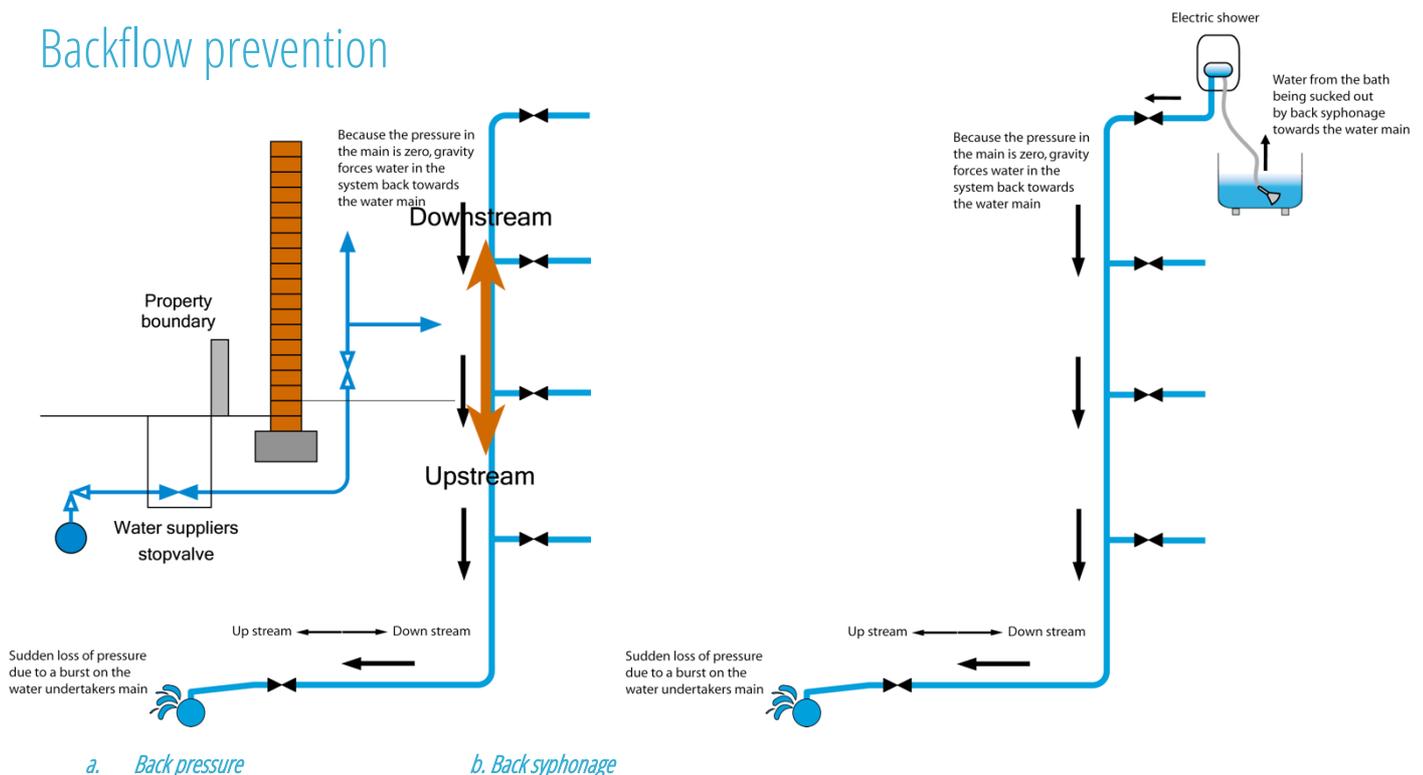


- c. Any mobile tanker or gulley cleaning vehicles.
- 6. Sewerage treatment works and sewer cleaning:
 - a. Drain cleaning plant.
 - b. Water storage for agricultural applications.
 - c. Water storage for firefighting systems.
- 7. Commercial agricultural:
 - a. Commercial irrigation outlets below or at ground level and/or permeable pipes, with or without chemical additives.
 - b. Insecticide or fertiliser applications.
 - c. Commercial hydroponic systems.

The distinction between fluid category 4 and fluid category 5 is difficult to distinguish since both categories constitute a serious risk to health. In general, however, water classified as fluid category 4 has the potential to cause harm over a period of days to weeks to months, whereas water classified as fluid category 5 may cause harm after only a very short exposure of minutes to hours to days or even a single exposure.

It must also be remembered that it is forbidden for water from any other fluid category to come into contact with water under fluid category 1.

Backflow prevention



Schedule 2 paragraph 15 of the Water Supply (water fittings) Regulations 1999, deals with backflow prevention. Backflow is simply the reversing of the normal direction of the water flow and can be as a result of backpressure (where the water pressure downstream is greater than the water pressure upstream) or back siphonage (where the water is sucked backwards through the pipework due to sudden loss of pressure). This can lead to contamination of the water undertakers mains cold water supply. See the diagrams above:

Cross connection of wholesome water with water from other sources can be another major source of contamination by back pressure and back syphonage. Cross connections can occur in the home easily simply by connecting mixer taps on hot and cold water supplies. If the mixing tap or valve is a true mixer (not a bi-flow mixer), then a cross connection between hot and cold supplies is deemed a cross connection between a fluid cat. 1 water (cold) to a fluid cat. 2 water (hot). In this instance, the simple installation of a single check valve on the cold supply will prevent contamination. However, not all back flow situations are so easily sorted out.

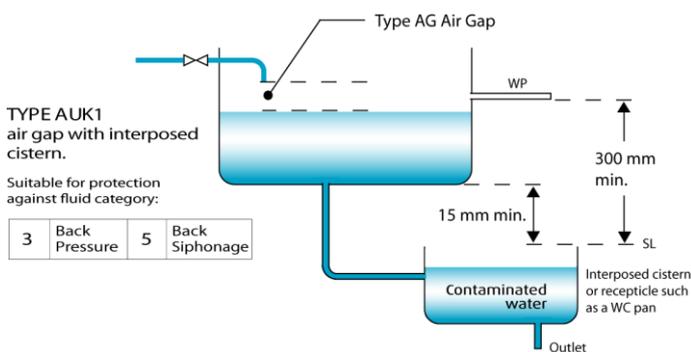
Upstream and downstream explained

AC2.6 Identify the standard backflow prevention devices that are used in cold water systems in dwellings supplying water to appliances

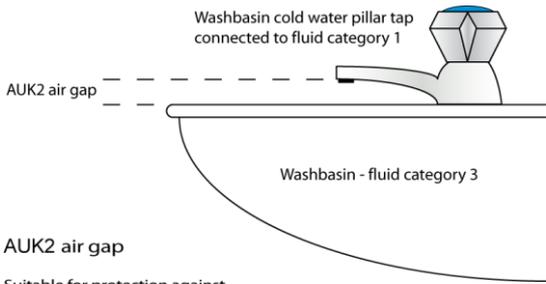
Appliance	Risk	Prevention
Baths	Back pressure and back syphonage through mixer taps. Fluid category 2 and 3	Where both hot and cold supplies are taken from the mains cold water supply and no shower hose exists, Type EA/EB single check valve installed on the hot and cold supplies. Where the supplies come from unbalanced sources e.g. high pressure cold and low pressure hot and no shower hose exists, Type EA/EB single check valves on both hot and cold supplies Where a shower hose exists e.g. a bath/shower mixer tap, Type EC/ED double check valve installed on the cold supply. AUK2 airgap at the appliance.
WCs	Fluid category 5	AUK1 air gap
Over the rim bidets	Fluid category 5	AUK3 airgap
Wash hand basins	Back pressure and back syphonage through mixer taps. Fluid category 2 and 3	AUK2 airgap at the appliance Where both hot and cold supplies are taken from the mains cold water supply, Type EA/EB single check valve installed on the cold supply.
Sinks	Fluid category 5	AUK3 airgap
Mixer taps	This is dependent on the appliance that the tap is	AUK2 airgap – washbasins and baths AUK3 airgap – kitchen, utility and cleaners

	serving.	sinks All mixer taps connected to the mains cold water supply – Type EA/EB single check valve (minimum)
Outside taps	Fluid category 3	Type EC/ED Double check valve
Shower mixer valves/ instantaneous showers	Back pressure and back syphonage through mixer valves. Fluid category 2 and 3 Back syphonage through instantaneous electric showers. Fluid category 3	Where both hot and cold supplies are taken from the mains cold water supply and the shower hose is restrained by a retaining ring, Type EA/EB single check valve installed on the cold and hot supplies. Where a shower hose exists e.g. a shower mixer valve, Type EC/ED double check valve installed on the cold supply. Shower valves connected to low pressure cistern fed hot and cold supplies do not require backflow protection.
Refrigerators, washing machines and dishwashers.	Fluid category 3	Most domestic dish washing and clothes washing machines have inbuilt airgaps to accommodate fluid category 3. Where no such air gap exists, the cold water supply must be protected with a Type EC/ED double check valve

Below are examples of the backflow prevention devices listed in the above table:



AUK1 air gap with interposed cistern

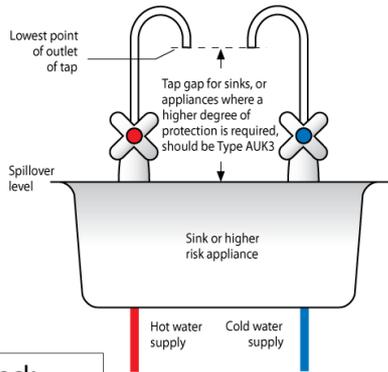


AUK2 air gap

AUK2 air gap

Suitable for protection against fluid category:

X	Back Pressure	3	Back Siphonage
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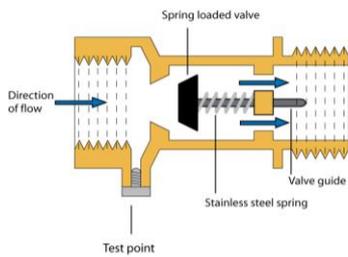


AUK3 air gap

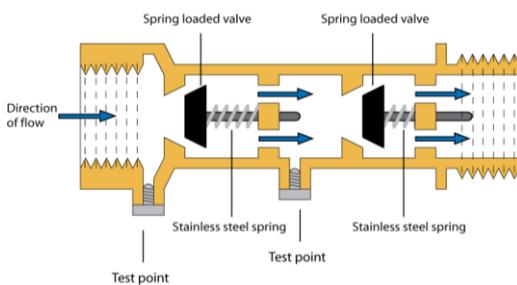
AUK3 air gap.

Suitable for protection against fluid category:

X	Back Pressure	5	Back Siphonage
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Type EA/EB Single Check Valve



Type EC/ED Double Check Valve

AC2.7 Identify the working principles of cold water system components

Baths

Connections to baths vary depending on the position of the taps. For domestic installations, bath taps have a $\frac{3}{4}$ inch BSP male thread for connection with a $\frac{3}{4}$ " x 22mm tap connector.



WCs

All WCs are provided with a float operated valve to the WC cistern. The float operated valve (FoV) for WC cisterns can either be bottom fed or side fed and all have $\frac{1}{2}$ " BSP male threads to allow connection to the water supply via a $\frac{1}{2}$ " x 15mm tap connector. The FoV should be provided with a servicing valve for maintenance, repair and replacement



Over the rim bidets

Over-rim bidets installed in domestic premises can either have single or combination taps installed. All taps fitted to over-rim bidets must have an AUK2 air gap provided between the outlet of the tap and the spill-over level of the bidet. The Water Regulations Advisory Scheme (WRAS) Installation Requirement Note IRN R010 also stipulates that the water supply to combination taps shall have reasonably balanced pressures. Where unbalanced water pressures are used, then approved single check valves must be fitted immediately upstream of both hot and cold supplies.



Wash hand basins

Wash hand basins installed in domestic premises can either have single or combination taps installed. Single taps have $\frac{1}{2}$ " male BSP threads while combination taps often have 10mm copper tails. All taps fitted to wash basins must have an AUK2 air gap provided between the outlet of the tap and the spill-over level of the basin.



Again, Installation Requirement Note IRN R010 also stipulates that the water supply to combination taps shall have reasonably balanced pressures. Where unbalanced water pressures are used, then approved single check valves must be fitted immediately upstream of both hot and cold supplies.

Sinks

All sinks for domestic purposes, whether manufactured from ceramics or stainless steel must have taps that give an AUK3 air gap. Sink taps can either be single high-neck pillar taps, combination taps or wall mounted bib taps, depending upon the installation requirements. The water in sinks should be



regarded as fluid category 5 (see textbook 1). Single taps have ½ " male BSP threads while combination taps often have 15mm copper tails.

Urinals

Urinals, although not a domestic appliance, require careful consideration. Connecting a urinal to the water supply can be completed in one of either two ways:

- Via an automatic flushing cistern, or;
- A manual or automatic flushing valve

Urinals using automatic flushing cisterns must be installed in such a way that does not constitute a wastage of water. WRAS note IRN R075 states that urinals using automatic flushing cisterns should be installed to give a flush rate not exceeding 10 litres per hour for a single urinal bowl and 7.5 litres per hour for each 700mm of a slab urinal or two or more urinal bowls.

Urinals using flushing valves must not deliver a flush exceeding 1.5 litres per single flush per bowl each time the valve is operated.

In each case, the water supply must be protected by an air gap or some such no less effective mechanical device in accordance with fluid category 5.



Refrigerators

Many modern refrigerators contain ice making facilities that can be connected directly to a cold water supply. Where this is possible, the refrigerator connection should be installed in accordance with fluid category 2. The reason for this is that, although the water is fluid category 1, it undergoes both a change in temperature and state for it to become ice. Therefore, this kind of installation must be fitted with a single check valve or an approved EA/EB Backflow prevention device.

Washing machines /Dishwashers

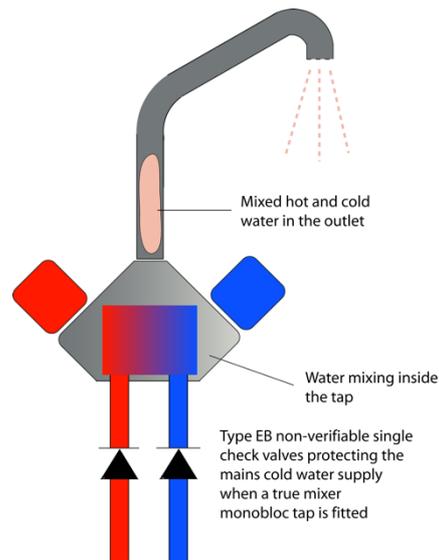
Washing machines/Dishwashers are classified as fluid category 3 and must be protected against backflow. In most instances, an air gap to guard against backflow is already built into the appliance by the manufacturer. However, where multiple washing machines are installed on the same installation, then some form of mechanical backflow prevention is required. This is usually an approved type EC/ED backflow prevention device (or double check valve).

Modern washing and dishwashing machines only require a cold connection to the water supply. Internal heaters heat the water as required.

Taps, outlets and valves

Mixer taps

True mixer taps allow both hot and cold water to be mixed inside the tap body, and as such, constitute a cross connection between fluid category 1 and fluid category 2, which is not allowed under the Water Supply (water supply) Regulations 1999. Both hot and cold supplies must be protected by an approved EA/EB backflow prevention device (single check valve).



Bi-flow mixer taps

Bi-flow mixer taps are essentially two taps within a single tap body. The tap is divided through the body and into the spout so that the hot and cold water supplies do not mix until they emerge from the spout. They do not require backflow protection.



Pillar taps

These are available with both ½" and ¾" male BSP tails for use on washbasins and baths. They are designed to give an AUK2 airgap at the appliance, the outlet of the tap being higher than the spill-over level of the appliance.



High Neck Pillar taps

Similar in design to pillar taps, high neck pillar taps are designed for use on kitchen sinks. The high neck provides an AUK3 air gap suitable for fluid category 5, which is a mandatory requirement for kitchen/utility sinks, cleaners sinks, Belfast sinks and any sink or washbasin installed in a health care facility.



Bib taps

Bib taps are predominantly used in conjunction with Belfast sinks, cleaners sinks and situations where an AUK3 air gap is a requirement, such as hospitals, dental and doctors surgeries and health care facilities.

In most cases, they are fixed to the wall using back-plate elbows, although as can be seen in the photograph, they can also be installed with concealed pipework.



Hose Union Bib taps (Outside taps)

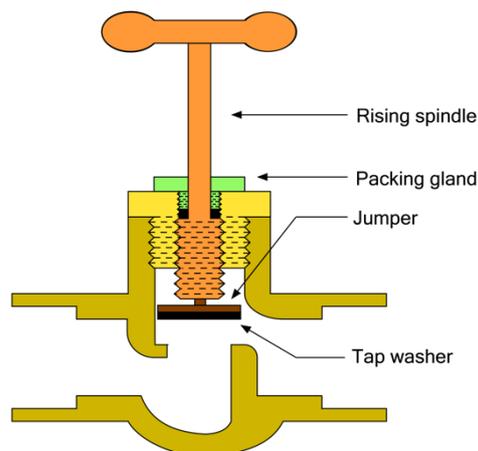
Similar in design to bib taps, hose union bib taps have threaded hose connection at the spout for easy connection of a garden hose. These must be regarded as a fluid category 3 risk and be protected by an approved type EC/ED backflow prevention device (or double check valve).



Stop valves (BS5433 and BS1010)

Stop valves are designed for the isolation of high/mains pressure cold water supplies. Internally, they are very restrictive to the flow of water, which makes them unsuitable for use on low pressure supplies.

Stop valves are available with compression and capillary connections for use on copper, polyethylene and polybutylene pipe.

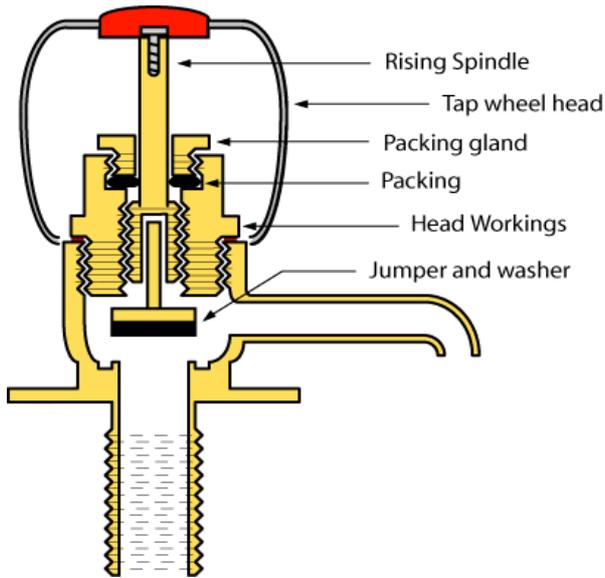


Stop valves have an arrow moulded into the body of the valve to show the direction of the flow of water.

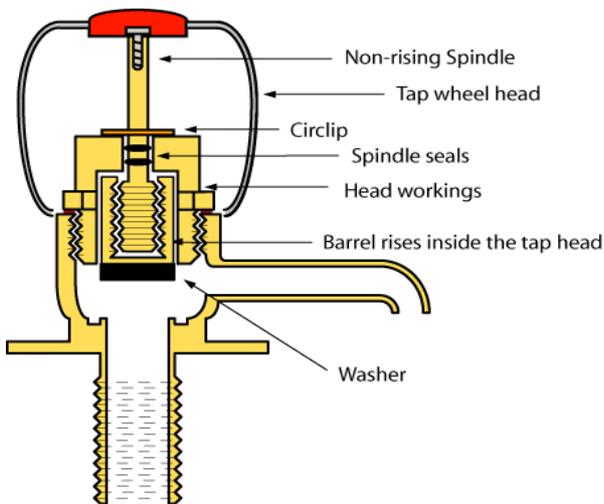
Taps

There are three categories of taps:

- Taps with rising spindles (BS1010)
- Taps with non-rising spindles (BS5412)
- Ceramic disc type



BS1010 tap head workings are interchangeable, inasmuch that tap head workings from one manufacturer will fit other taps.



Unlike BS1010 taps, the head workings are not interchangeable from manufacturer to manufacturer, with each company having their own design.



Taps with rising spindles (BS1010)

BS1010 taps contain a tap washer that is attached to a jumper plate. The jumper plate is then inserted into the rising spindle, which rises when the tap is rotated counter-clockwise, turning the tap on allowing water out of the tap spout.

Although BS1010 has been withdrawn for many years, BS1010 taps and head workings continue to be manufactured, because they are very reliable and can be repaired and refurbished easily and quickly.

Taps with non-rising spindles (BS5412)

BS5412 taps do not have a rising spindle. The spindle remains in one position, retained by a circlip. At the end of the spindle is a thread. When the tap is rotated counter-clockwise, the thread lifts a hexagonal-shaped barrel with a washer attached to it.

BS5412 taps are for use on washbasins, baths, kitchen sink and bidets, in $\frac{1}{2}$ " and $\frac{3}{4}$ " sizes.

Ceramic disc taps

Ceramic disc taps do not contain a washer. Instead they have two thin ceramic plates, one of which is fixed while the other rotates through 90° . Each plate has a pair of corresponding slots cut into them where the water passes through.

Ceramic discs tap heads correspond to the type of water. Hot tap heads rotate clockwise while cold rotate anti-clockwise. They are colour coded for easy identification red and blue.



Ceramic disc replacement needs to be carefully considered as the tap workings are not universal and the correct make and model of the tap must be available to be able to obtain the correct type of replacement.

A typical ceramic disc head workings

Full-way gate valves

Full-way gate valves are used predominantly to isolate low pressure water supplies from storage cisterns. They use a 'gate' to stop the flow of water without the need for a rubber washer. When the valve head is rotated counter-clockwise, the gate rises allowing water to flow.

The design of gate valves allows for water to flow at full bore with virtually no restriction in flowrate, hence the term 'full-way'.

They are not suitable for high pressure water supplies.



Spherical plug valves/ Servicing valves

These isolation/servicing valves contain a brass ball or sphere with a hole through the middle. When the hole is in line with the pipe, the valve is on and water will flow. When the valve is turned through 90°, the hole is across the flow of water and the water flow stops.

There are many versions of spherical ball valves available. Some have handles or levers, such as the types shown in the photographs, while others have a screwdriver slot to enable the valve to be turned on and off.



Drain valves (BS2878-2)

Drain valves, also known as drain-off valve and M/T valves, are used to allow systems to be completely drained of water for repair, maintenance or replacement. They should be placed at low points in the system, close to places where the drained water will not pose a nuisance.

There are many types of drain valve available, including types with male threaded ends and those with or without packing glands.

Drain valves must be fitted in accordance with the Water Supply (water fittings) Regulations.



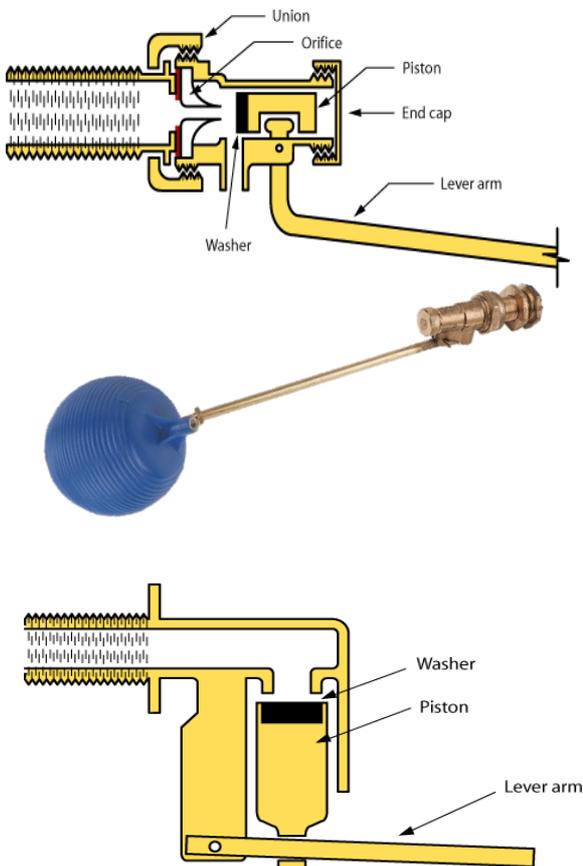
Float operated valves (to BS1212 parts 1-4)

Float Operated Valves or FoVs are used to control the flow of water into cisterns. Manufactured to BS1212, they are purposely designed to shut off the inflow of water once it has reached a predetermined level. They can be used on high pressure water or low pressure, depending on the type of orifice that the FoV is fitted with. A white orifice denotes high pressure supply (marked HP) and a red orifice denotes a low pressure supply (marked LP).

There are four specific types:

1. B.S.1212 Part 1: Portsmouth pattern and Croydon types
2. B.S.1212 Part 2: Diaphragm type (brass)
3. B.S.1212 Part 3: Diaphragm type (plastic)
4. B.S.1212 Part 4: Torbeck equilibrium type (WC cisterns only)

B.S.1212 Part 1: Portsmouth pattern and Croydon types



Portsmouth pattern

This type of FoV discharges water from underneath the valve. Because of this, they are prohibited from new installations without a back-flow prevention device as the outlet may become submerged in water if the valve fails, creating a possible back-flow contamination issue. However, they may be repaired if they are part of an existing installation.

The Portsmouth-type valve are vulnerable to noise and water hammer.

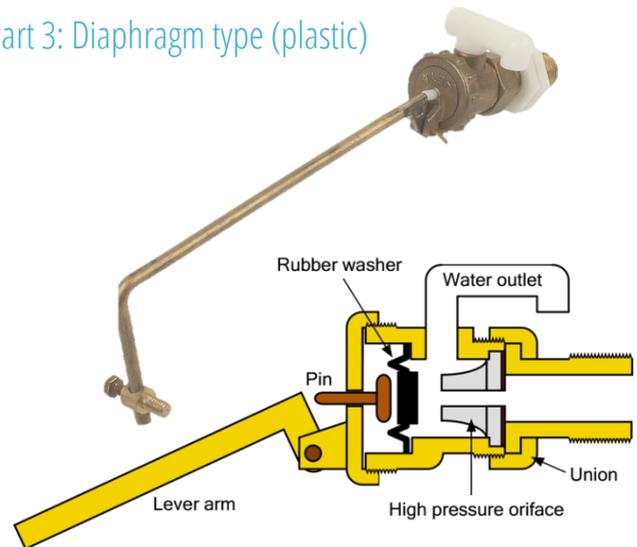
Croydon pattern

The Croydon-type FoV again discharges water from below the valve making it susceptible to back-flow issues. It is instantly recognisable due to the piston being in the vertical position. Croydon's tend to be very noisy in operation. The Croydon valve is an obsolete design that is no longer manufactured but may still be found in older, high level WC cisterns.

B.S.1212 Part 2: Diaphragm type (brass) and B.S.1212 Part 3: Diaphragm type (plastic)

Parts 2 and 3 FoVs discharge water from the top of the valve rather than underneath, making them less likely to encounter backflow problems. The main difference with this kind of FoV is the size of the rubber washer. It is large, flat and very flexible.

The valve has very few moving parts, making it quieter in operation than the part 1 and less likely to be associated with water hammer and pipework reverberation.



Part 3 FoVs are almost identical to the part 2 except they are made of plastic making them ideal for WC cisterns but they are not recommended for storage cisterns in roof spaces due to the risk of freezing and splitting of the plastic body.

B.S.1212 Part 4: Diaphragm Equilibrium type (Torbeck)

Known as the Torbeck valve, it works on the principle that when the valve is in the open position, there is equal pressure on both sides of the rubber washer. When the required water level is reached, the float arm closes the pressure relief orifice on the front of the valve creating a higher pressure in front of the rubber washer. This pushes the washer on to water outlet to stop the flow of water.

These valves are much quieter than other FoV types although the valve tends to close with a 'snap' action, which can create some pipe reverberation.

These are only for use on WCs.

