with the University Water Safety Plan and ACoP 'L8' including legionella risk assessments to BS8580.
25. 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.
26. All expansion vessels utilised on the domestic water services installation shall be flow through type which may mean adapting to suit.
27. Pressure reducing valves shall be installed on the mains cold water service immediately after it enters the building. These are required to reduce water pressure from potentially elevated incoming mains water pressure which can be experienced at the University.
    a. 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.
    b. 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.
28. Domestic hot water services.
    a. Wherever possible the storage of large amounts of hot water service should be avoided.
    b. The Building Management System must have the ability to control the temperature of any centralised 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.
    c. Sensors 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.
    d. Hot water services should be provided by one of the following alternatives: In all instances life cycle costs shall be undertaken as detailed earlier to determine the final preference. This to include energy, maintenance and carbon costs.
    e. 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

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f. Plate heat exchangers (PHE) should be installed N+1 with each sized to provide 100% of the design load.
g. Local instantaneous gas fired are also acceptable. These heaters shall be designed N+1 each to ensure 100% of the design load is maintained in the event of a unit failure.
h. Local electrical standalone heaters are also acceptable.
i. All hot water systems incorporating storage shall have automatically controlled destratification pumps, except small domestic cylinders that are below 150 litres in storage. Bespoke 'compact heat exchanger' water heating units for direct connection to district heating network complete with secondary return to reduce time lag on hot water delivery.
j. In all instances, except local discreet standalone heaters, full redundant standby shall be provided eg 2 x100% or 3x50% etc.
k. Thermal disinfection should be possible to be undertaken at the calorifiers and the pipework circulation.

29. Self regulating trace heating tape systems are to be used to prevent freezing and are not to be used to maintain domestic hot water circulation temperatures. Where trace heating tape is utilised on external pipework a temperature probe shall be installed in the cold-water pipework to monitor the temperature of the water local to trace heating tape. The design shall ensure cold water temperatures do not exceed 20°C.

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Design Components

Item	Manufacturer	Comments
Brassware	See separate design guide	There is a separate design guide giving details of all brassware outlets and this needs to be referred to.
Water Boilers		It is the University of Leicester's preference to use water boilers as opposed to kettles.
Water Boilers (point of use)	Zip	Point of use shall be used on low demand buildings except for larger lab sinks where some store volume may be required.
Thermostatic mixing valves	Horne	Outlet brassware is to be mechanical non-thermostatic Monobloc mixer tap outlets in low risk areas. TMTs or TMV's with individual hot and cold taps are however required in higher risk areas including all assisted toilets and bathrooms. TMVs are required to all showers and baths. A risk assessment needs to be carried out on each project and the designer shall consult the University on a project by project basis.
Valves (inc. PRV's etc.)	Honeywell Brockman Crane Hattersley Oventrop TA	PRV's ideally should be dynamic and static pressure reducing type.
Isolation Valves Serving Hot and Cold Water Outlets. Flow restrictors	Pegler EB300T Valves with small manual handle and colour coded red or blue to the service	Every local outlet or tap shall be fitted with a local means of isolation to enable easier servicing. Valves to be brass on copper and chrome on chrome pipe. Final connections to outlets may be undertaken using compression fittings for ease of future maintenance. WCs shall be provided with strainer cartridges instead of flow restrictor cartridges. In certain circumstances flow restrictors may be needed but these should only be included where absolutely necessary as they are regularly serviceable items.
Showers	Mira/ Rada/ Bristan	Shower heads should be a fixed spray (non adjustable) pattern. All are to be thermostatic fail safe.
Centalised Storage Water Heaters	Hoval Lochinvar Andrews BSS	Standby Margins shall be sized based on 2No @ 100% duty minimum or 3no. @50% duty.

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Item	Manufacturer	Comments
Water Storage Tanks	Braithwates Balmoral Dewey Waters	Storage facility shall generally be provided for resilience purposes for academic and residential developments primarily. Sectioned tanks are acceptable providing they are internally smooth with external flanging etc. Storage tank access shall be 1200mm minimum around all sides with 1500mm provided around flanges/ connections. Safe access to tanks shall be maintained for maintenance and cleaning purposes. Where internal ladders are provided these shall be stainless steel. External access ladders should be galvanised steel. All internal supports shall be solid, not hollow.
Pumps	Wilo Grundfos Armstrong	Variable speed multi-stage pumping should be employed (Duty/Assist/Standby configurations preferred for boosters). Inverters should be local to the pump sets and not part of the packaged pump set. Smaller systems, 1l/s peak demand may utilise package pump sets.
Pipework	Yorkshire Pegler	Traditional copper pipework as the University standard mechanical specification. Copper pipework to utilise solder ring fittings up to Ø54mm in lieu of end feed. Brazed fittings shall be used shall be used on pipework 67mm and above. Plastic pipework, stainless pipework and pressfit, push fit systems and crimped systems will not be accepted by the University. Compression fittings may be used on final connections to outlets only. Flexible connections to outlets are strictly prohibited.
Plate Heat exchangers	Hoval Alfalaval Stockvis BSS	2No @ 100% duty minimum or 3 @50% etc.
Water boosting sets	Grundfos Flowmech	Configured as per details in this document. Flow through expansion vessels needed. Soft start, intelligent variable speed.

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Item	Manufacturer	Comments
Insulation		Mineral Wool or Rockwool shall be used with an external foil faced vapour barrier. This shall be applied to all hot and cold-water installation pipework. Both hot and cold services will be finished in the same way to maintain the same finish. Phenolic foam will not be allowed on copper pipe systems. All thermal insulation shall be responsibly sourced and where applicable evidence shall be provided to the project BREEAM assessor/s. All thermal insulation shall be low embodied impact relevant to their thermal properties determined by the 'Green Guide' by achieving either A or A+ green guide rating. Insulation must be provided to the appropriate ECA recommended thicknesses and not British Standard requirements to satisfy the energy criteria for each development. All pipework supports shall be fully insulated with insulation inserts to the same thickness as the pipe insulation itself. Blocks must be fully load bearing. Alternative supports i.e. rubber lined clips will not be accepted.
Limscale Inhibitors	Salamander SESI Hydrotech UK Ltd	Electrolytic 'Fit and forget' units to be installed on services up to 22mm incoming services. Large Services shall utilise Physical Water conditioning as provided by Hydrotech, such as a Hydromag.

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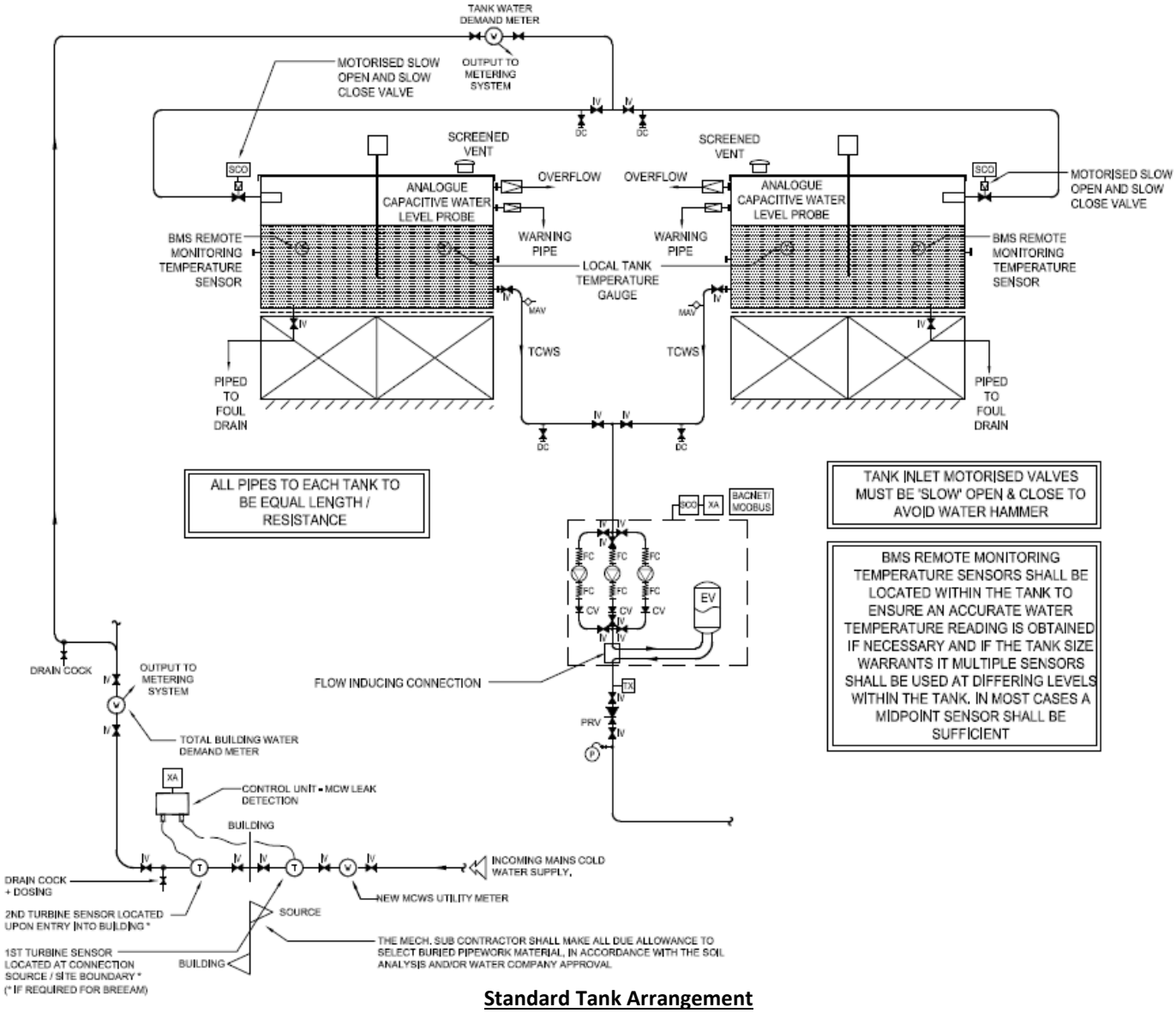

Standard Tank Arrangement

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