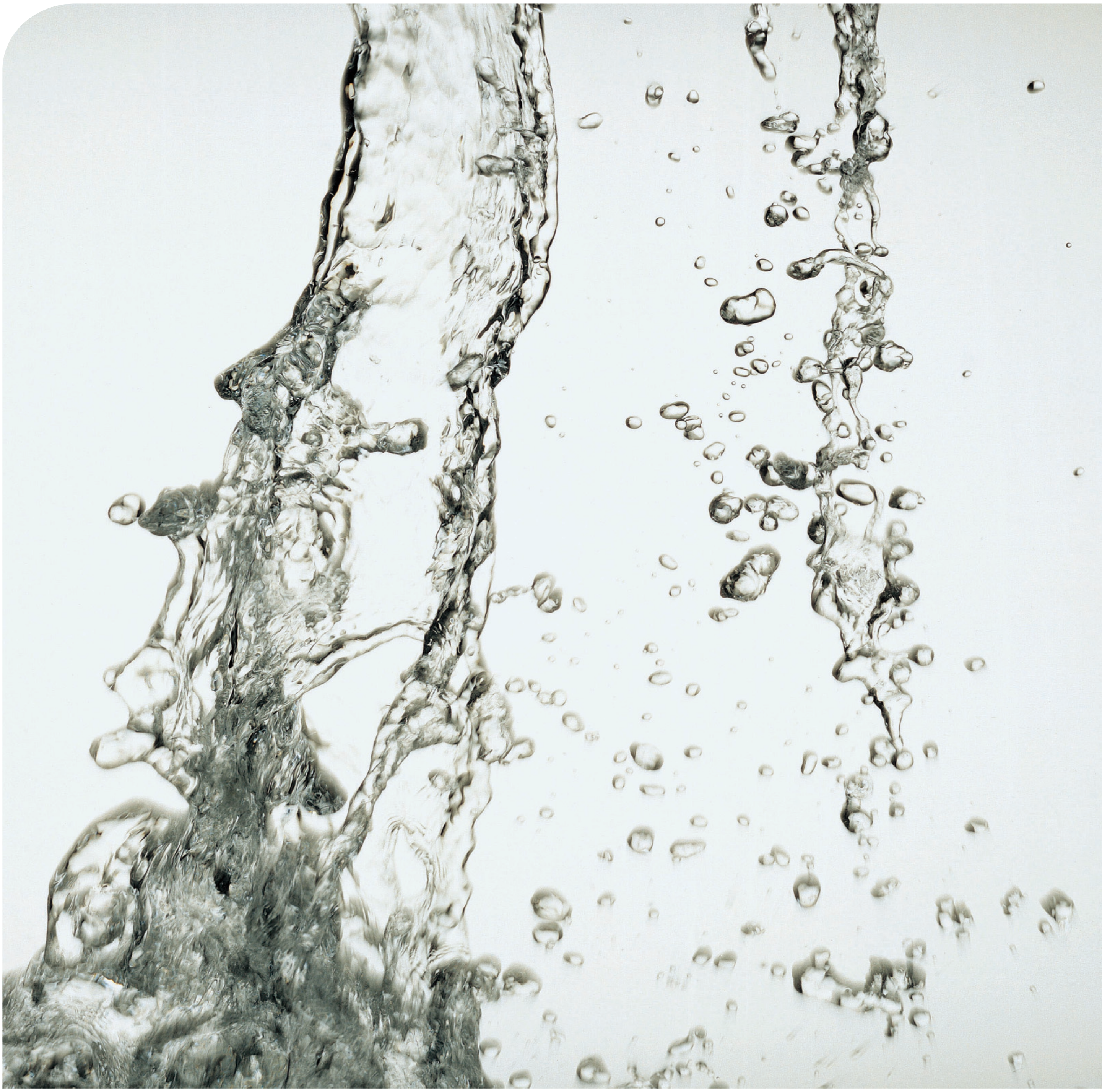
AECB Water Standards

Delivering buildings with excellent water and energy performance

VOLUME 1: THE WATER STANDARDS



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building knowledge

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Introduction

SECTION 1

Whilst water is a renewable resource, many areas of the UK are under water stress. Even for areas where water supply is plentiful, the energy to supply potable water, and treat the resulting wastewater is often raised as an environmental concern. In practice the energy used to heat water in the home is around seven times greater than this. For domestic buildings[1] achieving Passivhaus levels of thermal performance, the energy required to heat hot water is greater than for space heating. For these reasons, the AECB Water Standards prioritise hot water savings.

The AECB standards[2] are based on performance requirements for individual water-using devices rather than a whole building calculation method, which tends to encourage game playing with credits being awarded for fittings that can be easily changed. The whole building calculation approach also allows cold-water savings to offset increased hot water use.

For practitioners familiar with the Code for Sustainable Homes (CSH) water requirements, the AECB standards might seem to be less ambitious. This is in part because water recycling is not encouraged and in part because acceptable performance is considered which sets a lower limit on tap and shower flows and bath sizes. Thus whilst an enthusiast might choose to fit a very low flow shower head or a spray tap in the bathroom, most users would find such fittings unacceptable and so would almost certainly replace them, perhaps with a very high flow rate fitting. Instead the AECB Standards follow the North American and Australian lead by requiring fittings of the lowest water use that have been shown to be acceptable to the majority of users. This does not prevent householders installing even lower flow fittings should they wish to, but this cannot be made a requirement for a building of unknown occupancy. However user behaviour has a greater influence on water consumption than choice of fittings. The Good and Best Practice specifications should help careful users to use less water than predicted by the highest levels of the CSH.

[1] Hot water use tends to be much less for many non-domestic buildings.

[2] This document is supported by *VOLUME 2: AECB Water Standard*, Technical Background Report, which provides the detailed rationale behind the standards and explains why the AECB Standards differ from the current version of the Code for Sustainable Homes.

Summary of Recommendations

SECTION 2

There are two specifications; Good Practice and Best Practice.

Good Practice: will result in normal or improved levels of performance and comfort. Extra effort will be required at the design and specification stage compared to a standard building, but the choice of fittings will be wide with minimal additional expense over 'standard' fittings.

Best Practice: performance and comfort are maintained but meeting the standard may incur additional design effort and expense or a more limited choice of suitable fittings. Shower heads and tap outlets have a lower flow rate than under Good Practice[3], but Good Practice fittings must be provided for retrofitting should the low flow fittings be considered unacceptable by the end user. This is to encourage people to try lower flow fittings, whilst guarding against dissatisfied users over-reacting and retrofitting very high flow fittings.

Experimental technologies

Many people designing and building to AECB standards will be keen to innovate, and a variety of experimental and innovative approaches to water use are possible. As is always the case with innovation, some of these technologies will turn out to be great successes (and may in the future become incorporated into Good and Best Practice Standards), but others will fail at some point. Other innovations are likely to be very site-specific, or highly dependent on the client's attitude (e.g. waterless toilets), and so may never be widely applicable. As such, it is difficult to incorporate innovative technologies into a standard.

Appliances meeting the Good and Best Practice Standard are regarded as being suitable for the majority of users, with normal levels of performance and comfort. Where people are happy with lower volumes and flow rates, this should be encouraged but cannot be enforced.

In the case of easily replaced items such as shower heads or tap outlets, innovative or experimental devices may be fitted under the Good and Best Practice standards as long as a suitable replacement is provided as an option.

Installation of technologies that cannot easily be replaced by the householder (such as compost toilets, or appliances with specific drainage or pipe-work requirements) represent more of a risk should the appliance not prove acceptable. Consequently, a building with such technologies cannot be described as meeting the AECB Good or Best Practice Standard for water, and the water element of the property should be described as *Experimental*.

Water reuse and rainwater harvesting

The AECB Water Standards do not require the installation of grey or rainwater recycling because of the poor economic and environmental case for such technologies. It is possible that these technologies are appropriate in certain unusual situations but they should not be assumed to be appropriate by default.

[3] Lower flow tap outlets and shower heads do not necessarily cost more and so would be a requirement for Good Practice if user satisfaction could be guaranteed.

General Requirements

SECTION 3

Specified flow rates and water pressure

Flow rates in the AECB Standards are specified at the actual pressure available in the dwelling. Fittings specifically marketed for compliance with the CSH will often have flow rates quoted at 3 bar. Where the water pressure is greater than 3.5 Bar, a pressure regulator shall be fitted where the cold-water service pipe enters the building.

Where the mains pressure to the building is lower than 3 bar or fittings are fed by a header tank, then it is important to ensure that the specified fittings will perform adequately with the available pressure. Some water saving devices such as aerated tap outlets or aerating showers may not function correctly at pressures less than about 1 Bar. In this situation the designer shall explain the reasoning behind the chosen fittings.

Where available water pressure is low it may be difficult to achieve the required hot water dead leg volumes without recirculation, because larger pipes will be required to achieve sufficient flow rate. As secondary circulation can lead to very significant energy wastage, the dead leg requirements in certain cases may be relaxed in preference to specifying secondary circulation. Dead leg calculations are necessary for all buildings and the designer shall explain their workings if relaxation of the dead leg volume standard is required.

For fittings with a mixer valve, flow regulation shall be provided at the outlet rather than in the separate hot and cold feeds to the mixer.

Clear indication of hot and cold

All taps and mixer valves shall have a clear indication of hot and cold and be installed with the hot tap or lever position to the left where relevant (EN 200: 1989 ref. 5.2). This standardisation is to save water and energy and reduce the risk of scalding for partially sighted and blind people.

Urinals

Correctly installed urinals use significantly less water than WCs and waterless urinals use no water at all except for routine cleaning. However automatic flushing of urinals is difficult to regulate in a way that will meet the Water Fittings Regulations requirements of 7.5 litres per bowl per hour when the building is in use (10 litres for a single bowl). In addition it is common for the flushing rate to be increased in an attempt to reduce odour or trap blockage and this can lead to very high water use.

Thus where automatically flushed urinals are to be installed they should flush with a rate no greater than 4.5 litres per bowl, twice an hour and only whilst the building is occupied. This can be achieved by a suitable controller that incorporates presence detection and/or a timer with a flow rate set by a flow regulator.

An alternative is a flush per use urinal, either manual or by electronic sensor. The graph below shows that for lower use applications this technology is more economical than automatic flushing and the AECB Standard requires the designer to show calculations justifying the chosen urinal technology.

Waterless urinals avoid this problem and have a number of other advantages but care must be taken to avoid high financial and environmental costs associated with consumable and disposable components of some waterless urinal systems. In the absence of a recognised standard that considers the life cycle impact of waterless urinals, it is up to the designer or specifier to demonstrate that the chosen technology will have a lower impact than conventional flushed urinals installed in accordance with the Water Regulations.

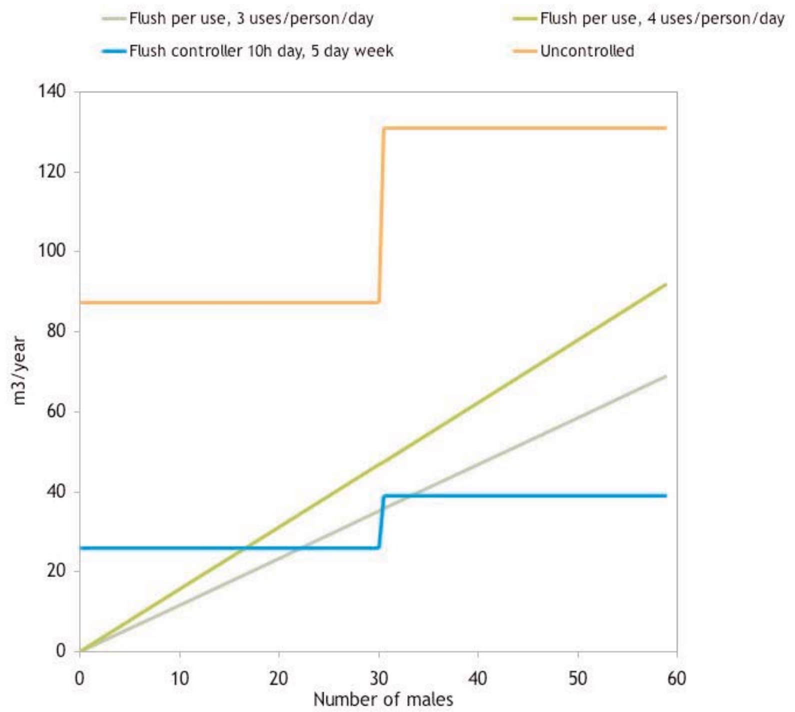

FIGURE 1. COMPARISON OF FLUSH PER USE AND TIMED FLUSH. CONSERVING WATER IN BUILDINGS, EA 2007.

AECB Good Practice Standard

SECTION 4

Fittings that meet the Good Practice Standard will allow normal or improved levels of performance and comfort. The choice of fittings will be wide with minimal additional expense over ‘standard’ fittings.

Appliance	Good Practice Requirement
Showers	6 to 8 l/min measured at installation. Mixer to have separate control of flow and temperature although this can be achieved with a single lever with 2 degrees of freedom (lift to increase flow, rotate to alter temperature). All mixers to have clear indication of hot and cold, and with hot tap or lever position to the left where relevant.
Basin and bidet taps (domestic)	4 to 6 l/min measured at installation (per pillar tap or per mixer outlet). All mixers to have clear indication of hot and cold with hot tap or lever position to the left.
Basin taps (washroom)	≤ 1.7 l/min measured at installation. Dead leg <0.5 litres.
Kitchen sink taps	6 to 8 l/min measured at installation. All mixers to have clear indication of hot and cold with hot tap or lever position to the left.
White Goods	Best energy class available, see energy standard for details.
WCs	≤ 6 l full flush when flushed with the water supply connected[4]. All domestic installations to be dual flush. All valve-flush (as opposed to siphon mechanism) WCs to be fitted with an easily accessible, quarter turn isolating valve with a hand-operated lever. Where a valve-flush WC is installed, the Home User Guide must include information on testing for leaks and subsequent repair. No requirement for dual flush for non-domestic installations.
Urinals	Where urinals are to be installed the designer shall justify the choice of technology, see text. For low user numbers, flush per use generally results in lower water use than automatic flushing. Where automatic flushing is installed it shall be controlled to provide two flushes an hour of no more than 4.5 litres/bowl, see text. Waterless urinals are preferred but evidence shall be provided to demonstrate that the running cost and environmental impact is less than for flushed urinals since some models have a high consumable cost.
Baths	≤ 180 litres measured to the centre line of overflow without allowing for the displacement of a person. Note that some product catalogues subtract the volume of an average bather. A shower must also be available. If this is over the bath then it must be suitable for stand-up showering with a suitable screen or curtain.

4 Fitting a delayed action inlet valve to a 6 litre cistern tested to BS EN 997 will be regarded as complying. Cisterns that have not been tested with the water supply connected and which are not fitted with such a valve are assumed to use an additional 1 litre per flush, thus a 5 litre WC is required to meet the standard.

AECB Good Practice Standard (cont.)

Appliance	Good Practice Requirement
Dead legs [5]	≤ 1.5 litre. All hot and cold pipes must be insulated (except exposed pipework at final connections). Heat loss from dead legs to be calculated. Baths exempt from dead leg requirement unless the bath filler also feeds a shower.
Dead legs off secondary circulation	≤ 0.5 litres. Secondary circulation should be avoided wherever possible but where installed in individual households, the pump is to be controlled by a timer, flow switch or presence detection. For flats, hotels, schools and the like, an evaluation of options such as continuous circulation and local hot water generation or storage shall be made. The most appropriate solution will depend on patterns of use, distance between fittings and the nature of the energy source[6].
Water softeners	Demand initiated (i.e. based on a volume of water rather than on a pre-programmed timer) and only appliances requiring soft water shall be connected to the softener. Only permitted in areas with water hardness over 200mg/l ($CaCO_3$).
Water metering, pressure regulation and leak detection	Where static water pressure is greater than 3.5 Bar, fit a pressure regulator where the cold water service pipe enters the building. A water meter shall be installed inside the building in a convenient to read location[7]. Either a leak detection and shutoff device or a simple to operate water supply isolating valve or switch shall be installed where the cold water supply enters the property.
Outdoor	Where an outdoor tap is installed, this shall be sub-metered. Appropriate number of water butts in relation to garden size and layout. Planting schemes shall be designed to be drought tolerant.
User Guide	Provision of user guide, details in technical guidance document. Commissioning checklist required.

[5] The term for the volume of water in the pipe between the hot water source and the outlet. This is approximately the volume of cold water that must be drawn off before hot water reaches the outlet.

[6] For example, point of use water heating would be most appropriate where electricity must be used, whilst a district heat main and continuous circulation might be appropriate where the energy source is waste heat, e.g. from district CHP.

[7] This can be a low cost turbine meter and is in addition to the utility meter.

AECB Best Practice Standard

SECTION 5

Normal levels of performance and comfort are maintained at this level. Additional effort will be required at the plumbing design stage. There may be a reduced choice of suitable fittings, and these may be more expensive than standard fittings. Shower heads and tap outlets have a lower flow rate than under Good Practice, but Good Practice fittings must be provided for retrofitting should the low flow fittings be considered unacceptable by the end user.

Appliance	Best Practice Requirement – as Good Practice plus:
Showers	≤ 6 l/min plus Good Practice fitting provided for use if required.
Basin and bidet taps (domestic)	≤ 4 l/min with reduced diameter aerator or spray to maintain force of water stream. Single lever mixer taps shall incorporate a water brake or equivalent to encourage a lower default flow rate. A Good Practice outlet fitting must be provided for use if required.
Basin taps (washroom)	As Good Practice. Dead leg ≤ 0.25 litre
Kitchen sink taps	≤ 6 l/min, single lever taps should be fitted with a water brake or some other means of ensuring that default flow is lower. A Good Practice outlet fitting must be provided for retrofit if required.
White Goods	Best energy class available, see Energy Standards for details.
WCs	≤ 4.5 l full flush when flushed with the water supply connected. Flush mechanism to utilise a leak-free siphon or to be fitted with a suitable leak detection warning device. As Good Practice for other requirements.
Urinals	As Good Practice.
Baths	As Good Practice.
Dead legs	≤ 0.85 litres. (Lower flow rates will permit smaller bore pipework). Baths exempt from dead leg requirement unless the bath filler also feeds a shower.
Dead legs off secondary circulation	≤ 0.25 litres. Where installed in a house, secondary circulation pump is to be controlled by a run on timer to be initiated by a flow switch, presence detection or a manual switch. For flats, hotels, schools and the like, an evaluation of options such as continuous circulation and local hot water generation or storage shall be made. The most appropriate solution will depend on patterns of use, distance between fittings and the nature of the energy source.
Water softeners	As Good Practice.
Water metering, pressure regulation and leak detection	A separate water meter is required on the hot water cold feed to provide an indication of hot water use.
Outdoor	As Good Practice. Garden planting schemes in areas of moderate or severe water stress (as defined by the Environment Agency) shall be designed to avoid the need for mains or borehole water, except in the case of edible crops.
User Guide	As Good Practice.

References

Table 1. Pipe lengths to meet dead leg targets. Note for microbore pipes, length may be limited by required flow rate and pressure drop rather than dead leg volume.

Pipe outside diameter, mm	10	10	12	15	15	22	22
Material	PEX	Cu	Cu	PEX	Cu	PEX	Cu
Wall thickness mm	1.70	0.60	0.60	1.70	0.70	2.20	0.90
Dead leg litres/m	0.03	0.06	0.09	0.11	0.15	0.24	0.32
Length for 1.5 litre dead leg (m)	43.90	24.70	16.40	14.2	10.3	6.20	4.70
Length for 0.85 litre (m)	24.90	14.0	9.30	8.00	5.90	3.50	2.70
Length for 0.5 litre (m)	14.60	8.20	5.50	4.70	3.40	2.10	1.60
Length for 0.25 litre (m)	7.30	4.10	2.70	2.40	1.70	1.00	0.80

The AECB Water Standard; Technical Background Report (provides the detailed rationale behind the standards and explains the differences with the current version of the Code for Sustainable Homes). January 2009. AECB.

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