

Keraflo
OUR WORLD IS WATER

Guide to the UK Water Supply Regulations

Introduction

Keraflo have manufactured top quality, delayed action float valves in the UK for over 30 years. The Aylesbury™ range is synonymous with float valve excellence with tens of thousands of products in continual use in demanding commercial applications throughout the UK and around the world.

The Aylesbury™ Float Valve Range

Aylesbury valves are designed to provide an accurate and efficient method of controlling the level of stored cold water in tanks, with and without raised float valve chambers.

Manufactured in the UK in a Lloyd's Register Quality Assured manufacturing facility, they are constructed to operate over long periods without the need for maintenance. In addition all valves come with a 1 year warranty which can be extended to 5 years at no cost.

The valves are easy to install with an “up and over” discharge arrangement which assists in facilitating Type AA, AB, AF, or AG air gap requirements under the Water Regulations.

The Aylesbury range is ideal for pumped systems as the open to closed “on/off” valve operation avoids pump hunting and water hammer. The set water level is unaffected by pressure fluctuation and the patented ceramic disk sealing mechanism means that there is no seat or washer to wear.

Specification Support

Keraflo have a National Sales Team to provide the very highest levels of technical advice and specification support at local level, including guidance regarding Water Regulations compliance. Technical advice is also available by phone, e-mail or via the Keraflo website.



UK Water Supply Regulations

Air gaps & design implications

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Foreword

On the 1st July 1999 the Water Supply (Water Fittings) Regulations 1999 were introduced. The following is designed to give an overview of the changes made from the “Water Supply Byelaws Guide” to the Water Supply Regulations 1999 (“Water Regulations”).

An important consideration of the Regulations is backflow prevention. Although not made retrospective it appears, according to some lawyers, that Statutory Instrument No. 1148 does have this effect and this being the case, they need to be implemented now rather than later.

As far as water storage tanks are concerned, the current Regulations do not impose any technical changes to the manufacture, construction or installation from the old Water Byelaws (now withdrawn). In essence, any water storage tank remains precisely the same and is still covered by the appropriate British Standards as detailed below.

In the case of:

One Piece Tanks	BS 7491: Part 2: 1992
Sectional Tanks	BS 7491: Part 3: 1994
Backflow Prevention	BS 6281 & BS 6282: 1992
Installation & Commissioning	BS 6700: 1997

There is, however, a change to the way “Specifications” are drawn-up as tanks to ‘Byelaw 30’ are no longer appropriate. From 1st July 1999, all tanks had to comply with Schedule 2, Section 7, Paragraph 16 of the water regulations or where necessary in Section 30. In practice, conformity to the appropriate British Standard (as listed above) is a requirement.

Under the old Water Byelaws, air gap requirements were relatively simple. The Regulations that have replaced them have introduced an increase in the number and type of air gaps. In addition, various new mechanical devices have been introduced, although some of these will be expensive and also introduce a maintenance requirement.

All overflows, warning pipes and other fittings and fixtures within a tank remain the same as the Byelaws, although a much greater emphasis is placed on the type of materials that may be used with particular regard to the effect on water quality when using a mix of different types of metals when immersed i.e. connections, tie rods and other fixtures & fittings.

Inlets to all cisterns should be provided with a servicing valve to facilitate maintenance, and a float valve or some other no less effective device that is capable of controlling the flow of water into the cistern. A solenoid valve responding to a level switch will be acceptable as a no less effective device to a float operated valve. In the past, some systems discharged water via an open ended pipe when the supply and water level within the tank was controlled electrically. This was generally associated with boosted water systems.

Notification

One of the grey areas relates to “Notification” where:

“5. (1) any person who proposes to install a water fitting etc.” This can be interpreted as an installer installing just a single water fitting.

Notice **MUST** be given to the Water Undertaker and **APPROVAL** received prior to any commencement of work. A completion certificate will also need to be furnished to the Water Undertaker and the person who authorised the installation or alteration. This impinges on Consultants’ responsibilities.

Approved Contractors

With certain exceptions “Approved Contractors” can bypass the need to obtain approval as outlined above and be self-regulated.

Only individuals may be “Approved Contractors” while a Company may refer to itself as ‘Approved’ as long as it employs at least one ‘Approved’ person. At this stage a minimum of an NVQ plus appropriate experience is required to apply to your local Water Undertaker or the Water Regulations Advisory Scheme (WRAS).

Fluid Risk Categories

The 3 categories of risk under the old Water Byelaws have been replaced by 5 categories under the current Regulations. The water supplied via any incoming main supply from a Water Undertaker is now classified as wholesome water rather than potable or domestic water.

While we list specific fluid categories (P10 & P11), they are not definitive and may be subject to some change in light of experience and interpretation.

Evolution of the Water Supply Regulations

- 1823** - First Water Byelaws introduced
- 1989** - Water Supply Byelaws implemented by Undertakers
- 1989** - National Water Council replaced with the WRc plc
- 1991** - Water Industry Act passed
- 1991** - Water Byelaws Scheme introduced
- 1999** - Water Supply Regulations replaced the Water Byelaws

Reasons for the new “Water Supply Regulations 1999”

- European Harmonisation - CE MARK ETC.
- Less prescriptive; the previous Byelaws were considered to be too specific and excluded fittings which may have been equal to equivalent approved products. This resulted in ‘Byelaw relaxations’
- More stringent notification
- Approved Contractors

In many ways, the new Water Supply Regulations 1999 are similar to the revoked Water Byelaws. They have been improved and brought up to date.

The aims however remain the same, i.e. **TO AVOID:**

- Waste
- Misuse
- Undue Consumption
- Contamination
- Erroneous Measurement (new)

Another important addition is that every water fitting **SHALL:**

1. Bear an appropriate CE MARK
2. Conform to an appropriate British Standard or some other (equal) National Specification of an EEA State
3. Be included in the “Water Fittings and Materials Directory”

Main changes

- Compulsory notification and approval
- 5 fluid categories
- Introduction of new backflow prevention requirements
- Direct connection of a pump to supply pipe should be less than 12 l/min
- The reintroduction of dual flushing systems

It is recommended that installers and specifiers check that all fittings are included in the “Water Fittings and Material Directory” produced by WRAS. This directory confirms which fittings and float valves are “approved”. If a product is in the Water Fittings and Material Directory it will have a CE mark and conform to the relevant British Standard if there is one.

Water Supply (Water Fittings) Regulations 1999

Statutory Instruments 1999 No 1148 & Amendment No 1506

Penalty for Contravening Regulations.

Any person contravening any of the Regulations is guilty of an offence and liable on summary conviction to a fine.

All engineers MUST therefore ensure that both the individual parts of and the system as a whole meet all the regulatory requirements otherwise they individually, as well as their company or organisation, may be liable.

Water Supply Regulations - Definitions

Backflow	means flow upstream that is a direction contrary to the intended normal direction of the flow within or from a water fitting
Back Siphonage	as backflow but caused by negative pressure in the supply pipe
Check Valve	a mechanical device that by means of elastic seal or seals permits water to flow in one direction only
Cistern	means a fixed container for holding water at not greater than atmospheric pressure
Critical Water Level	means the physical level of the fluid in any part of the receptacle a minimum of 2 seconds after closing the water inlet, starting from maximum water level
Maximum Water Level	means the highest physical level of the fluid reached in a part of the receptacle when operated continually under fault conditions
Double Check Valve Assembly	a mechanical device that permits water to flow upstream to downstream but not in the reverse direction
Pipe Interrupter	with permanent atmospheric vent means non-mechanical backflow prevention device with a permanent unrestricted air inlet, the device being installed so that the flow of water is in a vertical downward direction
Spill-over level	the level at which the fluid in a receptacle will first spill over the top edge if the inflow exceeds the outflow through any outlet and any overflow pipe
Tank	as a non-cylindrical closed vessel capable of containing water under pressure greater than atmospheric
Warning Pipe	an overflow pipe with an internal dip tube so fixed that its outlet, whether inside or outside the building, is in a conspicuous position where the discharge of water can be readily seen
Wholesome Water	in a drinkable form

Air Gap Definitions by Type

Type 'AA' - Air gap with unrestricted discharge.

A non-mechanical backflow prevention arrangement of water fittings where water is discharged through an air gap into a receptacle that has at all times an unrestricted spillover to the atmosphere. ie. tank without lid. **See Diagram 1**

TYPE 'AB' - Air gap with weir overflow.

A non-mechanical backflow prevention arrangement of water fittings complying with Type 'AA', except that the air gap is the vertical distance from the lowest point of the discharge orifice which discharges into the receptacle, to the critical level of the rectangular weir overflow. **See Diagrams 2, 3 & 4**

TYPE 'AC' - Air gap with vented submerged inlet and circular overflow.

TYPE 'AD' - Air gap with injector.

TYPE 'AF' - Air gap with circular overflow.

A non-mechanical backflow prevention arrangement of water fittings with an air gap measured downwards from the lowest point of the discharge orifice, which discharges into the receptacle, to the critical level. **See Diagram 5**

TYPE 'AG' - Air gap arrangement with minimum size circular overflow. **See Diagram 6**

TYPE 'AUK1' - Air gap with interposed cistern (incorporating Type AG air gap). **See Diagram 6**

TYPE 'AUK2' - Domestic tap gap.

TYPE 'AUK3' - Higher risk tap gap.

Schedule of non-mechanical backflow prevention arrangements and maximum permissible fluid category for which they are acceptable:

Type	Description of backflow prevention arrangements and devices	Suitable for protection against fluid category	
		Back-Pressure	Back-Siphoning
AA	Air gap with unrestricted discharge spillover level	5	5
AB	Air gap with weir overflow	5	5
AC	Air gap with vented submerged inlet	3	3
AD	Air gap with injector	5	5
AF	Air gap with circular overflow	4	4
AG	Air gap with minimum size circular overflow determined by measure or vacuum test	3	3
AUK1	Air gap with interposed cistern (eg a WC suite)	3	5
AUK2	Air gaps for taps and combination fittings (tap gaps) discharging over domestic sanitary appliances	X	3
AUK3	Air gaps for taps or combination fittings (tap gaps) discharging over any higher risk domestic sanitary appliances where a fluid category 4 or 5 is present	X	5

Note: X indicates that the backflow prevention arrangement or device is not applicable or not acceptable for protection against back-pressure for any fluid category within water installations in the UK.

Fluid Categories of Risk - Old vs New

Old Byelaws	New Classification
Class 3 or Schedule C risk	Fluid Category 1 Supplied by a Water Undertaker and complying with the requirements of regulations made under Section 67 of the Water Industry Act 1991 (6)
Class 3 or Schedule C risk	Fluid Category 2 Water in fluid category 1 whose aesthetic quality is impaired owing to; (a) a change in its temperature, or (b) the presence of substances or organisms causing a change in its taste, odour or appearance, including water in a hot water distribution system
Class 2 or Schedule B risk	Fluid Category 3 Fluid which represents a slight health hazard because of the concentration of substances of low toxicity, including any fluid which contains: (a) ethylene glycol, copper sulphate solution, or similar chemical additives, or (b) sodium hypochlorite (chloros and common disinfectants)
Class 1 or Schedule A risk	Fluid Category 4 Fluid which represents a significant health hazard because of the concentration of toxic substances, including any fluid which contains: (a) chemical, carcinogenic substances or pesticides (including insecticides and herbicides), or (b) environmental organisms of potential health significance
Class 1 or Schedule A risk	Fluid Category 5 Fluid representing a serious health hazard because of the concentration of pathogenic organisms, radioactive or very toxic substances, including any fluid which contains: (a) faecal material or other human waste (b) butchery or other animal waste; or (c) pathogens from any other source

Examples of Protection Required - by Application

Five categories of risk	
Fluid Category 1 Wholesome water supplied directly from a Water Undertaker's main	
Fluid Category 2 • Mixing of hot and cold water supplies • Domestic softening plant (common salt regeneration only) • Drink vending machines in which NO ingredients or carbon dioxide are injected into the water supply or distribution inlet pipe • HWS	
Fluid Category 3 • Water in primary circuits and heating systems in a house • Domestic wash basins, baths and showers • Domestic clothes and dishwashing machines • Drink vending machines in which ingredients or carbon dioxide are injected into the water supply or distribution inlet pipe • Commercial softening plant (common salt regeneration only)	
Fluid Category 4 • Pressurised fire-fighting systems • Food preparation • Dairies • Bottle washing apparatus • Dyeing equipment • Irrigation points/outlets • Brewery and distillation plants • Commercial dish washing machines • Printing and photographic equipment	• Car washing and de-greasing plants • Commercial clothes washing plants • Water treatment plant or softeners using other than salt • Primary circuits and general heating systems other than a house • Fire sprinkler systems using anti-freeze solutions • Domestic clothes & washing machines when used in commercial premises
Fluid Category 5 • Butchery and meat trades • WC pans, urinals and bidets • Bedpan washers • Hospital dialysis machines • Vegetable washing • Laboratories • Grey water-recycling systems • Dishwashing machines in healthcare premises	• Sewage treatment and sewage cleansing • Water storage for fire-fighting purposes • Mortuary and embalming equipment • Medical or dental equipment with submerged inlets • Washing machines in healthcare premises • Water storage for agricultural purposes

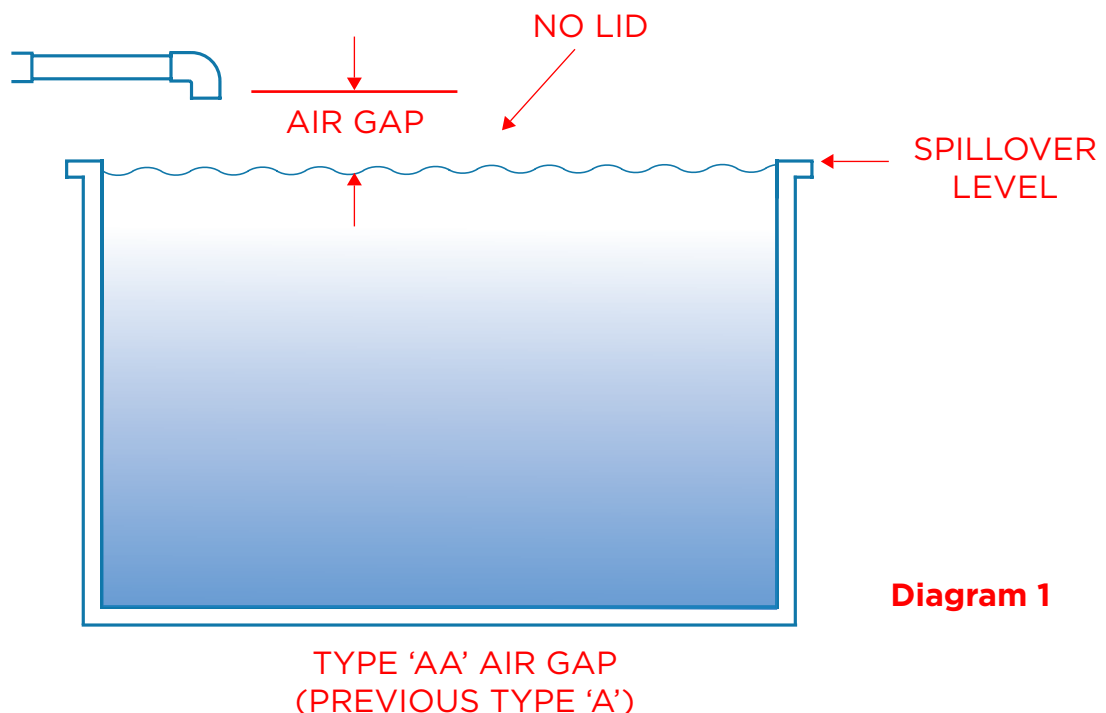
Air Gaps - Design Implications

An air gap is the form of backflow prevention device most preferred by UK Water Authorities. If a vacuum should occur in the supply pipe, air will be drawn in rather than water. In order to comply with the Water Supply Regulations a minimum vertical distance must be provided between the outlet of the supply pipe and the stored water. This vertical height is sized on twice the bore of the incoming feed pipe with a minimum of 20mm.

Type 'AA' Air Gap

Type 'AA' air gaps offer protection for Category 5 risks - there is no alternative. The outlet of the supply pipe (or float valve) must be above the 'spill-over level' of the storage cistern. The spillover level must be an 'unrestricted' overflow and at all times must be open to atmosphere. The pipe discharging into the cistern must be within 15° of vertical and the vertical gap (air gap) to the spillover level must be sized on twice the bore of the incoming feed pipe, with 20mm the minimum size.

Diagram 1 shows a simple cistern without lid or overflow pipe, being supplied with water through a Type 'AA' air gap. It is advisable to fit an overflow system if water damage is likely to occur to the building during overflow conditions.



Type 'AB' Air Gap

Increasingly, there is a requirement for 'hygienic' **Type 'AB' air gaps**.

In this case the storage cistern needs to be in accordance with the requirements of the Regulations - storage of wholesome water but having an 'unrestricted overflow'. These requirements are generally satisfied by a slot weir according to BS6281 Part 1 fitted with a 0.65mm opening mesh.

Diagram 2 illustrates a cistern with an AYLESBURY 'KAX' type float valve fitted in a raised valve chamber with a slot weir incorporated in the main cistern. Generally, one slot along the length of the cistern is sufficient.

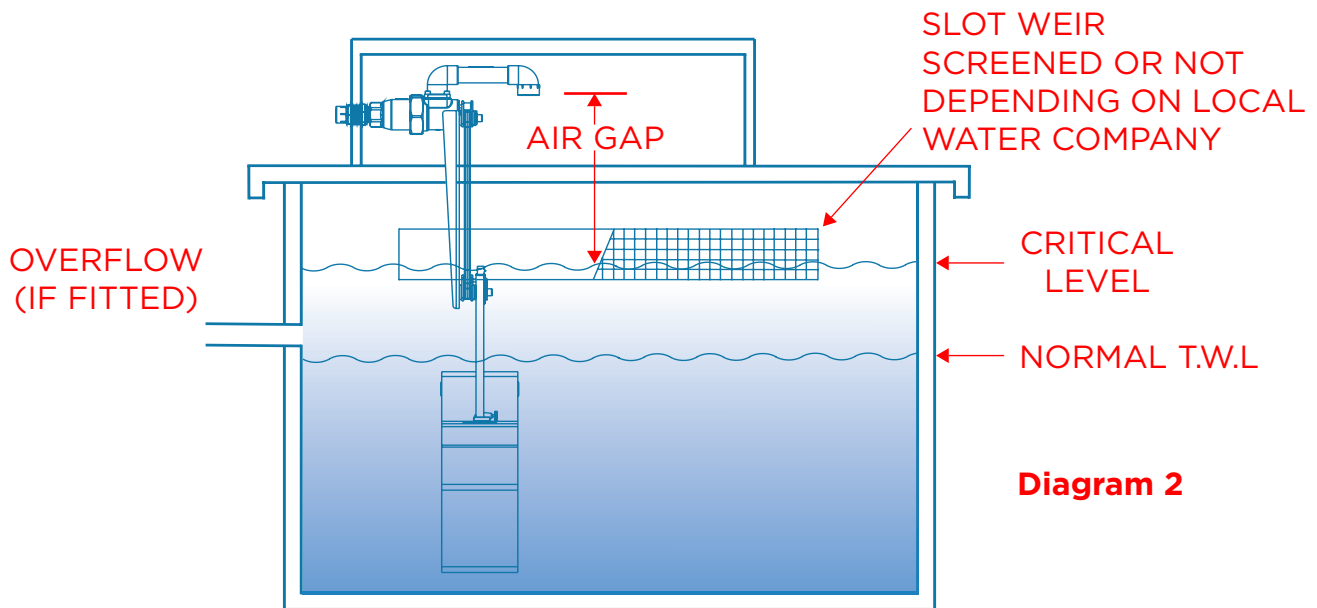


Diagram 2

TYPE 'AB' AIR GAP
(PREVIOUS TYPE 'A')

Diagram 3 illustrates an alternative arrangement, where the slot weir is incorporated in the raised chamber. In order to accommodate the length of slot required in BS6281 Part 1 a slot in two or three sides of the chamber is common practice.

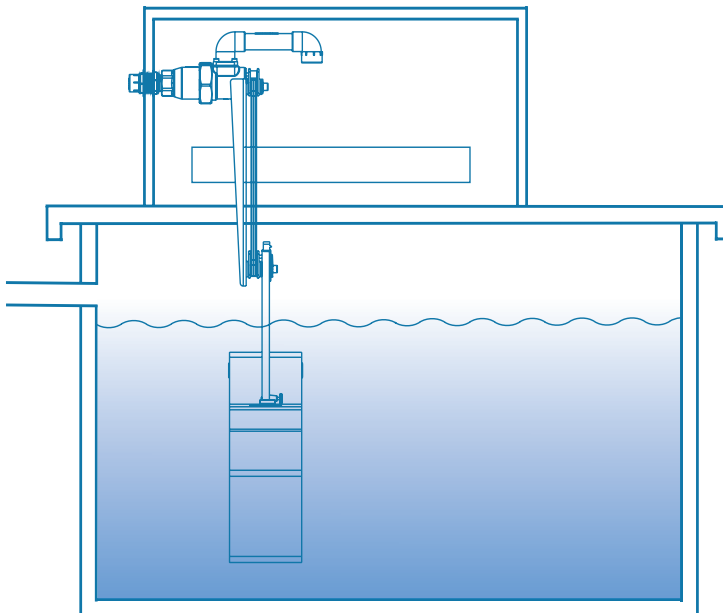


Diagram 3

Diagram 4 shows an AYLESBURY 'K' type float valve installed in a cistern, without a raised chamber, achieving a Type AB air gap. To prevent water damage should the float valve fail, a drain has been added between the weir plate and weir slot.

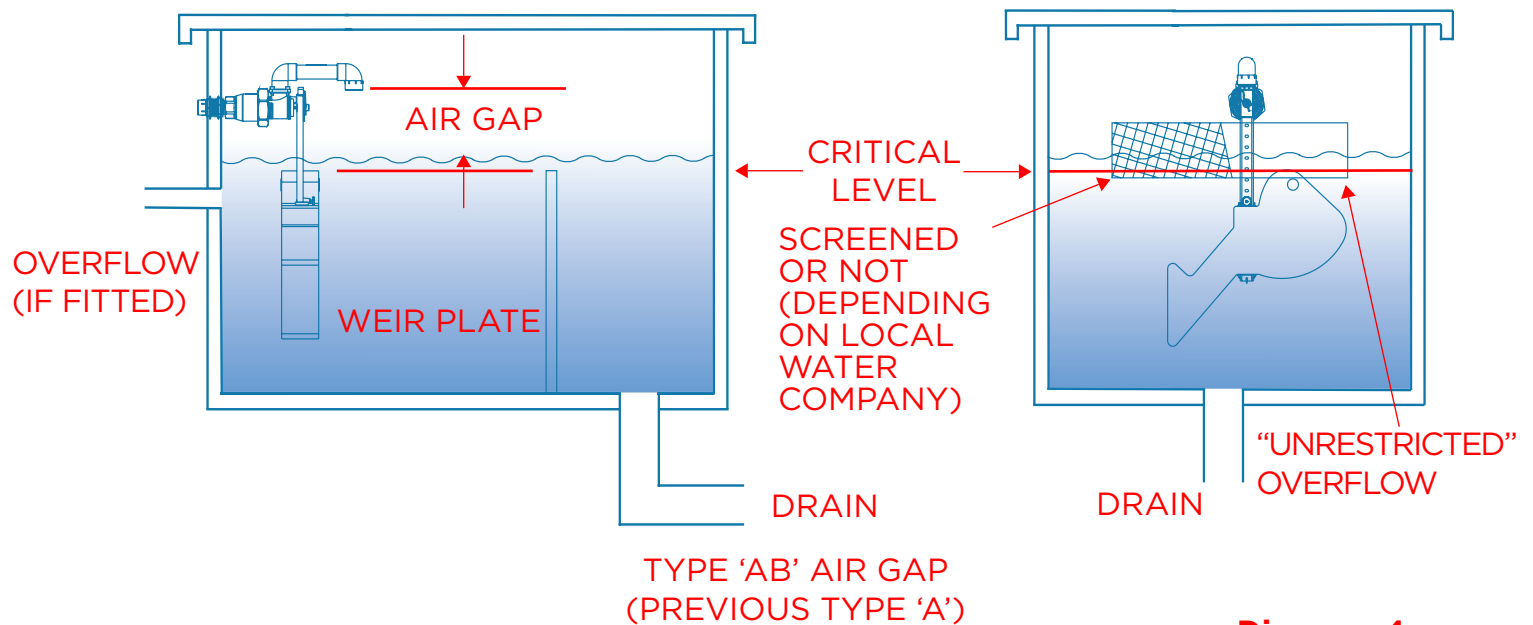


Diagram 4

Type 'AF' Air Gap

The Type 'AF' air gap provides protection for Category 3 & 4 risks. The air gap is sized on TWICE the bore of the incoming feed pipe but not less than 20mm. The air gap is measured from the 'critical water level' (C.W.L) to the lowest point of discharge of the supply pipe or float valve - see Diagram 5. This shows a cistern fitted with an AYLESBURY 'K' type float valve.

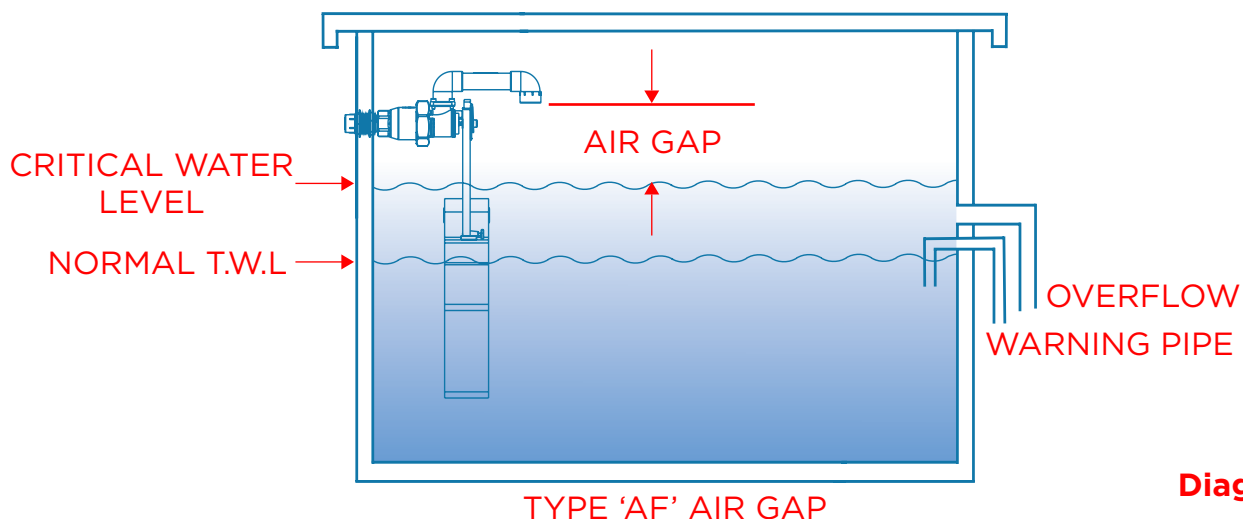


Diagram 5

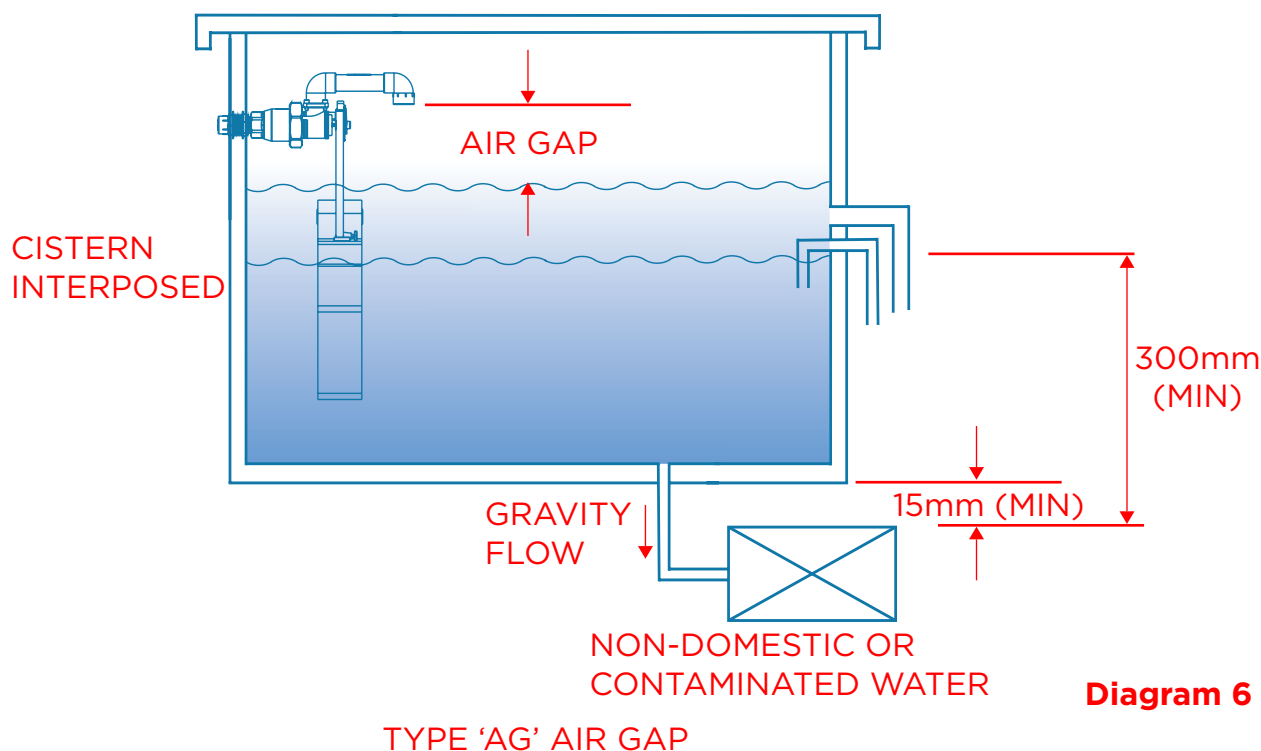
The critical level is the level the water will reach in a cistern should the float valve (or equivalent) fail and remain fully open e.g. punctured or removed float on BS1212 valves. All outlets except overflow/warning pipes must be closed and the supply pressure may be assumed to have a flow equivalent to a velocity of 3 m/s in the feed pipe.

The critical level can only be realistically established by practical testing. In order to keep the C.W.L. to a minimum height above the outlet level of the overflow, a low resistance overflow system should be fitted. This means large bore, short and as a few fittings as possible.

For cisterns of maximum capacity of 1000 litres fitted with a 1/2" BS1212 Part 2 or Part 3 or 1/2" Aylesbury 'K' Type valve only a 19mm bore warning pipe need be fitted. Provided the valve centre line is fitted no lower than the centre line of the warning pipe, no additional backflow protection is required. BS1212 Part 2 Valves which all have the outlet below the centre line require additional protection e.g. double check valve assembly.

Type 'AG' Air Gap

In certain circumstances, an interposed cistern incorporating a Type 'AG' air gap may be an acceptable alternative to a Type 'AA' or Type 'AB' air gap - see Diagram 6. This shows an interposed cistern fitted with an AYLESBURY 'K' type float valve.



Water must flow by gravity only from the interposed cistern to the point of use. Furthermore a minimum head (pressure) must exist between the interposed cistern and the contaminated liquid as shown above. This arrangement should prevent contamination of the interposed cistern but convection and diffusion can cause chemicals to flow up towards the interposed cistern. However the mains supply is further protected by a Type 'AG' air gap inside the interposed cistern.

General Guidance

(a) Prevention of Cross Contamination

No pump or booster drawing more than 12 litres per minute can be connected directly or indirectly to a supply pipe without permission from the local Water Undertaker.

A 'break tank' is often used to protect the mains supply, with either a Type 'AA' or 'AB' or 'AF' or 'AG' air gap. This stored water feeds the pump (booster set) that in turn often supplies large storage tanks at the top of tall buildings.

(b) Taking of Supplies

Any pipe conveying rainwater, recycled water or any other water from a source other than the Water Undertaker is not to be connected to any pipe carrying wholesome water supplied by the Water Undertaker, unless a suitable backflow prevention device or arrangement is installed in accordance with the requirements of the Regulations.

(c) Inlets to Cisterns

Inlets to all cisterns should be provided with a servicing valve to facilitate maintenance, and a float operated valve or some other no less effective device that is capable of controlling the flow of water into the cistern. The servicing valve should be fitted as close as reasonably practical to the float operated valve or other device. This does not apply to a pipe connecting two or more cisterns each of which has the same overflowing level.

Float controlled valves or equivalent inlet devices should be securely and rigidly attached to the cistern and installed so that the valve closes when the level of the water is not less than 25mm below the overflowing level of the cistern. Where the cistern is fitted with an approved alternative to a warning pipe, such as an indicator instrument or a visual or audible alarm, the inlet valve is to close when the water level is not less than 50mm below the overflowing level of the cistern.

(d) Outlets to Cisterns

Where practicable all outlets from a cistern should be taken from the bottom of the cistern.

(e) Warning and Overflow Pipes

All cisterns, except automatically operated urinal flushing cisterns, should be provided with a warning pipe, or some other no less effective device, installed in such a manner that it discharges immediately when the water in a cistern reaches the defined overflowing level. Where an alternative no less effective device is installed instead of a warning pipe, an overflow pipe should be installed. The outlet end of a warning or overflow pipe is not to be at a higher level than the inlet end; it should be installed on a downward inclined plane and not comprise or have connected to it any flexible hose.

A warning/overflow pipe should not be less than 19mm internal diameter, but the actual internal diameter of the pipe(s) installed should be capable of taking any possible flow in the pipe arising from any failure of the inlet valve.

(f) Cold Water Storage Cisterns

Cisterns storing water for domestic purposes should be watertight and where required be lined or coated with a suitable impermeable material; they shall be provided with warning and overflow connections as appropriate which are so constructed and arranged as to exclude insects.

They should have a rigid, close-fitting and securely fixed cover which is not airtight but which excludes light and insects from the cistern; be made of a material or materials which do not shatter or fragment when broken and which will not contaminate any water which condenses on its underside; and, in the case of a cistern storing more than 1,000 litres of water, be constructed so that the cistern may be inspected and cleansed without having to be wholly uncovered.

Every cistern should be adequately supported to avoid distortion or damage and only installed in a place or position where the inside may be readily inspected and cleansed, and any float operated valve or other controls may be readily installed, repaired, renewed or adjusted. The cistern should have a minimum unobstructed space above of not less than 350mm.

Where the required capacity of water is provided by the use of two or more cisterns, the inlets and the outlets of the cisterns should be located so that water passes through the whole of the cisterns and short-circuiting does not occur.

Water storage - Typical Usage by Application

Type of Use	Number of Litres
Hotels	200 per bed
Hospitals	200 per bed
Children/Nursing Homes	200 per bed
Nurses Homes	120 per bed
Boarding Schools	90 per pupil
Hostels	90 per bed
Offices with canteen	45 per person
Offices without canteen	40 per person
Schools - secondary	20 per pupil
Schools - primary	15 per pupil
Restaurants	7 per meal

Hot or cold water storage.

Break tanks: 15mins. Pump supply.

As a general rule for water storage capacity, one third is hot and two thirds are cold.

Design Flow Rates to Sanitary Appliances

Rate of flow - litres/second

Outlet Fitting or Appliance	Design rate	Min.rate
WC cistern (to fill in 2 minutes)	0.13	0.05
WC pressure flushing valve (DN20)	1.50	1.00
WC flushing trough (per WC served)	0.15	0.10
Urinal cistern (each position served)	0.004	0.002
Urinal flushing valve	0.30	0.15
Washbasin (Pillar or Mixer taps) - see note 2	0.15	0.10
Handbasin (Pillar or Mixer taps)	0.10	0.07
Handbasin (Spray or Spray Mixer taps)	0.05	0.03
Bidet	0.20	0.10
Bath (G ¾)	0.30	0.20
Bath (G 1)	0.60	0.40
Shower head (see note 3)	0.20	0.10
Kitchen sink (G ½)	0.20	0.10
Kitchen sink (G ¾)	0.30	0.20
Kitchen sink (G 1)	0.60	0.40
Washing machine (see note 1)	0.20	0.15
Dish-washing machine (see note 1)	0.15	0.10

Notes

1. Flow rates required for washing and dish-washing machines for other than single dwellings should be obtained from the manufacturer.

2. Mixer fittings or combination tap assemblies deliver less flow than two separate taps; it is suggested that 70% of the above flow rates may be sufficient.

3. The rate of flow required to shower heads will depend on the type fitted; advice from the shower manufacturer should be sought.

Reference Sources

Water Supply (Water Fittings) Regulations 1999 - Guidance Documents British Standards

- BS6700 Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- BS1212 Parts 1, 2, 3, & 4 covering traditional float operated valves.
- BS6280 Method of Vacuum (backsiphonage) test for water using appliances.
- BS6281 Devices without moving parts for the prevention of contamination of water by backflow
Part 1: Type 'AB' air gap - previous Type 'A'.
Part 2: Type 'AF' and/or Type 'AG' depending on use - previous Type 'B'
Part 3: Pipe interrupters of nominal size up to and including DN42.
- BS6282 Part 1: Check valves up to and including DN54.
Part 2: Terminal anti-vacuum valves of nominal size up to and including DN54.
Part 3: In-line anti-vacuum valves of nominal size up to and including DN42.
Part 4: Combined check and anti-vacuum valves of nominal size up to and including DN42.
- BS7491 Part 1: Specification for one-piece cisterns of nominal capacity up to 500 litres.
Part 2: Specification for one-piece cisterns of nominal capacity from 500 litres to 25000 litres.

Specification Catalogue

Full technical information on all Keraflo products can be found in the Keraflo Specification Catalogue. A copy of this publication is available on request or may be downloaded at www.keraflo.co.uk

Downloadable Keraflo Valve Technical Drawings and Installation Guides

Drawings and fitting instructions for the full Keraflo product range are available on request or may be downloaded at www.keraflo.co.uk





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