INSULATION AGAINST FROST & HEAT GAIN

WATER BYLAW REQUIREMENTS

Where water systems are installed in situations where they might be subjected to freezing temperatures the professional installer will take care to ensure that the systems are installed in accordance with the Water Regulations. This should give a reliable trouble-free service, as far as possible, regardless of the weather.

No amount of insulation will prevent freezing, insulation simply delays its onset. The better and thicker the insulation, the longer the delay. So, the best precaution against the freezing of water systems in buildings is the obvious one of keeping the building temperature above the freezing point of water.

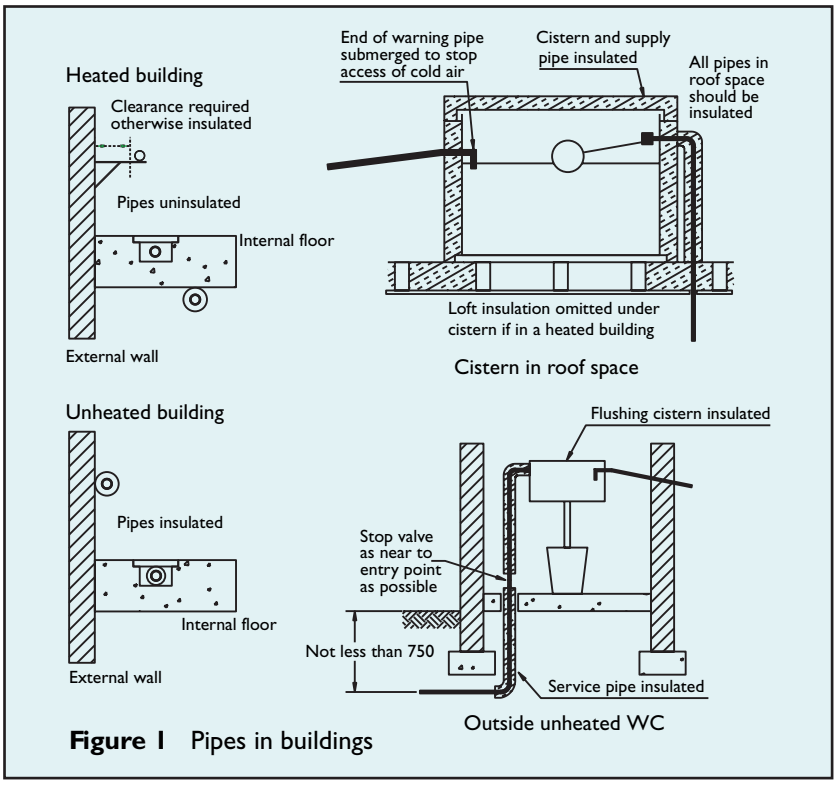

Figure 1 Pipes in buildings

Why might one frozen tube burst whilst another, also frozen, doesn't?

Since copper tubing to EN 1057 thin wall formerly Table X is capable of withstanding a minimum of 30% expansion and the volume of water when frozen only increases by about 10%, it is an established fact that if a copper system is frozen uniformly, it will distend but not burst. In practice, local freezing results in the formation of a plug of ice. This grows until the pressure increase melts the surface of the ice at the ice/tube interface. This phenomenon is called regelation, it allows the ice plug to move and equalise the pressure at each side. If the ice plug is prevented from sliding, by an elbow or terminal fitting, the pressure builds up as the ice plug grows until the hydraulic pressure in the unfrozen water exceeds the bursting pressure of the tube, the result is a "frost" burst. Regardless of the material from which the tube is manufactured, once an ice plug forms, the supply of water will be stopped and so frost precautions are still necessary.

Tube size (mm)	0.02 (W/mK)	0.025 (W/mK)	0.03 (W/mK)	0.035 (W/mK)	0.04 (W/mK)	0.045 (W/mK)
15	20	30 *(30)*	25	25 *(62)*	32	*(124)*
22	15	15 *(12)*	19	19 *(20)*	25	*(30)*
28	15	15 *(8)*	13	19 *(12)*	22	*(17)*
35	15	15 *(6)*	9	9 *(9)*	13	*(12)*
42	15	15 *(5)*	9	9 *(7)*	9	*(9)*
Note: Figures in brackets are calculated values shown in BS 6700.						

Table 1: Recommended minimum thickness (mm) of insulation for indoor cold water systems

Water Regulations

Water regulations require that all water services (except warning or overflow pipes) and water fittings shall be protected, so far as is reasonably practicable, against damage from freezing. Where this protection is to be in the form of insulation, then Table 1 gives suitable thicknesses based on the Thermal Conductivity of the insulation and the nominal outside diameter of the tube.

Studying the table will show that a small diameter tube requires relatively thicker insulation than a large diameter

tube. This is because the smaller diameter tube (especially when used to carry cold water) has relatively less heat energy in it. It will therefore cool to freezing temperatures more quickly and so need relatively thicker insulation than larger diameter tube.

Positioning services, appliances and water fittings

Regulations require tube and water fittings to be installed in positions where the risk of freezing is reduced. Particular care should be taken where double check valves and other devices used to prevent backflow and back-syphonage are installed. Tube and fittings which are at risk must be insulated and be capable of being drained. Figure 1 illustrates situations where insulation is and is not required. Where tube feeds an outside tap a servicing valve should be fitted, see Figure 2. In ventilated roof spaces the insulation should be equivalent to outdoor standards.

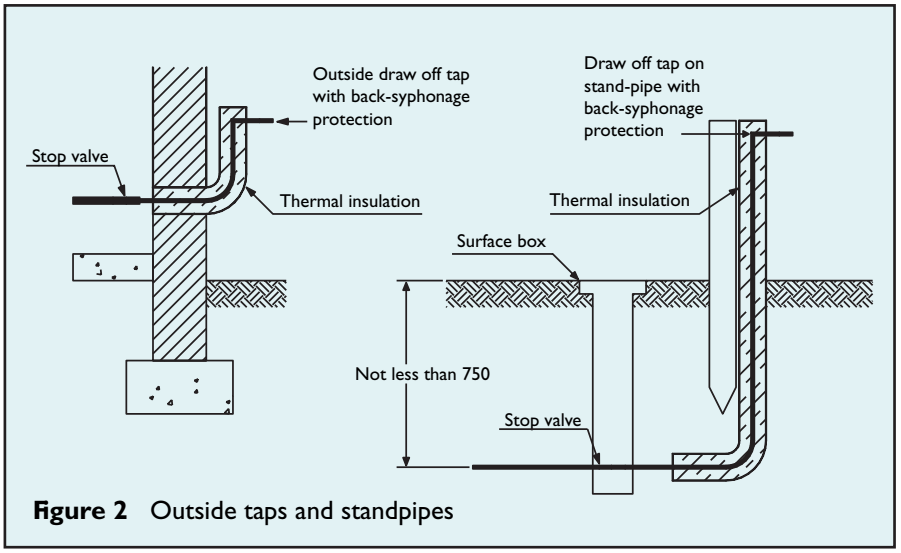

Figure 2 Outside taps and standpipes

Particular situations requiring special care include:

Tube installed near windows, air bricks, external doors, where draughts are likely;
Unheated roof spaces;
Unheated cellars;
Unheated outbuildings and garages;
Tube in contact with cold surfaces, such as the inside of an external wall;
Tube in chases and ducts formed in external walls;
Positions where the service entry point is closer than 750mm to external walls, see Figure 3.

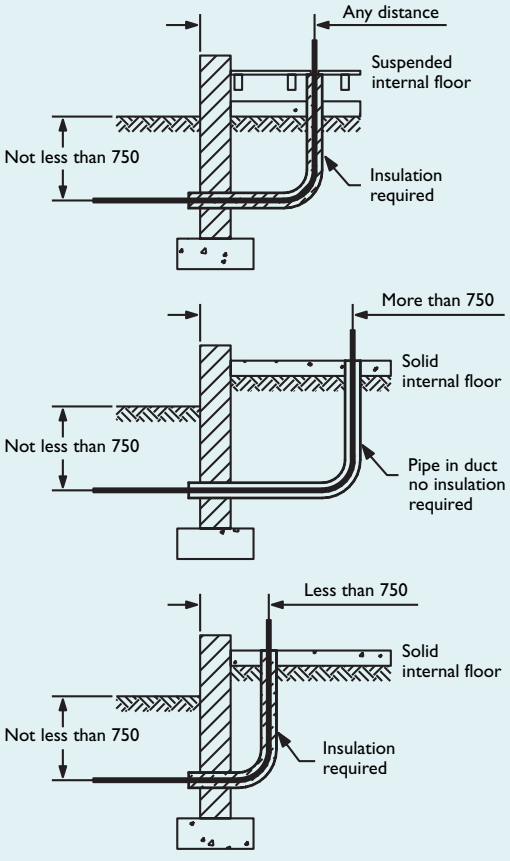

Figure 3 Service entry detail

Trace heating tape

Where water systems have to be installed in unheated buildings or external situations above ground level, insulation must be used. It might also be necessary to use trace-heating tape if the water supply is not to be interrupted during severe weather conditions. Self-regulating trace-heating tape is available, this consists of two electrical conductors separated by a special compound Both are enclosed in a plastic covering. If the temperature falls the electrical resistance of the separating compound reduces and so electricity flows causing the tape to be heated. This heating results in the resistance increasing thus reducing the electricity flow. Effectively the tape regulates its own temperature to keep itself as well as the tube it protects at the design temperature with the minimum use of electricity. The trace-heating tape should be fitted between the tube and its insulation.

Waterproof insulation

Where insulation is to be used where it can become wet, such as outdoors or underground, it must be waterproof. Closed-cell foam type is satisfactory. Insulation which can absorb water is actually worse than no insulation at all! This is because when wet the insulation looses it's insulating properties because water fills the small pores which trap the air. Also, because the insulation has a larger surface area than the tube it covers, heat is lost more rapidly resulting in quicker cooling.

Prevention of warming of cold water services

This is best achieved by designing the system so that the runs are kept a reasonable distance away from sources of heat. Where cold water services that are used for domestic purposes have to be installed near to sources of heat, or run through hot environments, such as in ducts with hot water or central heating mains, Water regulations require them to be insulated against heat gain to prevent waste of water. This so that the water will not be warm when drawn from the taps. Furthermore, if the hot environment is also humid, such as in a changing room and showers, insulation can also be used to prevent excessive condensation forming on cold water services.