Examination of Domestic Cold Water Systems

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AECOM

Domestic cold water systems

1. Aim
2. Design methodology
3. Water quality standards and regulations
4. Potential causes of cold water overheating
5. Mitigation measures
6. Summary

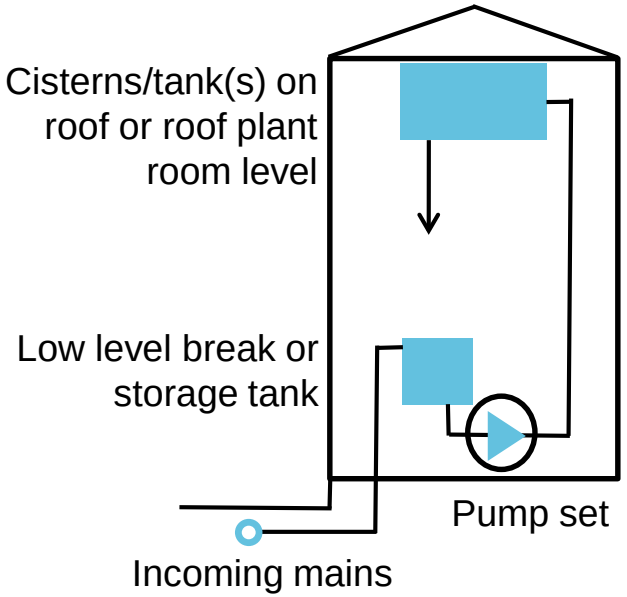
Domestic cold water systems– Aim

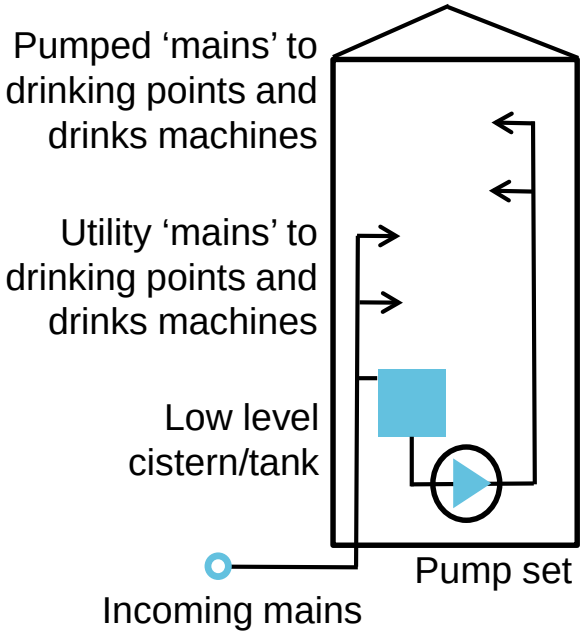
To highlight how various parameters may contribute to the performance of building cold water systems.

This examination comprises of three parts:

1. To understand current methodologies;
2. Examine potential causes of cold water systems overheating;
3. To suggest potential mitigation measures for system overheating to maintain acceptable DCWS quality.

Domestic cold water systems- Tracing the systems route





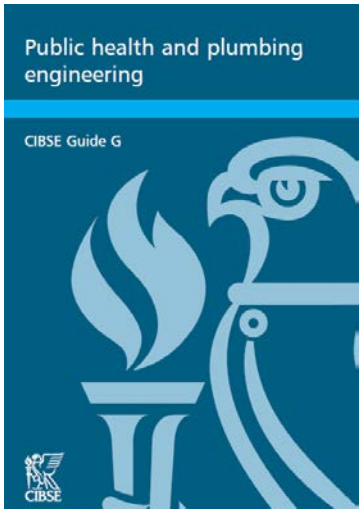
Images from* Plumbing Engineers Design Guide IoP 2002

(A) Combined pump and gravity (B) Mains water for drinking

Domestic cold water systems– Design methodology

Loading units: IoP, BS6700:2006, CIBSE Guide G

1. Probability theory;
2. Time between uses of an appliance;
3. Duration of use;
4. And flow rates when in use.



Domestic cold water systems– Research from academia

Webster 1972: Generalized binomial distribution function

Courtney 1976: Probabilistic model

Konen 1980 and Holmberg 1981: Dimensioning formula

Murakawa 2004: Development of the calculating method for the loads of water consumption in restaurant

Takata 2004: Development of the calculating method for the loads of cold and hot water consumption in office buildings

Blokker 2006: Simulation of water demands provides insight

Alitchkov 2007: Statistical method for estimation of peak water demands in supply systems for buildings

Saarekonno 2007: Domestic water consumption and its irregularity

Goncalves 2008: Model of design flow rate in water sub-metering systems using fuzzy logic and monte carlo method.

And many, many more.....

Domestic cold water systems– Legionella / bacteria

The Chartered Institute of Building Services Engineers Technical Memorandum TM13 '*The Control of Legionella*' identifies the following as temperatures for Legionella growth:

1. Dormant; 0°C to 20°C;
2. Will multiply; 20°C to 45°C;
3. Will not multiply and will die in time; 50°C to 70°C;
4. Not active; 70°C to 100°C.

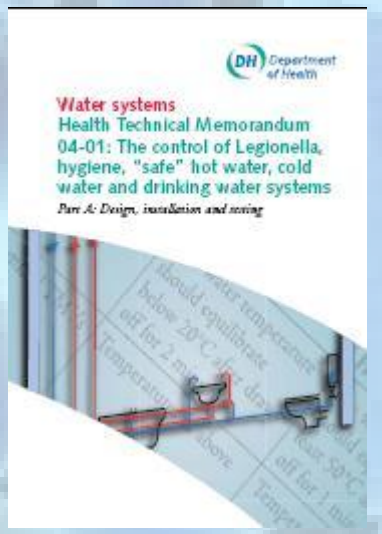
The most favourable temperature, based on empirical data suggests that the ideal microbial growth and proliferation is 36°C.

Domestic cold water systems– Legionella / bacteria

Appliances such as, WHBs, sinks, WC's, drinking fountains, bib taps and urinals are not typically associated with aerosol sprays.

Certain groups of people are known to be more susceptible:

1. men;
2. over 45 year olds;
3. smokers, alcoholics;
4. diabetics;
5. immune compromised and
6. cancer or respiratory or kidney disease.

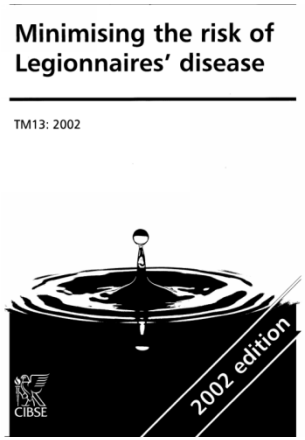


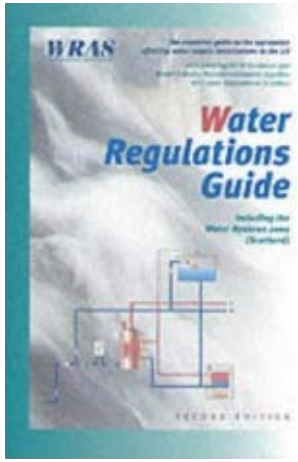
Obvious building where infection would prove catastrophic and potentially fatal is a hospital. The Department of Health have the Technical Memorandum HTM 04-01

BS 8580:2010 provides details of how to conduct a Legionella risk assessment.

Domestic cold water systems–
Water quality standards and regulations

1. CIBSE TM13 – ***'Minimzing the risk of Legionnaires disease'*** and BS8580:2010 - ***'Water quality- risk assessments for Legionella control'*** requires CWS to be below 20^{o}C after turned on 120s;
2. WRAS requires temperature below 25^{o}C;
3. UK Health and Safety Executives L8 requires temperature between 20^{o}C and 45^{o}C to be avoided.





Domestic cold water systems– Potential causes of cold water overheating

From the mains water supply network:

1. Mains water authorities should have a requirement to provide water less than 20^{o}C;
2. Rural location of a building on a radial service;
3. Burial depth of incoming water;
4. MWS storage tanks located above ground or in semi-buried configurations.

From water conservation measures:

1. Introduction of rainwater, grey water, black water recycling;
2. Use of percussion taps and low-flow fittings;
3. Lack of regular flushing of the system.

Domestic cold water systems– Potential causes of cold water overheating

From design and management:

1. Possibility of oversizing cold water storage tanks;
2. Reduced periods of occupancy;
3. Heat generating plant and equipment within ceiling voids;
4. DCWS pipelines should be kept minimum distances from LTHW pipelines;
5. Water storage tank location;
6. Lack of quality control of legislation in regards to thermal insulation of plant and equipment;
7. Insufficient space between heat generating plant and cold water storage tanks;
8. Lack of domestic water draw-off due to unoccupied spaces;
9. End user not implementing risk assessments and procedures to control the risk of Legionella.

Domestic cold water systems– Mitigation measures

1. Ensure pipe sizing is carried out as close as possible to the expected demand to ensure good flow, to minimize stagnation and potential heat gain;
2. External MWS pipework between site boundary and plantroom should be at a depth of 750mm;
3. Improve quality control with regards to thermal insulation and increase insulation on CWS;
4. Isolate and drain down one cold water storage tank section if it is a sectional tank as in hospitals, this will improve turnover-to-demand;
5. Controlled flush/bleed valves;
6. Provide a delayed action adjustable height ball valve within storage tank to allow stored volumes to be adjustable;
7. Introduce manual flushing strategy;
8. Enhanced void ventilation rates;
    1. Low and high level grilles;
    2. Introduce mechanical vent if necessary;
9. Introduce chlorine dioxide tablets – would address bacteria not temperature;
10. Install a small refrigeration system with pumps and plate heat exchanger to chill water within CWS tank;
11. Encourage clients to include post occupancy evaluation, which can be shared with the industry to help inform trends and future updates to standards and guidance.

Domestic cold water systems– Summary

We have covered here:

1. History of domestic services;
2. Current water standards and regulations;
3. MWS should be kept below 20^{o}C;
4. Potential causes of pipework heat pick-up and potential mitigation measures;
5. Suggestions for maintaining a healthier water supply to our clients;
6. Suggestion for promoting a culture of collaboration and knowledge sharing with the goal of benefitting the building services industry and our clients.

Thank you.

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