South Staffs Water

incorporating

CAMBRIDGE WATER COMPANY

Design Considerations
for Water Supplies in Apartment Buildings and Flats

Contents

Design considerations for water supplies in apartment buildings and flats

Introduction

This guidance is to help property developers and installers when designing water service layouts in multi occupancy buildings such as maisonettes, apartment blocks and flats.

This guide aims to bring together customers' expectations and the requirements of the Water Supply (Water Fittings) Regulations 1999, along with our experiences of helping customers. These range from leaking pipes in difficult to access locations, to third parties exerting control over water supplies, whether it is limiting the water supply, preventing access to fix leaks etc.

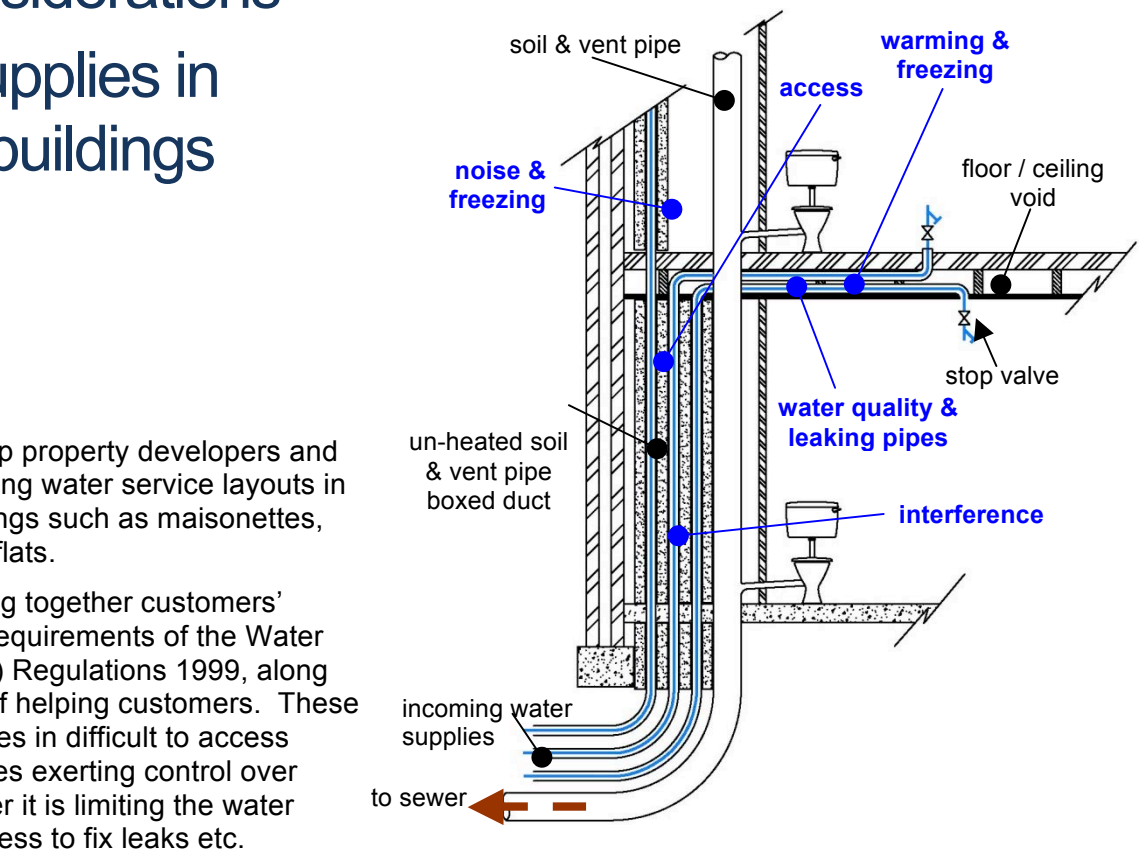
Our approach has been shaped by problems that could have been avoided if a little more consideration had been given to the plumbing system, location of control valves, pipe layouts and routing, during installation.

Whilst householders take comfort in being in control and independent from the influence of others, cases such as those highlighted below undermine the expectation that 'every man's home is his castle' which is still considered important today.

What are the most common problems?

Noise from plumbing and drainage can cause annoyance that can become intolerable over time, particularly with the increasing use of newer light weight construction methods and this is only likely to increase complaints. This noise can be caused either from the knocking of unclipped pipes, water being drawn off from taps or through toilet cisterns filling. Also noise from wastewater discarded into the drains such as toilet flushing or bath emptying can become intrusive.

Figure 1: Why water supplies should not be installed using the soil and vent pipe ductwork.



Warm water from cold taps can be as a result of pipework being routed through heated areas such as other apartments which the receiving user will have no control over. This can lead to excessive use and waste as water is drawn off until it runs cold at the tap.

Freezing pipes like the warming (above) can be the result of pipes running through unheated apartments or other unheated spaces such as basement parking areas etc. This can put public health at risk through the lack of drinking water and sanitation and in more severe cases damage to pipes and property when the supply thaws.

It must be remembered insulation can only delay the onset of frost or heat gain to the water so routing pipes through apartments will only add uncertainty.

Water quality can be affected due to the problems above, as the warmer temperatures will promote bacterial growth.

Leaking pipes and fittings are always annoying, even more so when it is someone else's leak on your property. But nothing is worse than when it

leaks inside your own apartment and you have no control in stopping it happen.

Access to your own control valves or pipes when you need to carry out maintenance is essential and having to plan access can be inconvenient and difficult, in extreme cases can turn routine maintenance into an emergency.

Interference by others whether this is simply turning off or restricting a water supply whether intentional or not is at best inconvenient and in the case of tapping into someone else's water supply to take water they are not entitled to is illegal.

If pipes are routed through apartments, not only is water temperature likely to be affected but reliable access for routine repair and maintenance can be problematical at best and in extreme cases cause a barrier.

How can these problems be avoided?

The requirements of the Regulations and the spirit in which they are written set out provisions, not only to protect current owners and users, but also those of the future as well. They require all water fittings to be of an appropriate quality and standard and fit for the circumstances to which it is to be used (Regulation 4).

These provisions intend that the occupier, owner or user has a constant supply of water fit for consumption and has full access and control, so they are able to use and maintain their own system. It will ensure the water that we supply is used efficiently, fittings do not cause damage and to make sure it is not contaminated before it can be used.

The nature of the way the Regulations have been written is such that a number of requirements need to be read in conjunction with each other to fully understand the spirit and what is deemed acceptable.

For buildings incorporating apartments and flats there are particular areas that need extra careful consideration. These are:

- How the pipe enters the building.
- The position and accessibility of controlling valves.
- Accessibility to pipes and fittings for maintenance and routing them to individual apartments.
- Ensuring that temperature and quality of water is not compromised before it can be used.

Plumbing requirements

Control valves

As the water supply enters the building there must be an incoming stop valve conveniently located. This must be above floor level and accessible to all for emergency situations when isolation of the supply is needed.

Once the water supply enters the individual apartments, the normal Regulation plumbing requirements will apply. This starts with providing an incoming stop valve somewhere practicable, normally located under the kitchen sink, when it enters the apartment, but they must not be located at high level eg in the ceiling where access is difficult.

Maintaining water quality

The most difficult aspect is to make sure the temperature and quality of water is not affected by the routing of pipework and careful consideration is needed. To ensure water is not affected the temperature should be maintained below 20^{o}C before it is delivered to the tap. Ambient room temperatures can vary widely between individual apartments to suit occupiers' comfort needs. Apartments can also remain unheated for extended periods, particularly where occupiers may be away on holiday or when they are not occupied.

Whilst temperature gain (warming) is likely to be less of an issue in communal areas, it may not always be possible to completely remove the problem, and insulation will still be needed in most cases to preserve water quality.

Frost protection

The level of frost protection needed to prevent damage and keep a water supply flowing will depend on the location, temperatures that pipes and fittings are likely to be subjected to, the quality of insulation and the workmanship when it is installed.

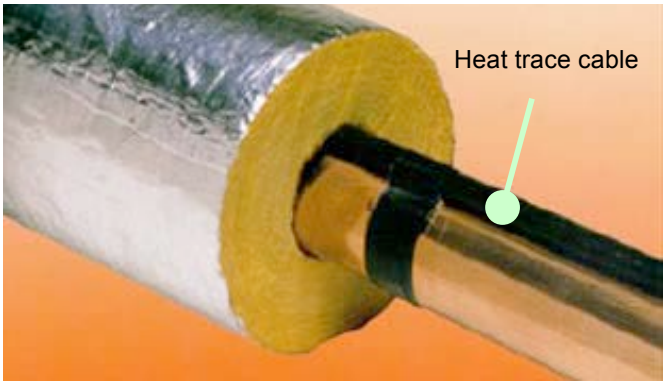
The workmanship during installing insulation is as critical as the selection of the right quality of insulation. Insulation must cover all exposed pipework and fittings, as leaving one small exposed part will allow the cold to penetrate and undo all of the good work in protecting the system as Figure 4 demonstrates.

The Water Fittings Regulations Guide identifies that plumbing systems will fall into one of two conditions:
Normal Conditions where the plumbing system is inside the thermal envelope of the building, this is where the plumbing system may be left in an unheated space for up to 12 hours a day, or
Extreme Conditions where fittings are either outside of any building or, inside the building but outside of the thermal envelope.

Pipes and fittings routed through unheated spaces inside the building such as through communal areas or ducting between floors etc should be insulated according to **Normal Conditions** to minimise any undue warming or freezing.

Other exposed areas, such as basement garages and external bin areas, are considered to need **Extreme Condition** insulation.

Figure 2: Trace heating applied to pipework prior to insulation being applied



However, for critical needs such as the main drinking water supply, an active protection system should be used for pipes subjected to **Extreme Conditions**. Trace heating is one method that can ensure the supply of water is not disrupted during extended cold periods.

Figure 3: Polyethylene foam and nitrile rubber insulation

Insulation outside of the building or in damp/wet environments must be of the waterproof 'closed cell' type that will not absorb water because if it did it would not give the protection needed. These are typically made from either flexible nitrile rubber foam or the more ridged polyethylene foam.

Figure 4: Lack of insulation will allow internal water meters to freeze and split causing a loss of water supply

We consider that for **Normal Conditions** insulation needs to offer protection for a minimum of 12 hours at -5°C.

This means that for the most commonly available closed cell insulation it needs to be 32mm thick to protect a15mm copper pipe or 19mm thick for either a 22mm copper pipe or 25mm (OD) MDPE pipe.

In **Extreme Conditions** the insulation needs to offer a minimum of 12 hours protection at -10°C. This translates to insulation thickness of 330mm for 15mm copper pipes or 60mm for 22mm copper or 25mm MDPE pipes.

The insulation thickness can be reduced where trace heating is used by approximately 50% but it should never be less than 25mm wall thickness.

Please note: The thickness of insulation will vary depending on a number of factors, thermal conductivity of the insulation material, the incoming water temperature and external air temperatures. The examples given above are based on a thermal conductivity of 0.34W/mK at 0°C. The 'Line Temperature' of the incoming water is assumed to be 7°C for normal conditions and 2°C for extreme conditions.

WRAS has produced a free to access Insulation Calculator tool on their website www.wras.co.uk/publications_default.htm which should be used when considering different insulation materials to ensure the right level of protection is offered.

Reducing noise

Cold water storage and WC cisterns can be the cause for most plumbing noise and is particularly noticeable at night when filling. This is due to either water flowing through the float valve or it splashing on the surface of the water in the cistern. This noise may be transmitted through pipework and can be amplified by boarding.

The noise can be reduced by mounting it on a strong sound base and encasing it with sound absorbent material.

Little noise is generated in straight pipes but the turbulence in bends and valves can give rise to noise which can be amplified when pipes are fixed to lightweight panels. This should be avoided and wherever possible pipes should be fixed to the heavier parts of the buildings structure.

Water hammer can produce a knocking noise and is normally created by the quick closing of taps or other valves. This creates a high pressure surge and will vibrate pipes and loose parts in fittings.

To minimise the impact of noise in pipes they should be routed through communal areas where the noise can dissipate more easily. Properly clipped pipes will prevent the pipe knocking and causing physical damage, although only replacing fittings with loose components can remove the reverberation noise. The material and size of pipes will determine the spacing for fixing brackets and pipe clips **see Figure 5**. Consideration should be given to the use of plastics pipes as they generate less noise than metal ones.

Figure 5: Guidance for maximum spacing of fixing brackets - Water Regulations Guide Table 4.18

TYPE OF PIPING	NOMINAL DIAMETER OF PIPE		SPACING ON HORIZONTAL RUN	SPACING ON VERTICAL RUN
	mm		m	m
Copper complying with R250 (Half hard) and R290 (Hard) of BS EN1057: 1996 and stainless steel complying with BS 4127: Part 2:1972	22		1.8	2.4
	28		1.8	2.4
	35		2.4	3.0
	42		2.4	3.0
	54		2.7	3.0
	67		3.0	3.6
	76		3.0	3.6
	108		3.0	3.6
	133		3.0	3.6
	159		3.6	4.2
	Copper	Steel		
Copper complying with R220 (Annealed) of BS EN 1057: 1996 and steel complying with BS 1387:1985	15	15	1.8	2.4
	22	20	2.4	3.0
	28	25	2.4	3.0
	35	32	2.7	3.0
	42	40	3.0	3.6
	54	50	3.0	3.6
	67	65	3.0	3.6
	75	80	3.6	4.5
	108	100	3.9	4.5
Ductile iron complying with BS EN 545.	75		2.7	2.7
	100		2.7	2.7
	150		3.6	3.6
Unplasticised PVC[1] complying with BS 3505:1986	1/4		0.6	1.1
	1/2		0.7	1.3
	3/4		0.7	1.4
	1		0.8	1.6
	1 1/4		0.9	1.7
	1 1/2		1.0	1.9
	2		1.1	2.2
	3		1.4	2.8
	4		1.6	3.1
	6		1.9	3.7
Black MDPE pipe complying with BS 6730: 1986 (1998)	25		0.6	1.2
	32		0.6	1.2
	50		0.8	1.5
	63		0.8	1.6
Chlorinated PVC-C[2] complying with BS 7291: Parts 1 & 4	12 to 25		0.5	1.0
	32 to 63		0.8	2.2
Polybutylene (PB) and cross-linked polyethylene (PE-X)[2] complying with BS 7291: Parts 1, 2 & 3	Up to 16		0.3	0.5
	18 to 25		0.5	0.8
	28		0.8	1.0
	32		0.9	1.2
	35		0.9	1.2

Notes:
[1] Figures are for normal ambient temperatures at or below 20°C. For temperatures above this the pipe manufacturer should be consulted.
[2] Based on water temperatures up to 80°C

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Where to route pipework

Services for ground floor apartments can be easily installed in the traditional manner as used for houses and should pose few problems. Upper floors apartments need greater care to find the most suitable routing and can be more problematical.

To ensure practical access can be maintained and to make sure individual properties do not reduce the water quality, pipe routes should be through communal areas such as corridors and stair wells. This will ensure no one occupier can unduly influence the quality or supply of water provided for other occupiers.

Whilst most householders will be friendly with their neighbours, disputes often occur and cannot be predicted, this can have a greater impact in apartment buildings and consideration should be given to avoid personal spaces that can cause conflict.

Figure 6: Routing of individual water supplies using communal areas.

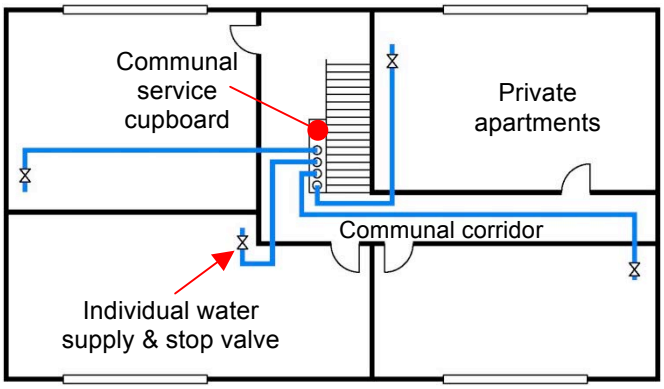
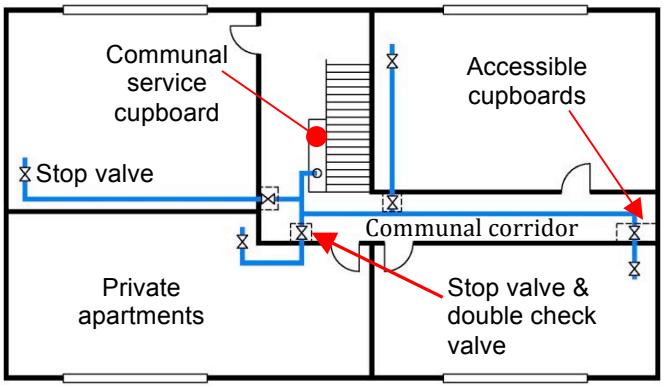


Figure 7: Pipe routing for a single common water supply to feed multiple apartments using communal areas.



In these areas pipes can be located in the traditional manner through floor joists where ready access can be gained through ceilings or lifting of the floor using small hand tools. In solid floors access to pipes must be through ducts with removable covers under normal floor coverings. Embedded ducts with removable access points at either end that allow a pipe to be readily removed are also acceptable, however if this method is used for insulated pipes you must check that the pipe can still be easily removed.

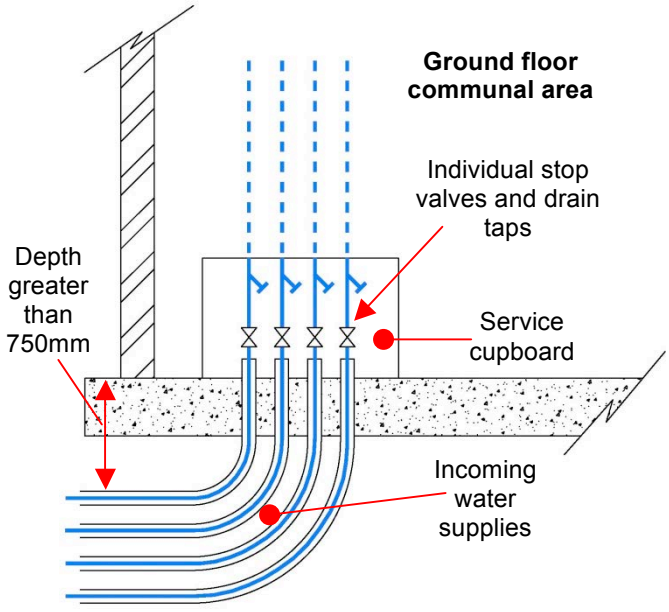
Following these rules will ensure easy and reliable access to pipes and fittings for maintenance. The risk of leak damage to individual apartments is minimised as is noise from water use. This also reduces the opportunity for malicious interference.

However there are some specific requirements that apply for both individual apartment water supplies direct from the mains and single common supply systems, whether they are fed direct from the mains or from storage.

Individual supplies

Where individual water supplies are provided the pipe should enter the building fabric in the normal manner via a duct into a communal area (see Figure 8) and should terminate with a stop valve, which needs to be accessible to all occupiers.

Figure 8: Showing typical arrangement separate incoming water supplies through with accessible cupboard to all occupiers.



Single building supply

Where a single common water supply system is used to serve all apartments additional requirements apply. Each apartment connection from the common supply must have an individual communal stop valve accessible to all occupiers. This should be in an area outside of the individual apartment. In addition, each apartment supply must also have zone protection using a double check valve. This is best located immediately after the communal stop valve and is needed to prevent cross-supply between apartments, see Figures 7 & 10.

Figure 9: Example of an internal manifold installation

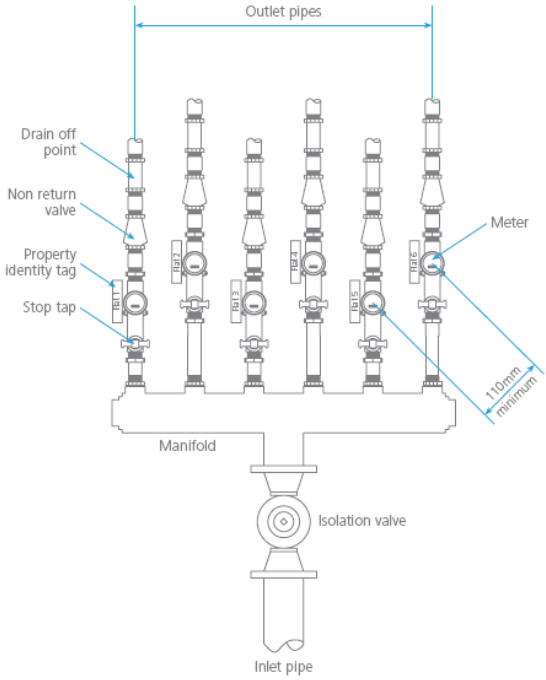
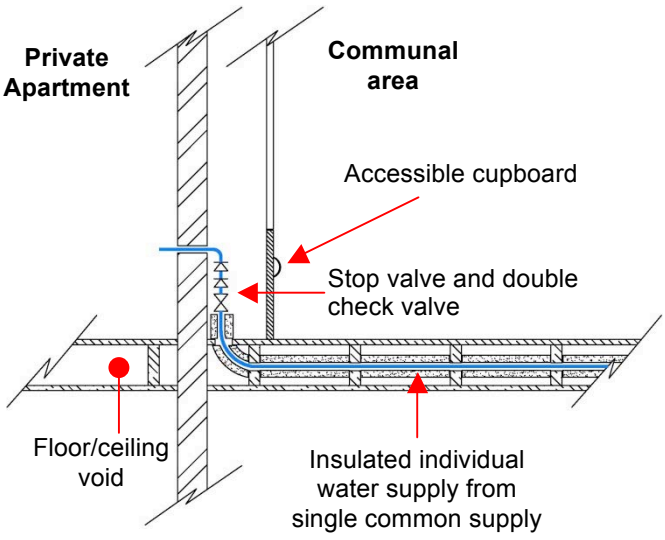


Figure 10: Showing an accessible stop valve and zone protection



Storage

Storage cisterns are often used to supply apartments when the incoming water supply cannot reach the upper floors, or where the incoming water supply cannot meet all of the occupiers needs. These storage cisterns need to meet the normal requirements eg made from materials that will not affect the water quality, keep the water cool, prevent insects getting into the water etc.

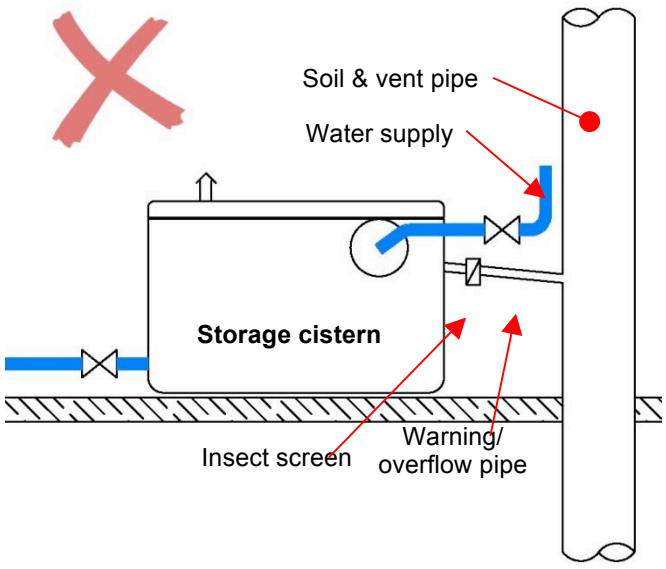
The installation must ensure that the stored water remains wholesome. The following factors need to be considered:

- Temperature of stored water.
- Routine maintenance to ensure debris, that could provide nutrients thereby supporting bacteriological growth, is cleaned out to.
- Warnings of overflow from the storage cistern can be quickly identified. This can be through electronic alarms or readily visible discharges from warning pipes.

However other problems have been highlighted in recent years from warning and overflow pipes particularly when the soil and vent pipe (soil stack or drainage system) is used to dispose of this overflow water.

Overflow and warning pipes should not offer a route for contamination to enter the storage cistern. Consideration must be given to how they can discharge the water safely and should not be connected direct to the soil and vent pipe. Such connections can allow sewage or gasses vented from the sewer to enter the storage cistern and has historically been the cause of contaminated drinking water, see Figure 11 below.

Figure 11 how not to install an overflow connection direct to soil and vent pipe



If a soil and vent pipe is to be used to dispose of overflowing water extra precautions must be made.

There should be a physical air gap between the warning and overflow pipe and the soil and vent pipes, this is usually made by a tundish arrangement.

There must also be seal between the soil and vent pipe and the storage cistern.

- A self closing mechanical seal is often the best method of protection see Figure 12.
- Water traps used in floor gullies Figure 13 should only be used in areas where the water seal will be replaced on a regular basis otherwise a mechanical seal should be used.

Figure 12: How to install an overflow discharging into a soil and vent pipe

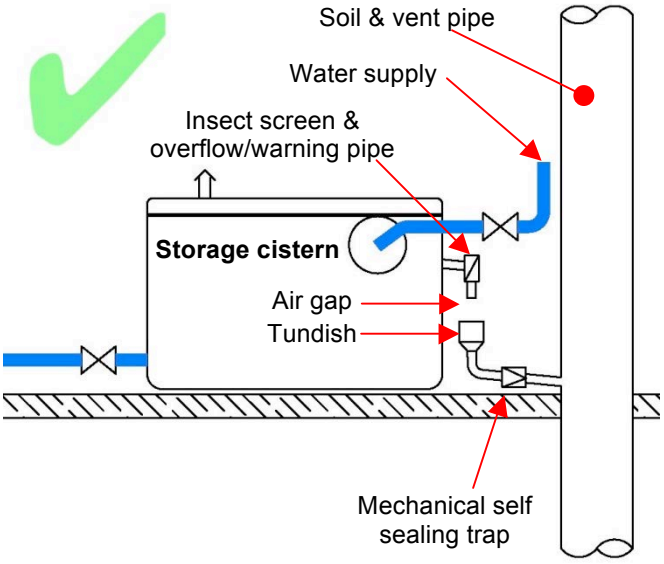
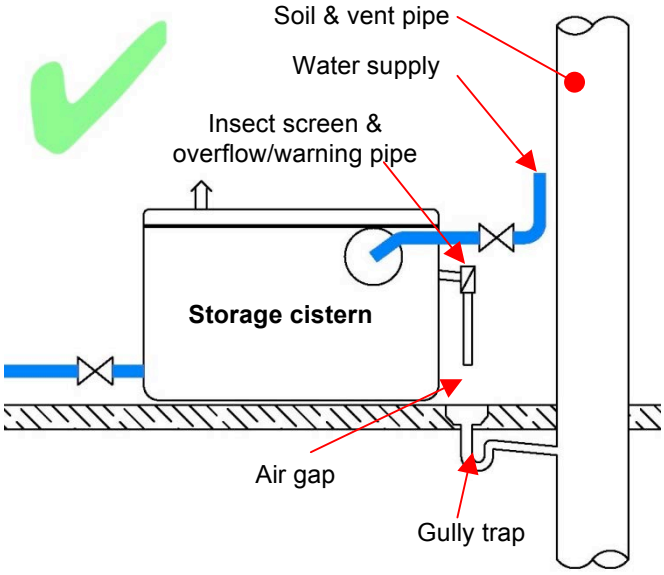


Figure 13: How to install an overflow using a gully trap



Water Reuse Systems

Water reuse systems such as rainwater harvesting and greywater are increasing and is often considered well suited to apartment type buildings. It is worth remembering that these systems also come under the Water Fittings Regulations as well.

Whilst our guide on Water Reuse Systems cover the normal installation requirements for these systems, when they are installed in apartment type buildings the requirements detailed in this guide will also apply.

Consideration must be given not only to pipe routes and storage cisterns, but also to allow accessibility to all ancillary equipment, such as the pumps, back-up supplies and storage tanks from a communal accessible area.

In particular if high level storage is used it must be accessible from a communal area if the storage cistern is not dedicated to only serving the apartment below it. Likewise there should be communal access to underground storage tanks.

In summary

By following this guidance it will ensure owners, occupiers and users will have the confidence that they will be able to:

- Easily access stop valves, pipes and fittings so they can carry out routine repairs and maintenance, or shut off the water in an emergency.
- Ensure that the supply is constructed and installed in such a way that it will not prematurely fail.
- Have confidence that pipes and fittings do not go through areas that would allow the water to become contaminated before it can be used.

- Ensure water is delivered at expected temperatures so that it is not unduly wasted.
- Reduce the chance of malicious damage or acts by others to water supplies, eg turning the water off, taking water from it especially when they are metered.
- Not have to worry about the risk of flooding by a neighbour's pipe, particularly where they may not take responsibility for repairing it.

Acknowledgements

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