

Water Regulations Tutorial # 8

Showers Baths Bidets

Updated October 2022

Bathrooms contain many types of water fitting which can be a source of contamination. The level of backflow protection required is dependant on the fitting and type of property. Modern plumbing systems supply the cold and hot water at mains pressure - or boosted for tall buildings. Such unvented systems have many advantages over gravity (vented) designs including – improved water quality, simpler pipe work, higher flow rates and reduced bacterial growth (less chlorination).

Many European bathroom fittings are designed for high pressure supplies and consequently the flow rate at typical gravity pressures (less than 1 bar) is often inadequate. With so many European fashion-styled fittings available, the designer is almost compelled to design new and refurbished properties with an unvented hot water system.

Older buildings in the UK often have cold mains (or boosted) supply and vented hot from a cold storage cistern. This creates a problem when using mixer taps, where the equal sized high pressure ports provide poor flow from the hot. Thermostatic Mixing Valves (TMVs) are designed for equal supply pressures and are likely to perform poorly with unbalanced hot and cold pressures. These are just some of the reasons for installing an unvented hot water system – there are many more.

When designing an unvented plumbing system, great care is required to provide the correct backflow protection. Schedule 2, paragraph 15 requires point of use protection –

*“Subject to the following provisions of this paragraph, every water system shall contain an adequate device or devices for preventing backflow of fluid from **any** appliance, fitting or process from occurring”.*

In addition to backflow prevention, public bathrooms should be designed to minimise Legionella risks and to provide hot water at a safe temperature.

BATHS – DOMESTIC SITUATIONS

A bath without a shower hose and separate hot and cold taps requires no protection on the supply pipes providing the taps discharge the correct height above the spillover level (rim) of the bath. A $\frac{3}{4}$ " tap requires 25 mm air gap to meet the requirement for an AUK2 tap gap. This is suitable for Fluid Category 3. Nursing homes and similar non-domestic situations – which are listed as Fluid Category 5 - should be protected with an AUK3 tap gap. This higher risk tap gap requires twice the bore e.g. 38 mm tap gap for a $\frac{3}{4}$ " (19 mm bore) tap. If the tap air gaps are less than the required gap, additional protection is required. The same applies for a shower hose that can become submerged.

Clause G15.14 states -

“Submerged inlets to baths or washbasins in any house or domestic situation are considered to be a Fluid Category 3 risk and should be supplied with water from a supply or distributing pipe through a Double Check Valve. Submerged inlets to baths or washbasins in other than a house or domestic situation, and sinks in any location, are considered to be a Fluid Category 5 risk and appropriate backflow protection will be required.”

Shower hoses for Fluid Category 3 should be protected by Double Check Valve or an approved manufacturer's integral “Divert with automatic return”. This is known as a type HC device and returns the bath outlet open to atmosphere if a vacuum (or loss of positive pressure) occurs at the inlet to the device. Curiously this device is suitable for Fluid Category 3. A “domestic situation” would include

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hotels and the bath shower hoses should have a Double Check Valve fitted if a HC device is not present. Arrow Valves model ED235 is designed for shower hoses on bath mixer taps for Fluid Category 3 and requires no tools to fit. Also available with optional flow limiter, ensuring water is evenly distributed to showers in multiple occupancy buildings (e.g. flats and hotels) in a controlled and balanced manner. See also “Equi-Flow” model AFLE (flow limiter only – no Double Check Valve).



Double Check Valve
(model ED235)

DOUBLE CHECK VALVES

Double Check Valves offer Fluid Category 3 protection. They are commonly available, inexpensive, do not discharge and are generally used for Fluid Category 3 applications where an air gap or HC device is impractical. However they require a minimum pressure to open and create an increasing headloss as the flow increases. Many 15 mm Double Check Valves create up to 0.5 bar headloss at 3 m/s pipe velocity. On a mains system the supply pressure may only be 1 bar at 0.15 l/s. The appliance may be on the first or second floor and additional Double Check Valves are often required serving the branch to that floor - *more about this in tutorial 9*. The combination of two or three Double Check Valves in series together with a low static head can lead to an inadequate flow. The Arrow Valves model ED132 Double Check Valve has exceptionally low head loss – e.g. 0.1 bar headloss @ 3 m/s pipe velocity.



Very low headloss Double
Check Valve
(model ED132)

Double Check Valves no longer need a test point. A DCV with no test points is described as “non-verifiable” and coded as type “ED” device. There is absolutely nothing to be gained from using a verifiable “EC” device. This would require 3 test points and would still only provide the same backflow protection as the ED – Fluid Category 3.

In certain circumstances, two single check valves in series can be used as an equal equivalent to a Double Check Valve, please see below.

SHOWERS – DOMESTIC SITUATIONS

Backflow becomes a concern if the shower hose can be submerged. An electric shower with a fixed head or shower hose that cannot become submerged requires no protection.



Single Check Valve
(model EB235)

A shower with a mixer tap (blending hot and cold water) requires a Single Check Valve (type EB) on the hot and cold supplies if the pressures are unbalanced. This is to prevent the hot water (Fluid Category 2) mixing with cold (Fluid Category 1 “wholesome”). The check valves are sometimes incorporated in the mixer tap housing. Arrow Valves model EB235 is designed to be fitted to shower hoses for Fluid Category 2 and requires no tools to fit.

Where the shower hose outlet can become submerged, an approved HC (Diverter with automatic return) or ED (Double Check Valve) is required for domestic situations.

BATHS / SHOWERS – FLUID CATEGORY 5 (HOSPITAL NURSING HOMES)

A bath or shower hose that can become submerged in a non-domestic situation must be supplied through a Fluid Category 5 protection device or arrangement. For vented systems, protection can be achieved by a storage cistern with a type AG air gap. There must be a dedicated distributing pipe to each bath/hose. The water company may allow one distributing pipe to supply several baths – contact them (*see contact details on our website*).

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Unvented systems require a dedicated storage cistern with a type AB air gap. A type DC Pipe Interrupter seems a simple solution for the shower hose. Unfortunately the restriction of the spray head would result in water discharging through the vent hoses rather than the spray and therefore a DC device should not be used. A boosted system drawing water from dedicated cistern with type AB gap is the only practical solution. Unlike vented systems (creating type AUK1 arrangement), the cistern must be dedicated, i.e. serving the baths/showers only. Having lost the mains pressure, this will need to be restored with a pump with suitable controls. Arrow Valves model BTAB is a very compact Break Tank and booster set with type AB air gap. The full-bore solenoid valve provides a filling rate exceeding a 1" float valve. This can be used to fill several baths.



Backflow prevention for the hot supply must have similar backflow Fluid Category 5 protection. Ultimately the hot system will be supplied by cold mains water (Fluid Category 1). Paragraph 15 of the Water Regulations stated earlier, requires point of use protection. Merely protecting the cold fill to the hot system with a type AB air gap would not be acceptable for supplying a bidet and hand washbasin. Hot water for domestic purposes – which includes personal washing - should be Fluid Category 2.

The implications of providing point of use protection to each hot supply to a bath with shower hose are plain to see. It is likely zone protection would be acceptable for supplying several baths from a single storage cistern and heating unit. Some water companies are accepting a lesser device (e.g. HC Diverter or ED Double Check Valve) for point of use protection, providing the connection to the cold supply pipe is appropriate to the Fluid Category – i.e. a type AB air gap for Fluid Category 5. This is a logical compromise and provides a more practical solution. This design - all designs - must be approved by the local water company – see *tutorial 5*.

CARE SHOWER

Healthcare thermostatic electric shower (meeting BEAB Care Mark requirements as being safe for use by elderly, young and sick) and Booster Pump package – model CSABATLF. The assembly has Fluid Category 5 backflow protection via the integral AB air gap preventing contamination should the hose become submerged in bath or toilet water.



BIDETS AND ABLUTION HOSES

The Water Regulations identify any hose used for toiletry purposes and the contents of a bidet as Fluid Category 5. For hygiene reasons, bidets must be supplied with domestic water, meaning Fluid Category 1 (cold) or Fluid Category 2 (hot).

There are two types of bidet – over-rim and ascending spray. G15.11 deals with over-rim bidets –

“Bidets in domestic locations with taps or mixers located above the spillover level of the appliance, and not incorporating an ascending spray inlet below spillover level or spray and flexible hose, may be served from either a supply pipe or a distributing pipe provided that the water outlets discharge with a Type AUK2 air gap above the spillover level of the appliance”.

The words “domestic locations” would exclude health care premises. Here, the tap gap should be upgraded to type AUK3.

Most bidets found in hospitals and nursing homes tend to be the ascending spray type or feature a submergible hose. The Water Regulations Guide shows many illustrations for vented systems but none for unvented, other than R15.10.1.

Unvented (mains or boosted) systems require a type AB air gap feeding the bidet. The same cistern cannot be used for the general hot services.

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The most practical arrangement is a cistern (break tank) with type AB air gap supplying cold water to a bidet and also supplying a dedicated electrical heater or heat exchanger (hot water cylinder). The heater should **not** store warm water at 43°C - due to risk of bacterial growth (e.g. Legionella and Cryptosporidium). The water should be stored at 60°C min. (we suggest 80°C max.) and a Thermostatic Mixing Valve (TMV) - meeting the requirements of TMV3 scheme – should be used at point of use – see TMV heading.

The Water Regulations Guide illustrates a number of ways to install a bidet from a cistern (i.e. vented) but there are no illustrations or R clauses for an unvented installation. G15.10 states –



*“Ablution Plant”
(model BTHW)*

*Delivers safe hot water
with Fluid Category 5
backflow prevention*

*Bidets of this type (submersible outlets) may;
“Be supplied with cold and/or hot water through Type AA, AB, or AD backflow
prevention arrangements serving the bidet only; or, ... “*

In practice a type AA air gap must not be used for a cistern and type AD “Jump-Jet” are normally for small (e.g. 3 mm bore) OEM applications. The only practical option is therefore type AB air gap. To comply with all the requirements of the Water Regulations, Arrow Valves have designed the “Ablution Plant” – model BTHW.

The Ablution Plant provides point of use Fluid Category 5 backflow protection, preventing cross contamination within the building. The unit contains a Break Tank with type AB air gap, booster pump, water heater with thermostat set to 62°C and thermostatic mixing valve (TMV3) all contained within a cabinet. The unit is normally installed behind a removable panel in a

washroom and delivers warm water at a safe temperature to a bidet or abluion hose adjacent to a WC.

Arrow Valves also offer a point of use Category 5 Break Tank & Booster Set that utilises the existing hot and cold water supplies – model BTMIDI-HS. The unit purges the contents in the break tank after use, so there is no stored warm water that could be a potential Legionella risk.



*Hot water Midi
(model BTMIDI-HS)*

HAND BASINS

Water supplied to the cold tap should be “wholesome” (Fluid Category 1) so it is suitable for drinking. Taps not suitable for drinking (e.g. hose union taps) should be labelled in accordance with clause G27.4 “Not Drinking Water”.

Assuming no plugs are provided, self-closing taps should be used – G28.1. A servicing valve with an automatic flow limiter is ideal for conserving water and preventing splashing – model AFL. This allows the designer to accurately calculate the demand and size the pipes and plant accordingly.

The hot supply must be Fluid Category 2 and therefore suitable for personal washing. Fluid Category 2 is simply Fluid Category 1 “wholesome” that has been heated to above 25°C (aim to keep cold water below 20°C – G9.1).

Steel supply pipes (galvanised or black) may be used for sanitary purposes – providing a Single Check Valve is used at the connection to the wholesome supply.

THERMOSTATIC MIXING VALVES (TMVs)

Clause G18.5 states the requirement for Thermostatic Mixing Valves –

“Terminal fittings or communal showers in schools or public buildings, and in other facilities used by the public, should be supplied with water through thermostatic mixing valves



*TMV5213 Kit 6
15 mm TMV Kit 6 – supplied with four AFL
Servicing Valves and test point*

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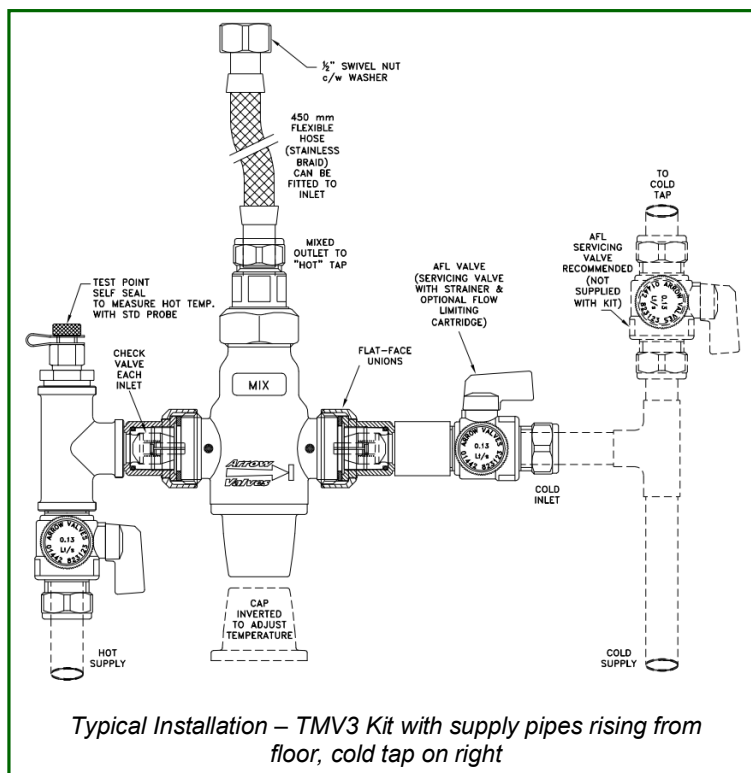
so that the temperature of the water discharged at the outlets does not exceed 43°C”.

Generally TMVs should be fitted at points of uses, i.e. one TMV per outlet. However where a number of outlets are in the same area – e.g. three hand wash basins, these can be served from one TMV (22 mm). This “group” mixing is **not** recommended for high risk applications – see TMVA code of practice. The mixed outlet should be as short as possible to conform to G18.4 and to minimise the Legionella risk. Clause G18.4 states –

“Where practicable the hot water distribution system should be designed and installed to provide the required flow of water at the terminal fittings to sanitary and other appliances at a water temperature of not less than 50°C (see note) and within 30 seconds after fully opening the tap. This criteria may not be achievable where the hot water is provided by instantaneous or combination boilers”.

Note – for public buildings the outlet temperature is 43°C max.

Servicing valves should be fitted to the hot and cold supplies to aid maintenance (Clause G11.1). The Arrow Valves TMV5213 is normally supplied with AFL (Automatic Flow Limiting) servicing valves. These valves enable a strainer only or combined strainer and automatic flow limiting cartridge to be fitted and removed through the side port without disconnecting pipes. The AFL Valves are supplied with serviceable 180 µm strainers. In **addition** the cartridges can incorporate an automatic flow limiting facility to assist with water conservation and unbalanced supply pressures. TMVs perform best with equal supply pressures e.g. unvented hot and cold.



TEMPERATURE MEASUREMENT

Once installed, the outlet temperature must be set using a probe digital thermometer with a minimum refresh rate of 4 times a second.

- Cold - the cold temperature can be measured at the cold tap. This should be below 20°C (R17.1.3.b)
- Hot - insert probe into test point (15 mm kit versions). This should be above 55°C (G18.2)
- Mixed - the mixed temperature at the “hot” tap should be set slightly below the maximum permissible temperature – use values in table below if no other specification is provided

Description	NHS Max. Temp	NHS High Pressure	NHS Low Pressure	Suggested AFL Cartridge (has strainer too)
Wash hand basin	41°C	HP-W	LP-W	2 x 0.07 Lt/s
Shower	41°C	HP-S	LP-S	2 x 0.13 Lt/s
Bidet	38°C	HP-B	LP-B	2 x 0.07 Lt/s
Bath (unassisted)	44°C	HP-T44	LP-T44	2 x 0.17 Lt/s
Bath (assisted)	46°C*	HP-T46	LP-T46	2 x 0.17 Lt/s

**This high fill temperature should only be considered in exceptional circumstances where there are difficulties in achieving an adequate bathing temperature. The building manager should also have in place specific policies that prevent the possibility of persons judged to be at high risk gaining access to the bath unaccompanied (taken from TMVA Recommended Code of Practice for Safe Water Temperatures).*

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SUMMARY

1. For domestic situations - including hotels - ensure the bath shower hose has an approved HC diverter valve. If not, fit a Double Check Valve.
2. For health care premises, consider the consequences of not providing Fluid Category 5 protection.
3. All public hot water outlets - including schools, hotels etc. – must be have a TMV (or equivalent) set to discharge at no more than 43°C.
4. Zone backflow designs must specifically be approved by the local water company. All proposed commercial installations must be notified – *see tutorial 5*.

Thank you for your interest