Unit 206: Domestic hot water systems

Outcome 3 (part 2)

Installation requirements of domestic hot water plumbing systems

Efficiency

Keeping efficiency

Once the water is heated, the system needs to retain the heat and supply hot water effectively to the outlet on demand.

Heat loss is minimised by the use of insulation on the cylinder and pipework. (Building regulations part L).

There also needs to be a control on the length of pipe used to deliver the hot water to the outlet.

1. Waste of cold water before the hot water is drawn off.
2. Hot water is left in the pipe which cools down.

Efficiency

Keeping efficiency

BS6700 states the maximum length of pipe before it becomes a dead leg.

12 - 22mm – 12m

22 - 28mm – 8m

Over 28mm – 3m

Water Regs recommend that the temperature at a terminal fitting must not be less than 50^{o}C within 30 seconds after fully opening the terminal fitting.

Efficiency

Keeping efficiency

Active dead leg: term used to mean that a lot of cold water has to be drawn off before the hot water reaches the outlet.

- Waste of water
- Waste of heated water left in pipe

Passive dead leg: section of pipe that has been capped off and water cannot flow or be drained off.

- Stagnant water

Efficiency

Legionella and bacterial growth can occur in passive dead legs.

Passive dead legs **must** be kept to a minimum length after appliances have been removed to avoid this occurring.

Efficiency

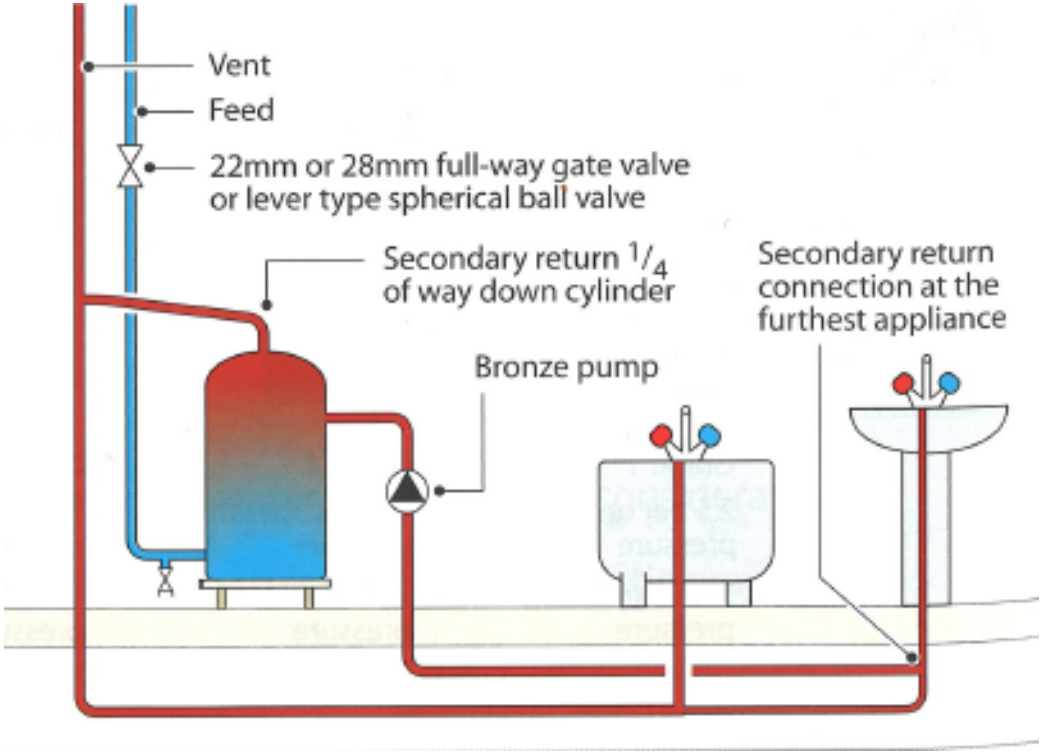
Keeping efficiency

To overcome a dead leg, localised hot water can be installed, or the use of a secondary circulation should be used.

- Bronze pump
  - Return
- Smaller return pipe
  - Essex flange
- Top one-third of cylinder
  - Timer control

Efficiency

Secondary circulation



This allows the circuit of hot water to be much closer to the outlet point and therefore fitted to systems with long pipe runs (dead legs).

Efficiency

Secondary circulation

The connection to the cylinder for the secondary circulation should be made in the top third of the cylinder, commonly using an Essex flange.

The return pipe to the cylinder can be a smaller diameter than the flow.

These systems are often on time clocks to save energy when hot water is not demanded.

Efficiency

Keeping efficiency

In vulnerable situations where there may not be any heating underneath the insulation on a hot water pipe, a trace heating element can be used. This involves attaching a low temperature heating element to the outside of the pipe, which is controlled by a thermostat when the temperature lowers – this prevents freezing.

It can also be used to overcome waste of water in active dead legs.

Installation

Location of pipework

Consideration needs to be taken where and how to install pipework:

- Unsightly for the customer
- Creaking in joists due to expansion and contraction
- Transfer of heat if the hot pipe is below the cold pipe
- Insulation in vulnerable areas
- BS6700
- The Water Regulations

Installation

Cold water warming up: This can happen due to the hot and cold water pipes being too close together so the heat from the hot water pipe transfers over to the cold water pipe. Hot water pipes should be installed above cold water pipes to avoid this transfer of heat, and insulated to avoid heat loss.

As already mentioned, if the hot water cylinder overheats, the vent pipe discharges into the CWSC – this can also warm the cold water up.

BS8000 pt15 states that the hot pipe should be above the cold pipework, and that if there is any possibility of heat transfer the pipe should be insulated.

Installation

Pipe protection

- Frost/freezing
- Heat loss
- Damage
- Being drilled into (pipe guard)
- Plastic pipe locations (metal tape)

Plumbers must always be conscious of waste and energy conservation. Efficiency of the system is paramount.

Installation

Pipe protection

It is very important to protect hot water pipes in vulnerable places by insulating the pipes:

- In a suspended ground floor void
- Unheated garage or room
- In the loft area

Frost and freezing damage.

Installation

Fluid **categories**

Fluid category	Description	Example	Protection
1	Wholesome water supplied from the water undertaker	Mains water	None
2	Water that would be classed as Cat 1 except for colour, odour, appearance or temperature – (aesthetically impaired)	Hot water in cylinder, discharge from combi tap, softened water	Single check valve
3	Fluids representing a **slight** health risk and aren't suitable to be drunk	Primary water, bath and shower water, washing machines and dishwashers	Double check valve
4	Fluids representing a **significant** health risk, containing toxic substances	Commercial primary water, microorganisms, pesticides, swimming pools	RPZ valve
5	Fluids representing a **severe/ serious** health risk, containing pathogenic organisms, radioactive, faecal	Urinal, WC, bidets, grey water, Medical rooms, laboratories, abattoir.	Air gap

Installation

Contamination

Under the Water Regulations we have the responsibility to prevent the contamination of wholesome water within a property.

- Non-approved material
- Stop back flow
- Stop back pressure
- Stop back siphonage
- Avoid cross connections

This can be achieved by the use of either an air gap or mechanical means.

Installation

Contamination
Non-approved material

Water Regulations states that **lead** pipe must not be installed and should be removed where possible. Using a proprietary fitting a connection can be made to existing lead pipe.

Installation

Contamination
Stop back flow
Stop back pressure

Backflow is simply the flowing of water in the wrong direction, due to loss of system pressure. If, for example, the mains cold water were shut off in the street for repairs, the cold water in your plumbing system would backflow (or flow backwards) into the water main. This is sometimes called back pressure.

Installation

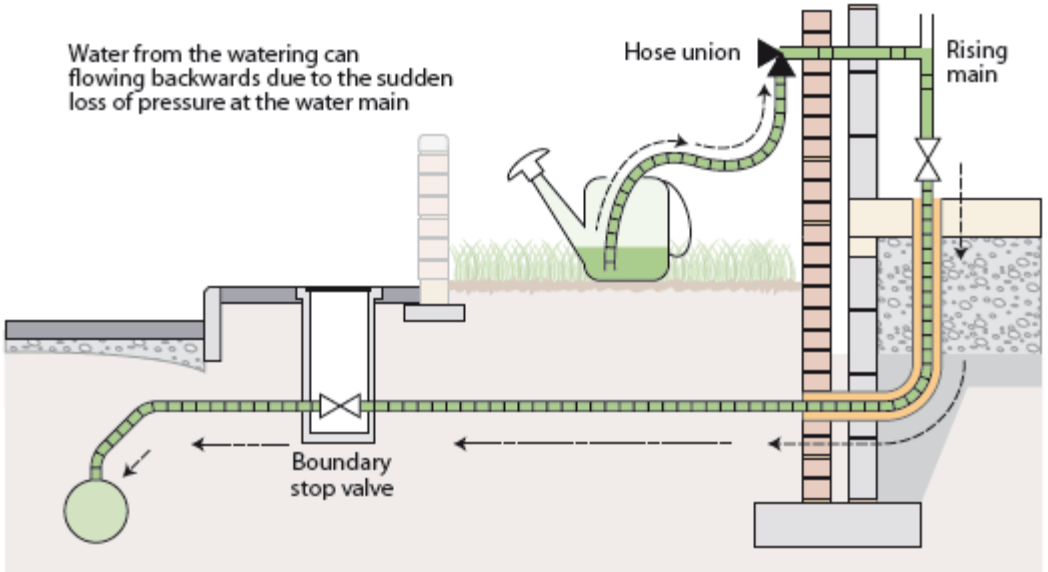
Contamination
Stop back siphonage

Back siphonage occurs when the pressure at the supply end of the water main (ie in the street) drops suddenly. This causes a vacuum that can literally suck water backwards.

Installation

The dangers of back siphonage can be understood from the following scenario:

A watering can of weedkiller is being filled with water from a hosepipe. The pressure suddenly drops due to a burst water main or the fire service using water from the main to fight a fire. The contents of the watering can (including the weedkiller) will be sucked up the hose, through the tap and down into the water main, contaminating the wholesome water with weedkiller solution.



Installation

Contamination
Avoid cross connections

Cross connections between a sealed central heating system and the mains.

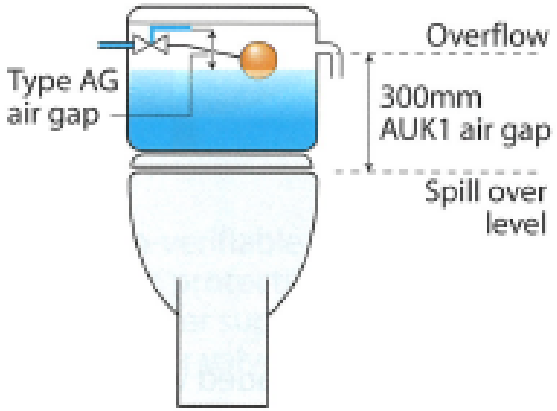
Cross connections between grey water harvesting and the mains.

Installation

Contamination

AUK1 air gap used in a WC cistern to separate the WC pan spill over level and the exit of the overflow.

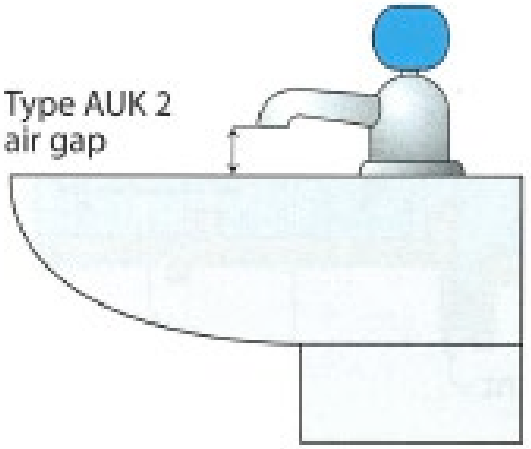
AG air gap used in a cistern to separate the water level within the cistern and the discharge point of the FOV.



Installation

Contamination

AUK2 air gap used on a basin, bath and bidet to separate the spill over level of the appliance and the outlet point of the tap (minimum of 20mm on a basin and 25mm on a bath). This is normally pre-set by the appliance and tap manufacturer.

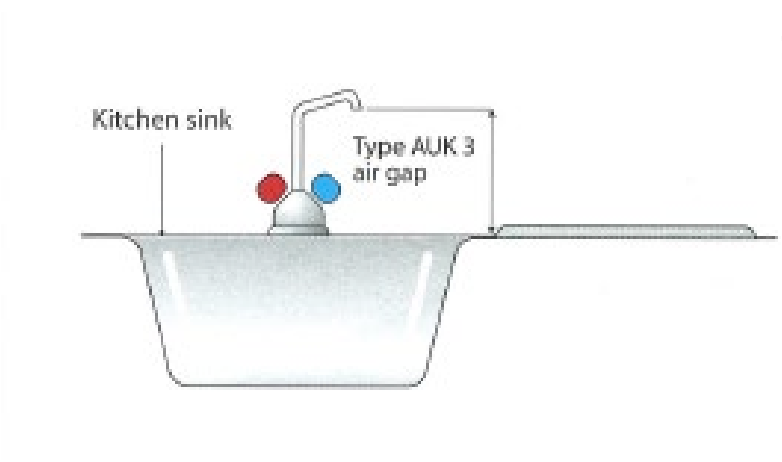


Care must be taken with globe taps and older appliances.

Installation

Contamination

AUK3 air gap is used on a kitchen sink to separate the spill over level of the appliance and the outlet point of the tap, (minimum of twice the bore of the supply pipe).

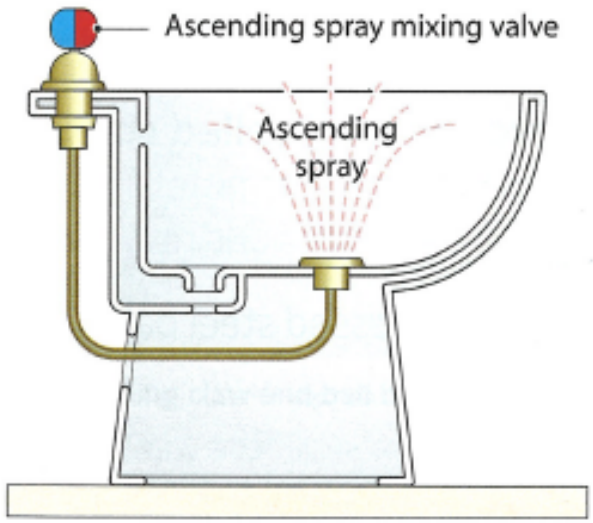


Installation

Contamination

There are certain situations a plumber **must** be conscious of when installing appliances:

- An ascending bidet **must not** be connected to a combination boiler, as this appliance has no air gap, and the combination boiler is mains fed.



Installation

Contamination

There are certain situations a plumber **must** be conscious of when installing appliances:

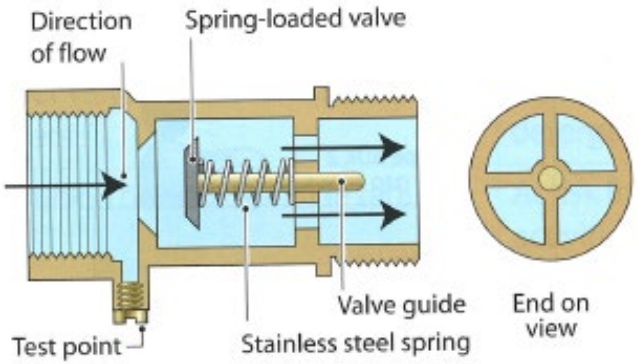
An over rim bidet with a flexible shower hose **must not** be connected to a combination boiler, as the flexible hose poses a risk of contamination.

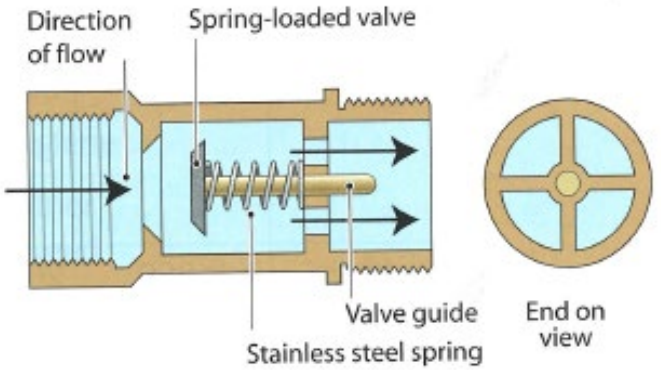
Installation

Contamination

A single check valve is used in the supply pipe to prevent backflow and allows the water to flow in one direction only.

Verifiable with a test point; non-verifiable cannot be tested.





Installation

Contamination

The single check valve is the simplest form of mechanical back flow prevention. It is basically a spring loaded one-way valve and can be used where wholesome water is at risk from cross contamination from category 2 water.

Example:

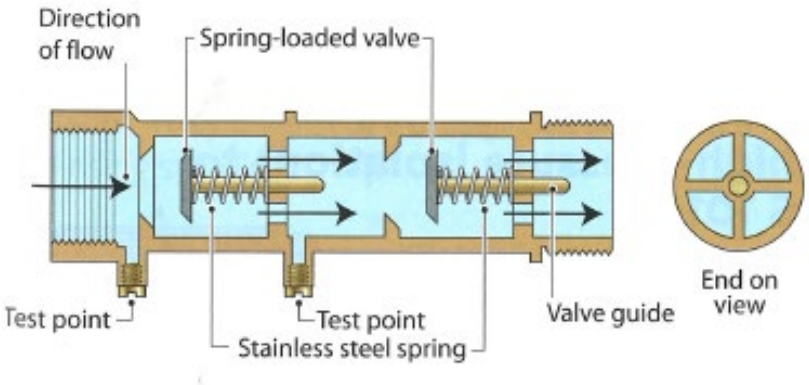
A basin monobloc mixer tap is connected to both hot water (category 2) and cold water (category 1). A single check valve must be used to stop the hot water entering the cold water pipe, as the tap acts as a cross connection.

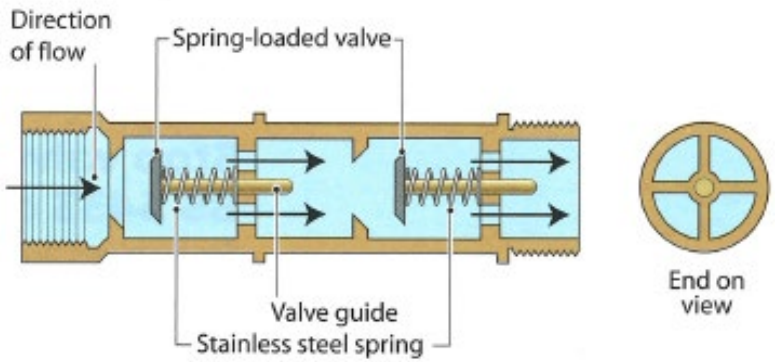
The same happens for a shower mixer valve or mixers that have hot water supplied under mains pressure.

Installation

Contamination

A double check valve is used in the supply pipe to prevent backflow and allows the water to flow in one direction only. Again these can be verifiable or non-verifiable.





Installation

Contamination

The double check valve offers greater back flow protection and is used to protect wholesome water against the back flow of category 3 water.

Example

Instantaneous shower, hose union bib tap (outside tap), filling loop on a combination boiler.