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INSURER AUGMENTED
APPROVED DOCUMENT

G

Insurer Requirements for Enhanced Escape of Water Protection and Safety in Building Plumbing and Water-Based Fire Suppression Systems

based on

The Building Regulations 2010

Sanitation, hot water safety, water efficiency

RISCAuthority

FPA Fire Protection Association

Foreword

Insurer Augmented Approved Document G (Water Supply): 2021 Edition

In 2018 insurers dealt with 228,000 escape of water claims, at a cost of £617m - an increase from £529m paid out five years previously, according to statistics supplied by ABI. Escape of water affects around 43% of domestic properties in the UK, with an average active leak flowrate of 20.63ml/mm or 30 litres per day.

Escape of water (EoW) events can displace people from their homes, incur great disruption, significant property damage, financial cost and, in some instances even lead to businesses failing. Poorly designed and installed systems can also lead to serious personal injury and death through scalding. Best practice with respect to the design and the installation of various plumbing systems is well established having been developed over the years in consultation with industry and manufacturers through the various iterations of The Building Regulations Approved Document Guidance and the British Standards. Despite the quality and the technical detail within those documents, escape of water events remain the most costly peril faced by insurers in the domestic and residential environment and harm from scalding incidents persist as high risk factors for the very young and old within the home.

Changes in housing construction methods, construction materials, and water system products may also be impacting greatly upon the scale of loss and where additional water-based systems are specified for the purposes of fire suppression or green energy capture, accredited systems ensuring competence and product performance will be required to ensure they do not exacerbate losses in the future.

Escape of water and its effects are seldom fully considered by system designers, architects, installers and project managers. Unlike electrical or gas installations, there is no statutory requirement for persons installing or working on the majority of plumbing systems to be qualified. This may be because ordinarily, an escape of water incident does not pose an immediate risk to life. This could explain why the majority of escape of water incidents are attributable to poor workmanship.

This first edition of the ‘Approved Document G incorporating insurers’ requirements’ seeks to enhance site practices and reinforces what should already be happening by collating pertinent Regulations and guidance in a single document that is freely available. This document also identifies roles and responsibilities to aid the various project stakeholders understand the delivery components of safe and reliable water delivery systems.

The additional text relating to property protection has been developed through the Risk Insight, Strategy and Control Authority (RISCAuthority), an insurer-funded research initiative, and published by the Fire Protection Association (FPA). The technical expertise for this document has been provided by the Technical Division of the FPA, external consultants and experts from the insurance industry, who together form the various RISCAuthority Steering Groups. Although produced with insurer input, it does not (and is not intended to) represent a pan-insurer perspective. Individual insurance companies will have their own requirements, which may be different from, or not reflected in, the content of this document.

Aim

The aim of this document is to provide loss prevention guidance for those who design, install and commission plumbing systems in domestic and commercial buildings. This guide reinforces information from The Water Supply (Water Fittings) Regulations 1999, various British Standards and literature published by various manufacturers and introduces additional guidance where deemed lacking.

Introduction to RISCAuthority

Risk Insight Strategy and Control Authority

Reducing insurable risk through research, advice, and best practice guidance

What is RISCAuthority?

RISCAuthority is an annually funded research scheme supported by a significant group of UK insurers that conducts research in support of the development and dissemination of best practice on the protection of property and business.

Why does RISCAuthority exist?

In the United Kingdom there are very clear dividing lines drawn between stakeholder responsibilities for the protection of lives and the protection of property and business. Almost without exception, government-generated laws and requirements pertaining to the workplace and built environment detail performance up to and no further than the assurance of safety of lives with no further demands for the protection of property or businesses.

RISCAuthority conducts research with a view to influencing and augmenting mandatory requirements for loss prevention and protection. This aims to ensure business resilience is included in the overall protection strategy and that, in the event of fire, flood, escape of water and other perils, more happens following successful evacuation to ensure the ongoing viability of the property and the business conducted within it.

What does RISCAuthority do?

Through a series of technical working groups, RISCAuthority seeks:

- wherever possible to anticipate future events that may detrimentally impact upon the business of the UK insurance industry and invest accordingly to mitigate the consequences
- to identify issues currently affecting UK property insurance and invest accordingly to provide insurers with a means of managing the situation
- to maintain and improve the industry guidelines that underpin current insurer business and property protection practice
- to make business and property protection financially and technically attractive to the insured property owner
- to act as a focal point for all stakeholders with interests in business and property protection
- to encourage commonality with government policy where prudent.

These aims can be broken down into the key activities of:

- lobbying
- stakeholder engagement
- standards representation
- information gathering
- data and case study interpretation
- research
- production of best-practice guides
- development of insurance toolkits
- dissemination of knowledge and information.

For more information, and to access a wealth of free guidance and advice, visit www.riscauthority.co.uk

Use of this guide

How to use this guide

This guide reproduces in its entirety the text from Approved Document G: Sanitation, hot water safety and water efficiency, which will be familiar to those working in the design, installation and commissioning industries. Additional requirements for property protection designed to help you add resilience are provided as white text on a blue background in normal font. Additional guidance is included in Appendices. To assist with interpretation, the page numbering, table of contents and indexing of AD'G' has been preserved in-so-far as it is possible to do so. Insurer requirements included as Appendices are included as discreet sections with their own numbering system.

Document Format

- The Essential Principles of Escape of Water Prevention and Limitation (RISCAuthority Addition)
- AD 'G' fully augmented with RISCAuthority Essential Principles
- RISCAuthority added appendices
    - Appendix D: Roles and responsibilities
    - Appendix E: Escape of water risk assessment
    - Appendix F: Qualifications
    - Appendix G: Methods, protection, automatic isolation devices and testing
    - Appendix H: Lifting plant (sump pumps)
    - Appendix I: Water-based fire suppression systems

The Essential Principles of Escape of Water Prevention and Limitations

The basic principles that all designers, installers and commissioners should follow throughout a project are:

	PRINCIPLE	DESCRIPTION
QUALITY	Principle 1	• The systems shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.
	Principle 2	• The designer, installer and commissioner shall be suitably qualified and experienced, belonging to a relevant professional body.
	Principle 3	• Only certified products shall be used to build the system.
RESPONSE	Principle 4	• The design, installation and commissioning of the system shall be risk assessed.
	Principle 5	• The system shall be designed to reduce the likelihood and consequence of an escape of water incident.
	Principle 6	• The system shall be designed for ease of maintenance.
	Principle 7	• During installation, the system shall be isolated when unoccupied.
	Principle 8	• When in-service, it shall be possible to readily isolate the system, by means that are readily identifiable.
	Principle 9	• The system pressure shall be limited to 3.0-bar.
	Principle 10	• The system shall be pressure tested in accordance with the prevailing Regulations and Standards and a permanent record of those tests made.
	Principle 11	• The system outlet temperatures shall be limited to 48ºC.
	Principle 12	• All documents pertaining to the design, installation and commissioning of the system shall be made permanent and retained.

Symbols used in this guide


Good practice


Bad practice


Discussion topic

Frequently asked question

Quality

PRINCIPLE 1

The systems shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.

This will be deemed satisfied if:

- The hot and cold-water services have been designed in accordance with the requirements set out in The Water Supply (Water Fittings) Regulations 1999, BS EN 806-2:2005 and BS 8558:2015.
- Pipework shall not be buried in-screed, but instead located in purpose made ducts or chases where the removal of covering is achievable for inspection.
- Joints shall be kept to an absolute minimum.
- Isolation and shut-off valves shall be readily identifiable on schematic plans and appropriately labelled.
- Manufacturer's instructions and guidance shall be adhered to.
- All pipework and fittings shall be thermally protected to the appropriate level.
- When commissioning, all services shall be appropriately tested and records made.
- A minimum commissioning period of not less than 8 hours is recommended that should be attended for its full duration.

PRINCIPLE 2

The designer, installer and commissioner shall be suitably qualified and experienced, belonging to a relevant professional body.

This will be deemed satisfied if:

- Qualifications and experience of designers, installers and commissioners is verified.
- Designers hold relevant qualifications and are members of an appropriate body. For example, The Chartered Institute of Plumbing and Heating Engineering ('CIPHE').
- Installers and commissioners hold relevant qualifications such as Level 3 NVQ and Advanced Craft Gold CSCS card. Also, members of an appropriate body, e.g. CIPHE.

PRINCIPLE 3

Only certified products shall be used to build the system.

This will be deemed satisfied if:

- Products comply with The Water Supply (Water Fittings) Regulations 1999 and BS EN 806-2 in terms of performance, corrosion resistance and life expectancy.
- Product procurement is auditable and suppliers and manufacturers are readily identifiable.

Response

PRINCIPLE 4

The design, installation and commissioning of the system shall be risk assessed.

This will be deemed satisfied if:

- Various sources of water services listed and an assessment of the likelihood of them causing a loss coupled with impact, both financial and project delay.
- List of risk controls to remove identified hazards or measures to minimise the risk.

PRINCIPLE 5

The system shall be designed to reduce the likelihood and consequence of an escape of water incident.

This will be deemed satisfied if:

- A detailed emergency response plan is in place with identified actions and confirmation that those expected to take action have authority to do so and have been provided with the necessary training.
- Automatic leak detection, alarming and isolation systems are used to good effect and do not impair the performance of other mechanical and electrical systems.

Performance

PRINCIPLE 6

The system shall be designed for ease of maintenance.

This will be deemed satisfied if:

- Pipework shall not be buried in-screed, but instead located in purpose made ducts or chases where the removal of covering is achievable for inspection.
- Isolation and shut-off valves shall be readily identifiable on schematic plans, appropriately labelled and accessible.
- Manufacturer's instructions and guidance shall be adhered to with particular regard to clearances and access for maintenance.

PRINCIPLE 7

Prior to commissioning, systems shall be isolated when competent personnel are not present on site to implement emergency response actions.

This will be deemed satisfied if:

- This risk assessment measure is stated in installation method statements.
- Unoccupancy shall be included in the risk assessment..
- A specific risk assessment is completed prior any system being left live when competent engineers are not on site.

PRINCIPLE 8

When in-service, it shall be possible to readily isolate the system, by means that are readily identifiable and accessible.

This will be deemed satisfied if:

- Isolation, shut-off and drain valves shall be readily identifiable on schematic plans and appropriately labelled and positioned for easy access.

PRINCIPLE 9

Domestic hot and cold water system pressures shall be limited to 3.0-bar.

This will be deemed satisfied if:

- The incoming supply to the property (house or apartment), or storey of a high rise building is limited to 3.0-bar via the installation of a pressure reducing valve.

NOTE: Fire suppression systems, specifically designed to operate at higher pressures are not subject to this principle.

PRINCIPLE 10

The system shall be pressure tested in accordance with the prevailing Regulations and Standards and a permanent record of those tests made.

This will be deemed satisfied if:

- The hot and cold-water services have been commissioned (e.g. pressure tested) in accordance with the requirements set out in The Water Supply (Water Fittings) Regulations 1999, BS EN 806-2:2005 and BS 8558:2015 and records made.
- Manufacturer's instructions and guidance concerning testing shall be adhered to and records made.

PRINCIPLE 11

The system outlet temperatures shall be limited to 48ºC.

This will be deemed satisfied if:

- Thermal mixing valves are installed and commissioned to confirm outlet temperatures.

PRINCIPLE 12

All documents pertaining to the design, installation and commissioning of the system shall be made permanent and retained.

This will be deemed satisfied if:

- An appropriate system is setup on project inception to retain all documents and communications generated throughout the project.
- As installed documentation is provided to the building manager.

Index to additional guidance incorporated into AD'G'

Para	Subject	Changes/Action
Introduction	Property Protection	Twelve essential principles to be achieved in the design, installation and commissioning of domestic and commercial plumbing systems.
General guidance	Work which is not notifiable	It is an insurer's essential requirement that any work that is undertaken is done so by suitably qualified and experienced person for that work.
General guidance	Materials and workmanship	Three essential principles to be achieved with respect to system design, installation and commissioning.
General guidance	Interaction with other legislation	Two additional pertinent Standards listed.
G.1	Cold water supply	Three essential principals for property protection.
G1(1/2) b (i)	Performance	The supply pressure shall be limited to 3.0-bar.
G1(1/2) c (i)	Performance	Requirements for system design, installation and testing.
G2	Water efficiency	Two considerations concerning leak detection.
G2	Performance	Leak detection.
G3	Hot water Supply and systems	An essential principle for consumer protection and three essential principles for property protection.
G3 - 3.65 (i)	Prevention of scalding	Outlet temperature limits.
G3 – 3.69 (i – v)	Installation	Various requirements
G6	Water-based Suppression systems	New section
G7	Renewable energy systems	New section
Appendix D	Roles and responsibilities	Additional appendix
Appendix E	Escape of water risk assessment	Additional appendix
Appendix F	Qualifications	Additional appendix
Appendix G	Methods, protection, automatic isolation devices and testing	Additional appendix
Appendix H	Lifting plant (sump pumps)	Additional appendix
Appendix I	Water-based fire suppression systems	Additional appendix

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MAIN CHANGES IN THE 2015 EDITION

This approved document supports Regulation 36 and Part G of Schedule 1 to the Building Regulations 2010. It takes effect on 1 October 2015 for use in England*. The 2010 edition, as amended, will continue to apply to work started before 1 October 2015 or work subject to a building notice, full plans application or initial notice submitted before that date.

The main changes are:

- Introduction of an optional requirement for tighter water efficiency in Regulation 36 (section G2).
- Introduction of a fittings approach as an alternative to using the water efficiency calculator (section G2).
- Inclusion of the water efficiency calculator methodology into this approved document, with minor alterations resulting from European efficiency labelling and consequential amendments resulting from removal of references to the Code for Sustainable Homes (Appendix A).
- The annex listing the relevant competent person self-certification schemes has been deleted.

CHANGE MADE BY THE 2016 AMENDMENTS

The change, made to section G2, requires the water efficiency calculator to be completed for new dwellings where a shower will not be provided.

* This approved document gives guidance for compliance with the Building Regulations for building work carried out in England. It also applies to building work carried out on excepted energy buildings in Wales as defined in the Welsh Ministers (Transfer of Functions) (No 2) Order 2009.

Contents

DIAGRAMS

TABLES

Introduction

What is an Approved Document?

This document has been approved and issued by the Secretary of State to provide practical guidance on ways of complying with Requirements G1 to G6 and regulations 7 and 36 of the Building Regulations 2010 (SI 2010/2214) for England and Wales, as amended. The Building Regulations 2010 are referred to throughout the remainder of this Document as 'the Building Regulations'. Where appropriate the Approved Document also gives guidance on relevant requirements in the Building (Approved Inspectors etc.) Regulations 2010 (SI 2010/2215).

The intention of issuing Approved Documents is to provide guidance about compliance with specific aspects of the Building Regulations in some of the more common building situations. They include examples of what, in ordinary circumstances, may be reasonable provision for compliance with the relevant requirement(s) of the Building Regulations to which they refer.

If guidance in an Approved Document is followed there will be a presumption of compliance with the requirement(s) covered by the guidance. However, this presumption is not conclusive, so simply following guidance does not guarantee compliance in an individual case. It is also important to note that there may well be other ways of achieving compliance with the requirements. There is therefore no obligation to adopt any particular solution contained in this Approved Document if you would prefer to meet the relevant requirement in some other way. However, persons intending to carry out building work should always check with their Building Control Body (BCB), either the local authority or an Approved Inspector, that their proposals comply with Building Regulations.

The guidance contained in this Approved Document relates only to the particular requirements of the Building Regulations that the document addresses (see 'Requirements' below). However, building work may be subject to more than one requirement of the Building Regulations. In such cases the work will also have to comply with any other applicable requirements of the Building Regulations.

This document is one of a series that has been approved and issued by the Secretary of State for the purpose of providing practical guidance with respect to the requirements of Schedule 1 and regulation 7 of the Building Regulations 2010 (SI 2010/2214) for England and Wales.

At the back of this document is a list of all the documents that have been approved and issued by the Secretary of State for this purpose.

Consideration of technical risk

In relation to the installation of new and replacement sanitation and hot water services, building work must satisfy all the technical requirements set out in Schedule 1 to the Building Regulations. Attention should be paid in particular to the need to comply with Part A (Structure), Part B (Fire safety), Part C (Site preparation and resistance to contaminants and moisture), Part J (Combustion appliances and fuel storage systems), Part L (Conservation of fuel and power) and Part P (Electrical safety), as well as Part G.

The insurer Essential Principles (EP) for the prevention and limitation of Escape of Water (EoW) and additional safety are:

EP1	The systems shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.
EP2	The designer, installer and commissioner shall be suitably qualified and experienced, belonging to a relevant professional body.
EP3	Only certified products shall be used to build the system.
EP4	The design, installation and commissioning of the system shall be risk assessed.
EP5	The system shall be designed to reduce the likelihood and consequence of an escape of water incident.
EP6	The system shall be designed for ease of maintenance.
EP7	During installation, the system shall be isolated when unoccupied.
EP8	When in-service, it shall be possible to readily isolate the system, by means that are readily identifiable.
EP9	The system pressure shall be limited to 3.0-bar.
EP10	The system shall be pressure tested in accordance with the prevailing Regulations and Standards and a permanent record of those tests made.
EP11	System outlet temperatures shall be limited to 48oC.
EP12	All documents pertaining to the design, installation and commissioning of the system shall be made permanent and retained.

How to use this Approved Document

In this document the following conventions have been adopted to assist understanding and interpretation:

a. Texts shown against a blue background are extracts from the Building Regulations or Building (Approved Inspectors etc.) Regulations, and set out the legal requirements that relate to compliance with the sanitation, hot water safety and water efficiency requirements of Building Regulations. It should be remembered however that, as noted above, building works must comply with all the other applicable provisions of Building Regulations.

b. Key terms are defined below and are printed in ***bold italic text***.

c. Details of technical publications referred to in the text of this document are repeated as references in Appendix C. A reference to a publication is likely to be made for one of two main reasons. The publication may contain additional or more comprehensive technical detail, which it would be impractical to include in full in this Document but which is needed to fully explain ways of meeting the requirements; or it is a source of more general information. The reason for the reference will be indicated in each case. The reference will be to a specified edition of the document. The Approved Document may be amended from time to time to include new references or to refer to revised editions where this aids compliance.

d. Insurer additions to the main body of AD'G' are show in white font on blue background (as this is).

e. Additional insurer requirements are shown in Appendices D, E and F.

Where you can get further help

If you do not understand the technical guidance or other information set out in this Approved Document and the additional detailed technical references to which it directs you, there are a number of routes through which you can seek further assistance:

- The Government website: www.gov.uk
- If you are the person undertaking the building work you can seek assistance either from your local authority building control service or from your approved inspector (depending on which building control service you are using, or intend to use, to certify compliance of your work with the requirements of the Building Regulations).
- Businesses registered with a competent person self-certification scheme may be able to get technical advice from their scheme operator.
- If your query is of a highly technical nature you may wish to seek the advice of a specialist, or industry technical body, in the area of concern.

Information and guidance pertaining to the insurer additions may be sought from the Fire Protection Association, who are responsible for the RISC Authority scheme at EoW@RISCAuthority.co.uk or admin@RISCAuthority.co.uk

Responsibility for compliance

It is important to remember that if you are the person (e.g. designer, builder, installer) carrying out building work to which any requirement of Building Regulations applies you have a responsibility to ensure that the work complies with any such requirement. The building owner may also have a responsibility for ensuring compliance with Building Regulation requirements and could be served with an enforcement notice in cases of non-compliance.

The requirements

This Approved Document deals with the sanitation, hot water safety and water efficiency requirements in the Building Regulations 2010.

Limitation on requirements

In accordance with regulation 8 of the Building Regulations, the requirements in Parts A to D, F to K and P (except for paragraphs G2, H2 and J7) of Schedule 1 to the Building Regulations do not require anything to be done except for the purpose of securing reasonable standards of health and safety for persons in or about buildings (and any others who may be affected by buildings or matters connected with buildings).

Paragraph G2 is excluded from regulation 8 as it deals with the conservation of water. Paragraphs H2 and J7 are excluded from regulation 8 because they deal directly with prevention of the contamination of water and of oil pollution. Parts E and M (which deal, respectively, with resistance to the passage of sound, and access to and use of buildings) are excluded from regulation 8 because they address the welfare and convenience of building users. Part L is excluded from regulation 8 because it addresses the conservation of fuel and power. All these matters are amongst the purposes, other than health and safety, that may be addressed by Building Regulations.

General guidance

Key terms

The following are key terms used in this document:

Note: Terms shown with * are defined in legislation, either in the Building Act 1984 or the Building Regulations 2010, where the definition may be fuller than the definition given here.

BCB means Building Control Body: a local authority or an Approved Inspector.

***Building** means any permanent or temporary building, but not any other kind of structure or erection, and a reference to a building includes a reference to part of a building. This includes dwellings (houses, flats) and public buildings.

Building work** includes the erection or extension of a ***building, the provision or extension of a ***controlled service or fitting*** in or in connection with a building, and the ***material alteration*** of a building, or a controlled service or fitting.

Combined temperature and *pressure relief valve* means a mechanically operated valve that opens to discharge water when a fixed (factory set) temperature or fixed (factory set) pressure is exceeded.

Controlled service or fitting includes a service or fitting subject to Schedule 1 requirements in respect of sanitation, hot water safety, water efficiency, drainage and waste disposal, combustion appliances and fuel storage, conservation of fuel or power, and electrical safety.

Direct heating means a method of heating in which the heat source is integral with the hot water vessel. Examples are an electrical immersion heater, or a gas burner with a flue arrangement that passes through the vessel so that the flue transfers heat to the stored water, or the circulation of water from a vessel situated near a burner with a flue arrangement so that the flue transfers heat to the circulating water.

Domestic hot water means water that has been heated for cooking, food preparation, personal washing or cleaning purposes. The term is used irrespective of the type of ***building*** in which the hot water system is installed.

***Earth-closet** means a closet having a movable receptacle for the reception of faecal matter and its deodorisation by the use of earth, ashes or chemicals, or by other methods. This will therefore include chemical and composting toilets.

Exempt *buildings* and work means the erection of any building or extension of a kind described in regulation 9 of and Schedule 2 to the Building Regulations 2010; or the carrying out of any work to or in connection with such a building or extension, if after the carrying out of that work it is still a building or extension of a kind described in that Schedule.

Expansion vessel means a vessel to temporarily accommodate the expansion of water from the unvented hot water storage vessel as it is heated.

Greywater is domestic wastewater excluding faecal matter and urine. When appropriately treated this may replace the use of ***wholesome water*** in ***WCs, urinals***, irrigation or washing machines.

Harvested rainwater means rainwater harvested from roofs or other suitable surfaces and collected and stored. When appropriately treated, this may replace the use of ***wholesome water*** in ***WCs, urinals***, irrigation or washing machines.

Heated *wholesome water* means water that, when cold, was wholesome in accordance with the definition below and has been subjected to a heat source to increase its temperature.

Hot water storage system means a vessel for storing:

a. heated **wholesome hot water** or **softened wholesome hot water** for subsequent use

b. water that is used to heat other water together with any ancillary safety devices described in paragraphs 3.10 and 3.11 of this Approved Document and all other applicable operating devices.

Hot water storage system package means a ***hot water storage system*** having the safety devices described in 3.10 and 3.17 of this Approved Document factory-fitted by the manufacturer, together with a kit containing other applicable devices supplied by the manufacturer to be fitted by the installer.

Hot water storage system unit means a ***hot water storage system*** having the safety devices described in 3.10 and 3.17 of this Approved Document and all other applicable operating devices factory-fitted by the manufacturer.

Indirect heating means a method of heating stored water through a heat exchanger.

Kitchen means a room or part of a room which contains a ***sink*** and food preparation facilities

Material alteration means an alteration which results in a ***building*** or a ***controlled service or fitting*** not complying with, or being more unsatisfactory than it was before in relation to Schedule 1 requirements in relation to structure, means of warning and escape, internal and external fire spread, fire service access and facilities, and access and use.

Non-self-resetting energy cut-out means a device that will interrupt the supply of heat to a hot water storage vessel when a fixed (factory set) temperature is exceeded. If this protective device is actuated it should only be possible to reset it manually.

Preparation of food means handling, making and cooking of food.

Pressure relief valve means a mechanically operated valve that opens to discharge water when a fixed (factory set) pressure is exceeded.

Primary thermal store means a store of heat energy that can be used to heat ***domestic hot water*** by means of a heat exchanger. The thermal store can be heated by a variety of heat sources. Primary hot water thermal stores can be either vented or unvented.

Risk assessment for the purposes of this document means the identification of the hazards associated with a process or activity combined with an assessment of the probability and consequences of each hazard.

***Room for residential purposes** means a room, or a suite of rooms, which is not a dwellinghouse or a flat and which is used by one or more persons to live and sleep in, and includes a room in a hostel, a hotel, a boarding house, a hall of residence or a residential home, but does not include a room in a hospital, or other similar establishment, used for patient accommodation.

Sanitary accommodation means a room containing a ***WC*** or ***urinal***, whether or not it also contains other ***sanitary appliances***. Sanitary accommodation containing one or more cubicles counts as a single space if there is free circulation of air throughout the space.

Sanitary appliance means ***WC, urinal***, bath, shower, washbasin, ***sink***, bidet and drinking fountain. It also includes appliances that are not connected to a water supply (e.g. composting toilet) or drain (e.g. waterless ***urinal***).

Sanitary convenience** means closets and ***urinals.

Sink means a receptacle used for holding water (for ***preparation of food*** or washing up) supplied through a tap and having a wastepipe.

***Softened wholesome water** means water which would be regarded as wholesome for the purposes of regulations made under section 67 of the Water Industry Act 1991 (standards of wholesomeness) as they apply for the purposes of Part G of Schedule 1 in accordance with paragraph (2c) but for the presence of sodium in excess of the level specified in those regulations if it is caused by a water softener or water softening process which reduces the concentrations of calcium and magnesium.

Tundish means a device, installed in the discharge pipe from a valve, that provides an air break allowing discharge to be conducted safely to a place of termination. The tundish also provides a visible indication of a discharge and functions as backflow prevention device.

Temperature relief valve means a mechanically operated valve that opens to discharge water when a fixed (factory set) temperature is exceeded.

Unvented (closed) *hot water storage system* means a vessel fed with cold water from a supply pipe or dedicated storage cistern (without a vent pipe) and in which water is heated directly or indirectly. Expansion of the water when it is heated is accommodated either internally or externally and the system is fitted with safety devices to prevent water temperatures exceeding 100°C, and other applicable operating devices to control primary flow, prevent backflow, control working pressure and accommodate expansion.

Urinal means an appliance used for reception and disposal of urine.

Vented (open) *hot water storage system* means a vessel fed with cold water from a dedicated storage cistern. Expansion of the water when it is heated is accommodated through the cold feed pipe. A vent pipe connecting the top of the vessel to a point open to the atmosphere above the cold water storage cistern is provided as a safety device.

Water-closet *(WC) means a closet that has a separate fixed receptacle connected to a drainage system and separate provision for flushing from a supply of clean water either by the operation of a mechanism or by automatic action. Water-closets are also referred to as WCs.

Wholesome water means water complying with the requirements of regulations made under Section 67 (Standards of wholesomeness) of the Water Industry Act 1991. The regulations made under this Section at the time of publication of this Approved Document are for England the Private Water Supplies Regulations 2009 (SI 2009/3101), for Wales the Private Water Supplies (Wales) Regulations (SI 2010/66) and, for England, the Water Supply (Water Quality) Regulations 2000 (SI 2000/3184 as amended), and, for Wales, the Water Supply (Water Quality) Regulations 2001 (SI 2001/3911 as amended).

Types of work covered by this Approved Document

Building work

Building work, as defined in regulation 3 of the Building Regulations 2010, includes the erection and extension of a building, the provision or extension of a controlled service or fitting, and the material alteration of a building or a controlled service or fitting. In addition, Building Regulations may apply in cases where the purposes for which or the manner or circumstances in which a building or part of a building is used change in a way that constitutes a material change of use.

Under regulation 4 of the Building Regulations 2010, building work should be carried out in such a way that, on completion of work,

i. the building complies with the applicable Parts of Schedule 1 of the Building Regulations,

ii. in the case of an extension or material alteration of a building, or the provision, extension or material alteration of a controlled service or fitting, where it did not comply with any such requirement, it is no more unsatisfactory in relation to that requirement than before the work was carried out.

Work described in Part G concerns the provision or extension of controlled services or fittings. Work associated with installations covered in these sections may be subject to other relevant Parts of the Building Regulations.

Material change of use

A material change of use occurs in specified circumstances in which a building or part of a building that was previously used for one purpose will be used in future for another. Where there is a material change of use the Building Regulations set requirements that must be met before the building can be used for its new purpose.

Regulation 5 of the Building Regulations specifies the following circumstances as material changes of use:

- a building is used as a dwelling where previously it was not
- a building contains a flat where previously it did not
- a building is used as an hotel or boarding house where previously it was not.
- a building is used as an institution where previously it was not
- a building is used as a public building where previously it was not
- a building no longer comes within the exemptions in Schedule 2 to the Building Regulations where previously it did
- a building which contains at least one dwelling contains a greater or lesser number of dwellings than it did previously
- a building contains a room for residential purposes where previously it did not
- a building which contains at least one room for residential purposes contains a greater or lesser number of such rooms than it did previously
- a building is used as a shop where previously it was not

Parts G1, G3(1) to (3) and G4 to G6 will apply to all the material changes of use mentioned above. This means that whenever such changes occur the building must be brought up to the standards required by Parts G1 and G3 to G6.

Parts G2, G3(4) and regulation 36 will apply only to material changes of use where a building is used as a dwelling where previously it was not and where a building contains a flat where previously it did not.

Historic buildings

The types of building work covered by this Approved Document may include work on historic buildings. Historic buildings include:

a. listed buildings

b. buildings situated in designated conservation areas

c. buildings which are of architectural or historic interest and which are referred to as a material consideration in a local authority's development plan

d. buildings of architectural and historical interest within national parks, areas of outstanding or natural beauty and world heritage sites.

Special considerations may apply if the building on which the work is to be carried out has special historic or architectural value, and compliance with the sanitation or hot water safety requirements would unacceptably alter the character or appearance of the building or parts of it.

When undertaking work on or in connection with buildings with special historic or architectural value, the aim should be to improve sanitation and hot water safety where and to the extent that it is possible provided that the work does not prejudice the character of the host building or increase the risk of long-term deterioration to the building's fabric or fittings.

In arriving at a balance between historic building conservation and sanitation or hot water safety requirements, it would be appropriate to take into account the advice of the local authority's conservation officer before work begins. Guidance is also available in the English Heritage publication Building Regulations and Historic Buildings, 2002 (revised 2004), which is available at www.english-heritage.org.uk.

Note: Any building in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979 is exempt from all Building Regulations requirements including those in Part G.

Notification of work

In almost all cases of new building work it will be necessary to notify a BCB in advance of any work starting. There are two exceptions to this: where work is carried out under a selfcertification scheme listed in Schedule 3, and where work is listed in Schedule 4 to the Building Regulations as being not notifiable.

Competent person self-certification schemes under Schedule 3

Under regulation 12(6) of the Building Regulations it is not necessary to notify a BCB in advance of work which is covered by this Approved Document if that work is of a type set out in column 1 of Schedule 3 to the Regulations and is carried out by a person registered with a relevant self-certification (competent persons) scheme as set out in column 2 of that Schedule. In order to join such a scheme a person must demonstrate competence to carry out the type of work the scheme covers, and also the ability to comply with all relevant requirements in the Building Regulations. Details of current schemes including those relating to sanitation, hot water safety and water efficiency can be found at www.gov.uk. These schemes may change from time to time, or schemes may change name, or new schemes may be authorised; so the current list on the website should always be consulted. Full details of the schemes can be found on the individual scheme websites.

Where work is carried out by a person registered with a competent person scheme, regulation 20 of the Building Regulations and regulation 20(1) of the Building (Approved Inspectors etc.) Regulations 2010 require that the occupier of the building be given, within 30 days of the completion of the work, a certificate confirming that the work complies with all applicable Building Regulation requirements. There is also a requirement that the BCB be given a notice that this has been done, or a copy of the certificate, again within 30 days of the completion of the work. These certificates and notices are usually made available through the scheme operator.

BCBs are authorised to accept these certificates as evidence of compliance with the requirements of the Building Regulations. However, local authority inspection and enforcement powers remain unaffected, although they are normally used only in response to a complaint that work does not comply.

Work which is not notifiable under Schedule 4

Schedule 4 to the Building Regulations sets out types of work where there is no requirement to notify a BCB that work is to be carried out. These types of work are mainly of a minor nature where there is no significant risk to health, safety, water efficiency or energy efficiency. Health, safety, water efficiency and energy efficiency requirements continue to apply to these types of work; only the need to notify a BCB has been removed.

Where only non-notifiable work as set out in Schedule 4 is carried out, there is no requirement for a certificate confirming that the work complies with Building Regulation requirements to be given to the occupier or the BCB.

The types of non-notifiable work in Schedule 4 relevant to the sanitation, hot water safety and water efficiency provisions of the Regulations are:

i. in an existing hot water system, the replacement of any part which is not a combustion appliance, or the addition of an output device or control device. The work will however remain notifiable where commissioning is possible, and will affect the reasonable use of fuel and power. This is most likely to be where water heaters are being provided

ii. the installation of a stand-alone, self-contained fixed hot water appliance. This is restricted to a single appliance and any associated controls and must not be connected to, or form part of, any other fixed building service. However, if any of the following apply, the work will remain notifiable building work:
   - the service is a combustion appliance
   - any electrical work associated with the installation is notifiable
   - commissioning is possible and would affect the service's energy efficiency, such as that of water heaters

iii. the replacement of a sanitary convenience with one that uses no more water than the one it replaces, a washbasin, sink, bidet, fixed bath, or a shower but only where the work does not include any work to:
   - underground drainage
   - the hot or cold water system or aboveground drainage which could prejudice the health and safety of any person on completion of work

iv. replacing any part or adding an output or control device to an existing cold water supply

v. providing a hot water storage system that has a storage vessel with a capacity not exceeding 15 litres provided that any electrical work associated with the installation is also not notifiable.

Schedule 4 also sets out what types of electrical installation work in dwellings is non-notifiable. Full information on this is given in Approved Document P.

Insurer Essential Principle 2 -

Any work that is undertaken is done so by suitably qualified and experienced persons for that specific work. Suitable qualifications include plumbing studies to NVQ Level 3 to unvented hot water storage systems. Qualifications shall be current, and copies of certificates held on file to demonstrate competence. Where persons are not suitably qualified or experienced, their works shall be supervised, checked and permanent records made and retained.

Exemptions

Schedule 2 to the Building Regulations sets out a number of classes of buildings which are exempt from all Building Regulations requirements. However, the exemption has been removed in respect of some requirements of Part G where hot or cold water supply systems are shared with other buildings. This is to help ensure that the whole hot or cold water system is safe.
In particular:

i. the requirements of Parts G 1, G3(2) and G3(3) will apply to any greenhouse which receives a hot or cold water supply from a source shared with or located inside a dwelling

ii. the requirements of Parts G1, G3(2) and G3(3) will apply to any small detached building falling within Class 6 of Schedule 2 and any extension falling within Class 7 of Schedule 2 (which includes conservatories under 30m² in area) which receives a hot or cold water supply shared with or located inside any building that is subject to the Regulations.

Please note that the Regulations do not require the provision of hot or cold water systems to such exempt buildings, but if such systems are provided they must meet the minimum hygiene and safety requirements in those Parts.

All other Classes of buildings within Schedule 2 retain their exemption from compliance with Part G.

Materials and workmanship

Any building work which is subject to the requirements imposed by Schedule 1 to the Building Regulations shall be carried out in accordance with regulation 7. Guidance on meeting these requirements on materials and workmanship is contained in Approved Document 7.

Building Regulations are made for specific purposes, primarily the health and safety, welfare and convenience of people and for energy conservation. Standards and other technical specifications may provide relevant guidance to the extent that they relate to these considerations. However, they may also address other aspects of performance or matters which, although they relate to health and safety etc., are not covered by the Building Regulations.

When an Approved Document makes reference to a named standard, the relevant version of the standard to which it refers is the one listed at the end of the publication. However, if this version has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided it continues to address the relevant requirements of the Regulations.

Insurer Essential Principle 1 -

The system shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.

Insurer Essential Principle 3 -

Only certified products shall be used. Where applicable, manufacturers' installation guidance shall be followed. Some manufacturers' offer free technical training on the installation and use of their products. Insurers' expect due consideration to be given to undertaking such courses. It is also an essential principle that permanent records be made and retained.

Supplementary guidance

The Department for Communities and Local Government occasionally issues additional material to aid interpretation of the guidance in Approved Documents. This material may be conveyed in official letters to chief executives of local authorities and Approved Inspectors and/or posted on the websites accessed through: www.gov.uk.

Interaction with other legislation

This Approved Document makes reference to other legislation, including those listed below, that may also need to be considered.

Note: All statutory instruments can be accessed at www.legislation.gov.uk.

The Water Supply (Water Quality) Regulations 2000 (SI 2000/3184 as amended), and in Wales **the Water Supply (Water Quality) Regulations 2001** (SI 2001/3911 as amended) are made under the Water Industry Act 1991 and apply to the supply of water by a statutory water undertaker or a licensed water supplier. They make provision for the wholesomeness of water supplied for such domestic purposes as consist in or include cooking, drinking, food preparation or washing; or to premises in which food is produced.

The Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended) are made under the Water Industry Act 1991 and apply to any water fitting installed or used, or to be installed or used, in premises to which water is or is to be supplied by a water undertaker. They make provision for preventing contamination, waste, misuse, undue consumption and erroneous measurement of water supplied by a statutory water undertaker or licensed water supplier.

The Private Water Supplies Regulations 2009 (SI 2009/3101) in England and **The Private Water Supplies (Wales) Regulations 2010** (SI 2010/66) in Wales are made under the Water Industry Act 1991 and section 2(2) of the European Communications Act 1972 and are concerned with the quality of water supplied from private supplies for drinking, washing or cooking or for food preparation purposes.

The Workplace (Health, Safety and Welfare) Regulations 1992 (SI 1992/3004 as amended) are made under the Health and Safety at Work etc. Act 1974 and apply to any workplace or part of a workplace. They apply to the common parts of flats and similar **buildings** if people such as cleaners, wardens and caretakers are employed to work in these common parts. They make provision for, amongst other matters, space requirements, cleaning and provision of **sanitary conveniences**.

Food Hygiene (England) Regulations 2006 (SI 2006/14 as amended) and **the Food Hygiene (Wales) Regulations 2006** (SI 2006/31 W5 as amended) are made under European Communities Act 1972 and apply to measures relating to food (including drink) including the primary production of food. The provision of washbasins and sinks is relevant to Approved Document G.

Gas Safety (Installation and Use) Regulations (SI 1998/2451) extend to all dangers arising from the transmission, distribution, supply or use of gas conveyed from a gas storage vessel. The installation of gas heated water systems is relevant to Approved Document G.

BS EN 806 Specification for installations inside buildings conveying water for human consumption specifies requirements and gives recommendation for the design, installation, alteration, testing, operation and maintenance of potable water installations within buildings.

BS EN 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806.

G1 COLD WATER SUPPLY

The Requirement

This Approved Document deals with the following Requirement from Part G of Schedule 1 to the Building Regulations 2010.

REQUIREMENT	*LIMITS ON APPLICATION*
Cold water supply G1. (1) There must be a suitable installation for the provision of: (a) wholesome water to any place where drinking water is drawn off; (b) wholesome water or softened wholesome water to any washbasin or bidet provided in or adjacent to a room containing a sanitary convenience; (c) wholesome water or softened wholesome water to any washbasin, bidet, fixed bath or shower in a bathroom; and (d) wholesome water to any sink provided in any area where food is prepared. (2) There must be a suitable installation for the provision of water of suitable quality to any sanitary convenience fitted with a flushing device.	

Insurer's Essential Principles

The relevant essential principles for property protection are:

EP1 The systems shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.

EP9 The system pressure shall be limited to 3.0-bar to reduce the risk of a water fitting failing.

EP10 The system shall be pressure tested in accordance with the prevailing Regulations and Standards and a permanent record of those tests made to reduce the risk of an escape of water incident occurring.

Guidance

Performance

In the Secretary of State's view Requirement G1(1) will be met if:

a. the water supplied is wholesome;

b. the pressure and flow rate is sufficient for the operation of ***sanitary appliances*** planned in the ***building***;

EP9 - The supply pressure shall be limited to 3.0-bar. This can be achieved by the installation of a pressure reducing valve on the incoming supply or supply to the storey of high rise buildings

c. the supply is reliable; and

EP1 - Shall be designed, installed and tested in accordance with The Water Supply (Water Fittings) Regulations 1999 and BS EN 806.

d. the installation conveys ***wholesome water*** or ***softened wholesome water*** to the sanitary appliances and locations specified in the Requirement without waste, misuse, undue consumption or contamination of water.

The water will be wholesome if it is provided:

a. by a statutory water undertaker or a licensed water supplier; or

b. by a source complying with the Private Water Supplies Regulations 2009 (SI 2009/3101) in England or the Private Water Supplies (Wales) Regulations (SI 2010/66) in Wales.

In the Secretary of State's view Requirement G1(2) will be met if:

a. the water supplied is either wholesome, softened wholesome or of suitable quality having regard to the risks to health;

b. the pressure and flow rate is sufficient for the operation of the ***sanitary appliances***;

EP9 - The supply pressure shall be limited to 3.0-bar. This can be achieved by the installation of a pressure reducing valve on the incoming supply or supply to the storey of high rise buildings

c. the supply is reliable; and

EP1 - Shall be designed, installed and tested in accordance with The Water Supply (Water Fittings) Regulations 1999 and BS EN 806.

d. the installation conveys water to ***sanitary appliances*** and locations specified in the Requirement without waste, misuse, undue consumption or contamination of ***wholesome water.***

Wholesome water

1.1 Water supplied to the ***building*** by a statutory water undertaker or a licensed water supplier through an installation complying with the requirements of the Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended) may be assumed to be ***wholesome water***. The requirements in the appropriate water quality regulations are set out for ease of reference in Appendix B to this Approved Document.

1.2 Attention is drawn to the requirements of the Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended) which make provision for preventing contamination, waste, misuse, undue consumption and erroneous measurement of water supplied by a water undertaker or licensed water supplier.

1.3 Where a ***building*** is supplied with water from a source other than a water undertaker or licensed water supplier, the water shall be considered to be wholesome if it meets the criteria set out in the Private Water Supplies Regulations 2009 (SI 2009/3101) in England or the Private Water Supplies (Wales) Regulations (SI 2010/66) in Wales. The requirements in those regulations are set out for ease of reference in Appendix B to this Approved Document.

Softened wholesome water

1.4 Wholesome water which has been treated by a water softener or a water softening processes to adjust the content of hardness minerals may have raised levels of sodium. Where the water, after this treatment, still complies with the requirements for wholesome water it is still considered to be wholesome water.

1.5 However, where it complies with all requirements for wholesome water other than its sodium content, it will be considered to be wholesome softened water. Whilst wholesome softened water may be considered suitable for most purposes it should not be provided in place of wholesome water to any place where drinking water is drawn off or to any sink provided in an area where food is prepared.

Alternative sources of water

1.6 Water treated to the high standards of wholesome water is not essential for all of the uses that water is put to in and about ***buildings***, e.g. toilet flushing, irrigation. A variety of alternative sources are available for water. These include:

a. water abstracted from wells, springs, boreholes or water courses;

b. ***harvested rainwater***;

c. reclaimed ***greywater***; and

d. reclaimed industrial process water.

1.7 The design of treatment systems for water from alternative sources should incorporate measures to minimise the impact on water quality of:

a. failure of any components;

b. failure to undertake any necessary maintenance;

c. power failure where appropriate; and

d. any other measures identified in a risk assessment.

1.8 Guidance on the marking of pipework conveying water from alternative sources can be found in the WRAS Information & Guidance Note No. 9-02-05 Marking and identification of pipework for reclaimed (greywater) systems and in BS 8515:2009 *Rainwater harvesting systems – Code of Practice*.

1.9 Guidance on installing, modifying and maintaining reclaimed water systems can be found in the WRAS Information and Guidance Note No. 9-02-04 *Reclaimed water systems* and in BS 8515:2009 *Rainwater harvesting systems. Code of practice.*

1.10 Information on the technical and economic feasibility of rainwater and ***greywater*** can found in MTP (2007) *Rainwater and greywater: technical and economic feasibility.*

1.11 Information on the specification of rainwater and ***greywater*** systems can be found in MTP (2007) *Rainwater and greywater: a guide for specifiers.*

1.12 Guidelines for rainwater and ***greywater*** systems, in relation to water quality standards, can be found in MTP (2007) *Rainwater and greywater: review of water quality standards alternative and recommendations for the UK.*

1.13 Water from alternative sources may be used in dwellings for ***sanitary conveniences***, washing machines and irrigation, provided the appropriate risk assessment has been carried out. A ***risk assessment*** should ensure that the supply is appropriate to the situation in respect of the source of the water and the treatment of it, and not likely to cause waste, misuse, undue consumption or contamination of ***wholesome water***.

1.14 Any system/unit used to supply dwellings with water from alternative sources should be subject to a risk assessment by the system designer and manufacturer, and appropriate testing carried out to demonstrate that any risks have been suitably addressed. A risk assessment should include consideration of the effect on water quality of system failure and failure to carry out necessary maintenance.

RISCAuthority

G2 Water Efficiency

The Requirement

This Approved Document deals with the following Requirement from Part G of Schedule 1 and regulation 36 to the Building Regulations 2010, as amended.

Requirement	*Limits on application*
Water efficiency G2. Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention of undue consumption of water. **Water efficiency of new dwellings** 36 (1) The potential consumption of wholesome water by persons occupying a new dwelling must not exceed the requirement in paragraph (2). (2) The requirement referred to in paragraph (1) is either (a) 125 litres per person per day; or (b) in a case to which paragraph (3) applies, the optional requirement of 110 litres per person per day, as measured in either case in accordance with a methodology approved by the Secretary of State. (3) This paragraph applies where the planning permission under which the building work is carried out (a) specifies the optional requirement in paragraph (2)(b); and (b) makes it a condition that that requirement must be complied with. (4) In this Part, "new dwelling" does not include a dwelling that is formed by a material change of use of a building within the meaning of regulation 5(g). **Wholesome water consumption calculation** 37 (1) Where regulation 36 applies, the person carrying out the work must give the local authority a notice which specifies (a) which of the requirements in regulation 36(2) (a) or (b) applies to the dwelling; and (b) the potential consumption of wholesome water per person per day in relation to the completed dwelling. **Building (Approved Inspectors) Regulations 2010** **Application of Provisions of the Principal Regulations** 20 (1) Regulation 20 (provisions applicable to selfcertification schemes), 27 (CO emission rate calculations), 29 (energy performance certificates), 37 (wholesome water consumption calculation), 41 (sound insulation testing), 42 (mechanical ventilation air flow rate testing), 43 (pressure testing) and 44 (commissioning) of the Principal Regulations apply in relation to building work which is the subject of an initial notice as if references to the local authority were references to the approved inspector. (4) Regulation 37(2) of the Principal Regulations applies in relation to building work which is the subject of an initial notice as if after "work has been completed" there were inserted, "or, if earlier the date on which in accordance with regulation 17 of the Building (Approved Inspectors etc.) Regulations 2010 the initial notice ceases to be in force".	Requirement G2 applies only when a dwelling is (a) erected; or (b) formed by a material change of use of a building within the meaning of regulation 5(a) or (b).

EP5 and EP8 - Insurer's Considerations

Consideration should be given to the installation of devices that can:

- Detect a leak or an escape of water incident and alert the consumer.
- Autonomously isolate the incoming water supply and thus limit the amount of water lost.

Guidance

Performance

In the Secretary of State's view Requirement G2 will be met for new dwellings if:

a. the estimated consumption of wholesome water resulting from the design of cold and hot water systems (calculated in accordance with the methodology set out in Appendix A to this approved document and taking into account the use of any alternative sources of water provided in accordance with G1(2)) is not greater than the standard set by the Secretary of State of 125 litres/person/day of ***wholesome water*** or 110 litres/person/day where the optional requirement applies;

b. the manner in which ***sanitary appliances*** and white goods used in the design calculation undertaken to demonstrate compliance with paragraph (a) are provided and installed in the dwelling takes account of the other provisions in this approved document;

c. the manner in which any alternative sources of water used in the design calculation undertaken to demonstrate compliance with paragraph (a) are supplied to the dwelling, takes account of other provisions in this approved document;

d. a record of the ***sanitary appliances*** and white goods used in the water consumption calculation and installed in the dwelling is provided along with sufficient other information enabling ***building*** owners or occupiers to maintain the ***building*** and its services so as to maintain the water efficiency of the ***building***. In this context, relevant white goods are washing machines and dishwashers;

e. a record of the alternative sources of water used in the water consumption calculation and supplied to the dwelling is provided along with sufficient other information enabling ***building*** owners or occupiers to maintain the ***building*** and its services so as to maintain the water efficiency of the ***building***.

Where a ***building*** consists of more than one dwelling (such as a block of flats) it should be designed so that the estimated consumption of wholesome water resulting from the design of the cold and hot water systems for each individual dwelling should be no greater than the target.

EP5 - There are devices that can learn consumer behaviors and thus detect a leak or an escape of water incident. In some instances, they can isolate the incoming supply. Consideration should be given to the installation of such devices, especially in apartment blocks where escapes of water can cause extensive damage. However, the installation of any device shall not impede the operation of any fire suppression system that relies on the incoming supply.

General

2.1 The water used by ***sanitary appliances*** and relevant white goods in a new dwelling should be calculated using the manufacturer's declared value for water consumption of each of those appliances and white goods.

2.2 The estimated water consumption of a new dwelling should be calculated in accordance with the methodology set out in Appendix A, referred to as the water efficiency calculator.

2.3 The estimated consumption of ***wholesome water*** of a new dwelling should be no more than 125 litres/person/day or 110 litres/person/day where the optional requirement applies. This includes a fixed factor of water for outdoor use of 5 litres/person/day.

2.4 Where alternative sources of water are to be used in the dwelling design, this should be reflected in the estimate of water use.

Fittings approach

2.5 As an alternative to calculating the water consumption (as paragraph 2.2), a fittings approach that is based on the water efficiency calculator methodology may be used.

2.6 Where the fittings approach is used, the water consumption of the fittings provided must not exceed the values in Table 2.1. If they do, the water efficiency calculator must be completed to demonstrate compliance. Similarly, where a shower is not to be provided or where a waste disposal unit, a water softener or water re-use is to be provided the water efficiency calculator must be completed.

Table 2.1 **Maximum fittings consumption**

Water fitting	Maximum consumption
WC	6/4 litres dual flush or 4.5 litres single flush
Shower	10 l/min
Bath	185 litres
Basin taps	6 l/min
Sink taps	8 l/min
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram

2.7 Where the fittings approach is used, the notice given under regulation 37 should state "Less than 125 litres/person/day using fittings approach".

Optional requirement

2.8 The optional requirement only applies where a condition that the dwelling should meet the optional requirement is imposed as part of the process of granting planning permission. Where it applies, the estimated consumption of wholesome water calculated in accordance with the methodology in the water efficiency calculator, should not exceed 110 litres/person/day.

2.9 The person carrying out the work must inform the ***BCB*** where the optional requirement applies.

2.10 As an alternative to calculating the water consumption (as paragraph 2.8), a fittings approach that is based on the water efficiency calculator methodology may be used.

2.11 Where the fittings approach is used, the water consumption of the fittings provided must not exceed the values in Table 2.2. If they do, the water efficiency calculator must be completed to demonstrate compliance. Similarly, where a shower is not to be provided or where a waste disposal unit, a water softener or water re-use is to be provided the water efficiency calculator must be completed.

2.12 Where the fittings approach is used, the notice given under regulation 37 should state "Less than 110 litres/person/day using fittings approach".

Table 2.2 **Maximum fittings consumption optional requirement level**

Water fitting	Maximum consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin taps	5 l/min
Sink taps	6 l/min
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram

Notification of water efficiency calculation to the BCB

2.13 Where regulation 36 applies, regulation 37 of the Building Regulations and regulation 20(1) and (4) of the Building (Approved Inspectors etc.) Regulations require that a notice specifying the calculated potential consumption of **wholesome water** per person per day relating to the dwelling as constructed be given to the appropriate **BCB**.

2.14 In most cases, this notice must be given to the **BCB** no later than five days after the completion of the **building work**. However, where the **BCB** is an Approved Inspector and the dwelling is occupied before completion, the notice must be given no later than the day that the initial notice ceases to be in force in consequence of regulation 18 of the Building (Approved Inspectors etc) Regulations when this is earlier than five days after the completion of the work.

2.15 It is permissible for the notice to be served on the **BCB** electronically provided the **BCB** has stated its willingness to receive the document by those means and it is delivered to the electronic address that the body has specified.

2.16 Local authorities are unlikely to be able to give a completion certificate for the building until the notice required under regulation 37 of the Building Regulations has been received. Approved Inspectors are unlikely to be able to give a final certificate until the equivalent notice under regulation 20(1) and (4) of the Building (Approved Inspectors etc.) Regulations has been received.

G3 Hot water supply and systems

The requirement

This Approved Document deals with the following Requirement from Part G of Schedule 1 to the Building Regulations 2010.

Requirement	*Limits on application*
G3.	
(1) There must be a suitable installation for the provision of heated wholesome water or heated softened wholesome water to: (a) any washbasin or bidet provided in or adjacent to a room containing a sanitary convenience; (b) any washbasin, bidet, fixed bath and shower in a bathroom; and (c) any sink provided in any area where food is prepared.	
(2) A hot water system, including any cistern or other vessel that supplies water to or receives expansion water from a hot water system, shall be designed, constructed and installed so as to resist the effects of temperature and pressure that may occur either in normal use or in the event of such malfunctions as may reasonably be anticipated, and must be adequately supported.	
(3) A hot water system that has a hot water storage vessel shall incorporate precautions to: (a) prevent the temperature of the water stored in the vessel at any time exceeding 100°C; and (b) ensure that any discharge from safety devices is safely conveyed to where it is visible but will not cause a danger to persons in or about the building.	Requirement G3(3) does not apply to a system which heats or stores water for the purposes only of an industrial process.
(4) The hot water supply to any fixed bath must be so designed and installed as to incorporate measures to ensure that the temperature of the water that can be delivered to that bath does not exceed 48°C.	Requirement G3(4) applies only when a dwelling is (a) erected; (b) formed by a material change of use within the meaning of regulation 5(a) or (b).

Insurer's Essential Principles

The relevant essential principles for consumer protection are:

EP11 - The system outlet temperatures shall be limited to 48°C.

The relevant essential principles for property protection are:

EP1 - The systems shall be designed, installed and commissioned in accordance with the prevailing Regulations and Standards.

EP9 - The system pressure shall be limited to 3.0-bar. to reduce the risk of a water fitting failing.

EP10 - The system shall be pressure tested in accordance with the prevailing Regulations and Standards and a permanent record of those tests made.

Guidance

Performance

In the Secretary of State's view Requirement G3(1) will be met if:

a. the installation conveys hot water to the sanitary appliances and locations specified in the requirement without waste, misuse or undue consumption of water; and

b. the water supplied is ***heated wholesome water*** or heated softened water.

In the Secretary of State's view Requirement G3(2) will be met if all components of the hot water system including any cistern that supplies water to, or receives expansion water from the hot water system continues to safely contain the hot water:

a. during normal operation of the hot water system;

b. following failure of any thermostat used to control temperature; and

c. during operation of any of the safety devices fitted in accordance with paragraph G3(3).

In the Secretary of State's view Requirement G3(3) will be met for a ***hot water storage system*** that has a vented storage vessel if:

a. the storage vessel has a suitable vent pipe connecting the top of the vessel to a point open to the atmosphere above the level of the water in the cold water storage cistern and over it; and,

b. in addition to any thermostat, either the heat source, or the storage vessel is fitted with a device that will prevent the temperature of the stored water at any time exceeding 100°C; and

c. the hot water system has pipework that incorporates a provision for the discharge of hot water from the safety devices to an appropriate place open to the atmosphere where it will cause no danger to persons in or about the ***building***.

In the Secretary of State's view Requirement G3(3) will be met for a hot water system that has an unvented storage vessel if:

a. the storage vessel has at least two independent safety devices such as those that release pressure and so prevent the temperature of the stored water at any time exceeding 100°C in addition to any thermostat; and

b. the hot water system has pipework that incorporates a provision for the discharge of hot water from safety devices to be visible at some point and safely conveys it to an appropriate place open to the atmosphere where it will cause no danger to persons in or about the ***building***.

In the Secretary of State's view Requirement G3(4) will be met if:

the hot water outlet temperature is appropriate for the appliance being served, and any device to limit the maximum temperature that can be supplied at the outlet can not be easily altered by ***building*** users.

General

3.1 The delivered hot water can be considered as ***heated wholesome water*** or heated softened wholesome water where:

a. the cold water supply to the hot water system is wholesome or softened wholesome; and

b. the installation complies with the requirements of the Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended).

3.2 The Water Supply (Water Fittings) Regulations make provision for preventing contamination, waste, misuse, undue consumption and erroneous measurement of water supplied by a water undertaker or licensed water supplier. Guidance on the application of the Water Supply (Water Fittings) Regulations can be found in the Water Regulations Guide published by the Water Regulations Advisory Scheme.

3.3 Attention is also drawn to the requirements of the Gas Safety (Installation and Use) Regulations 1994 (SI 1994/1886) for all gas installation work.

3.4 Electrical work associated with hot water systems should be carried out in accordance with BS7671:2008 *Requirements for electrical installations (IEE Wiring Regulations 17th Edition)* *(Now superceded by 18th edition)*

3.5 For installations in dwellings and associated ***buildings***, attention is drawn to Building Regulations 2010 Schedule 1 Part P (Electrical safety – Dwellings) and to Approved Document P.

3.6 For workplaces and premises controlled in connection with a trade, business or other undertaking, attention is also drawn to the HSC publication *Legionnaires' Disease: Control of Legionella Bacteria in Water Systems. Approved code of practice and guidance*. L8, Health and Safety Commission 2000. ISBN 0 7176 1772 6. *(Now superceded by 4th edition)*

3.7 Pipework should be designed and installed in such a way as to minimise the transfer time between the **hot water storage system** and hot water outlets.

3.8 The safety requirements for hot water systems used solely for supplying water for industrial processes is contained in the Pressure Systems Safety Regulations 2000 (SI 2000/128) and further guidance is available in *Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice* L122 HSE Books 2000. ISBN 0 7176 1767 X.

Provision of hot water supply

3.9 The Requirement G3 only requires the provision of a hot water supply to:

a. any washbasin provided in association with a sanitary convenience in accordance with G4(2);

b. any washbasin, bidet, fixed bath or shower in a bathroom in a dwelling or provided for rooms for residential purposes, provided in accordance with G5;

c. any sink in a food preparation area, provided in accordance with G6.

There is no requirement under the Building Regulations to provide hot water to other washing facilities, but there may be such requirements under other legislation (see paragraphs 4.3, 4.4 and 6.4).

Design and installation of directly or indirectly heated hot water storage systems

General

3.10 Hot water storage systems should be designed and installed in accordance with BS 6700:2006 + A1:2009 Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages or BS EN 12897:2006 Water supply. Specification for indirectly heated unvented (closed) storage water heaters.

3.11 Hot water storage vessels should conform to BS 853-1:1996 Specification for vessels for use in heating systems. Calorifiers and storage vessels for central heating and hot water supply, BS 1566- 1:2002 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods, or BS 3198:1981 Specification for copper hot water storage combination units for domestic purposes or other relevant national standards as appropriate.

Vented hot water storage systems

3.12 Vented hot water storage systems should incorporate a vent pipe of an adequate size, but not less than 19mm internal diameter, connecting the top of the hot water storage vessel to a point open to the atmosphere above and over the level of the water in the cold water storage cistern.

3.13 In addition to the vent pipe referred to in 3.12 and any thermostat provided to control the temperature of the stored water to a desired temperature, vented hot water storage systems should incorporate either:

a. for all direct heat sources, a non-self-resetting energy cut-out to disconnect the supply of heat to the storage vessel in the event of the storage system overheating; and,

for all indirect heat sources, an overheat cut-out to disconnect the supply of heat to the storage vessel in the event of the stored water overheating so that the temperature of the stored water does not exceed 100°C; or

b. an appropriate safety device, for example, a ***temperature relief valve*** or a ***combined temperature and pressure relief valve*** to safely discharge the water in the event of significant over heating.

3.14 Vent pipes should discharge over a cold water storage cistern conforming to BS 417-2:1987 *Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders. Metric units*; or BS 4213:2004 *Cisterns for domestic use. Cold water storage and combined feed and expansion (thermoplastic) cisterns up to 500 litres. Specification*; as appropriate.

3.15 The cold water storage cistern into which the vent pipe discharges should be supported on a flat, level, rigid platform which is capable of safely withstanding the weight of the cistern when filled with water to the rim and fully supporting the bottom of the cistern over the whole of its area. The platform should extend a minimum of 150mm in all directions beyond the edge of the maximum dimensions of the cistern.

Note: Where an existing metal cistern is replaced, or a plastic cistern is replaced by one with larger dimensions, the existing support should be upgraded, as necessary, with one in accordance with paragraph 3.15.

3.16 The cistern should be accessible for maintenance, cleaning and replacement.

Unvented hot water storage systems – all systems

3.17 To minimize the danger from excessive pressure, unvented hot water storage systems should incorporate a minimum of two independent safety devices. These shall be in addition to any thermostat provided to control the desired temperature of the stored water. The selection of safety devices should take account of the physical location of the devices, and the design, configuration, location of components and performance characteristics of the system to which they are attached.

3.18 An acceptable approach might consist of:

a. a non self-resetting energy cut-out to disconnect the supply of heat to the storage vessel in the event of the storage system over-heating; and

b. a temperature relief valve or a combined temperature and pressure relief valve to safely discharge the water in the event of serious over-heating.

Alternative approaches to this are acceptable provided that they provide an equivalent degree of safety.

Note: See 3.35 for suitability of devices for primary thermal stores

3.19 Water heaters with a capacity of 15 litres or less that have appropriate safety devices for temperature and pressure will generally satisfy the requirement set out in G3(3).

Unvented hot water storage systems – systems up to 500 litres capacity and 45kW power input

3.20 Paragraphs 3.21 to 3.24 are in addition to the provisions of 3.17 above.

3.21 If an indirect supply of heat to an unvented ***hot water storage system*** incorporates a boiler, the energy cut-out may be on the boiler.

3.22 Any unvented ***hot water storage system*** up to 500 litres and less than 45kW should be in the form of a proprietary ***hot water storage system unit*** or package. The package and components should be appropriate to the circumstances in which they are used and should satisfy an appropriate standard that will ensure the requirements of regulation G3(2) and G3(3) will be met (e.g. BS EN 12897:2006 *Water Supply. Specification for indirectly heated unvented (closed) hot water storage systems* or BS 6700:2006 + A1:2009 *Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages).*

3.23 Any unvented ***hot water storage system unit*** or package should be indelibly marked with the following information:

a. the manufacturer's name and contact details;

b. a model reference;

c. the rated storage capacity of the storage water heater;

d. the operating pressure of the system and the operating pressure of the expansion valve;

e. relevant operating data on each of the safety devices fitted; and

f. the maximum primary circuit pressure and flow temperature of indirect ***hot water storage system units*** or ***packages.***

3.24 In addition, the following warning should be indelibly marked on the ***hot water storage system unit*** or package so that it is visible after installation:

WARNING TO USER

a. Do not remove or adjust any component part of this unvented water heater; contact the installer.

b. If this unvented water heater develops a fault, such as a flow of hot water from the discharge pipe, switch the heater off and contact the installer.

WARNING TO INSTALLER

a. This installation is subject to the Building Regulations.

b. Use only appropriate components for installation or maintenance.

Installed by:

Name .....

Address .....

Tel. No. .....

Completion date .....

Unvented hot water storage systems – systems over 500 litres capacity or over 45kW power input

3.25 Paragraph 3.26 and 3.27 are in addition to the provisions of 3.17 above.

3.26 Systems over 500 litres capacity will generally be bespoke designs for specific projects and as such are inappropriate for approval by a third party accredited product conformity certification scheme. Where this is the case, the unvented ***hot water storage system*** should be designed to the safety requirements in 3.17 by an appropriately qualified engineer.

3.27 Any unvented ***hot water storage system*** having a power input of more than 45kW, but a capacity of 500 litres or less should be in the form of a proprietary ***hot water storage system unit*** or package. The package and components should be appropriate to the circumstances in which they are used and should satisfy an appropriate standard that will ensure the requirement of regulation G3(2) and G3(3) will be met (e.g. BS EN 12897:2006 Water Supply. Specification for indirectly heated unvented (closed) hot water storage systems or BS 6700:2006 + A1:2009 Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages).

Safety devices

Non-self-resetting energy cut-outs

3.28 Non-self-resetting energy cut-outs may only be used where they would have the effect of instantly disconnecting the supply of energy to the storage vessel.

3.29 Non-self-resetting energy cut-outs should conform to:

a. BS EN 60335-2-73:2003 *Specification for safety of household and similar electrical appliances. Particular requirements. Fixed immersion heaters* and BS EN 60730-2-9:2002 *Automatic electrical controls for household and similar use. Particular requirements for temperature sensing control; or*

b. BS EN 257:1992 *Mechanical thermostats for gas-burning appliances.*

3.30 Where a non self-resetting energy cutout operates indirectly on another device (see paragraph 3.18) to interrupt the supply of heat (e.g. it is wired up to a motorised valve or some other suitable device to shut off the flow to the primary heater), the energy cut-out should comply with the relevant European Standard (see paragraph 3.29) or the supplier or installer should be able to demonstrate that the device has equivalent performance to that set out in relevant standards.

3.31 Where an electrical device is connected to the energy cut-out, such as a relay or motorised valve, the device should operate to interrupt the supply of energy if the electrical power supply is disconnected.

3.32 Where there is more than one energy cutout (see paragraph 3.35), each non-self-resetting energy cut-out should be independent (e.g. each should have a separate motorised valve and a separate temperature sensor).

3.33 Where an energy cut-out is fitted as set out in paragraphs 3.13 a) or 3.18, each heat source should have a separate non self-resetting energy cut-out.

Temperature and pressure relief devices

3.34 Where relevant, appropriate pressure, temperature or temperature and pressure-activated safety devices should be fitted in addition to a safety device such as an energy cut-out.

3.35 Temperature relief valves and ***combined temperature and pressure relief valves*** should not be used in systems which have no provision to automatically replenish the stored water (e.g. unvented primary thermal storage vessels). In such cases there should be a second non-selfresetting energy cut-out independent of the one provided in accordance with paragraph 3.18(a).

3.36 Temperature relief valves should conform to relevant national standards such as BS 6283–2:1991 Safety and control devices for use in hot water systems. Specifications for temperature relief valves for pressures from 1 bar to 10 bar. ***Combined temperature and pressure relief valves*** should conform to BS EN 1490:2000 Building valves. Combined temperature and pressure relief valves. Tests and Requirements.

3.37 ***Temperature relief valves*** (see paragraph 3.18) should be sized to give a discharge rating at least equal to the total power input to the hot water storage system, when measured in accordance with Appendix F of BS 6283-2:1991 or BS EN 1490:2000.

3.38 ***Temperature relief valve(s) or combined temperature and pressure relief valve(s)*** (see paragraph 3.18) should be located directly on the storage vessel, such that the stored water does not exceed 100°C.

3.39 In ***hot water storage system units*** and packages, the ***temperature relief valve(s)*** (see paragraph 3.18) should be:

a. factory fitted and should not be disconnected other than for replacement; and

b. not relocated in any other device or fitting installed.

3.40 The safety and performance of an unvented system is dependent on the choice of system and safety devices appropriate for the location

and correct installation of the system. Building owners and occupiers should therefore take care to choose installers who have the necessary skills to carry out this work. These skills can be demonstrated for example, by registration with a competent person scheme for this type of work or by the holding of a current registered operative skills certification card for unvented hot water systems.

3.41 The installation of an unvented system is notifiable building work which must be notified to the ***BCB*** before work commences. The ***BCB*** may then check to make sure the work is safe and meets current energy efficiency requirements.

3.42 If the installer is registered with a competent person scheme for the installation of unvented hot water systems it will not be necessary for the work to be notified in advance to the ***BCB***. Installers registered with such schemes will self-certify that the work complies with all relevant requirements in the Building Regulations and the building owner/occupier will be given a building regulations certificate of compliance which is usually issued by the competent person scheme operator.

Electric water heating

3.43 Electric fixed immersion heaters should comply with the provisions of BS EN 60335-2-73:2003 *Household and similar electrical appliances. Safety. Particular requirements for fixed immersion heaters.*

3.44 Electric instantaneous water heaters should comply with the provisions of BS EN 60335-2-35:2002 *Specification for safety of household and similar electrical appliances.*

3.45 Electric storage water heaters should comply with the provisions of BS EN 60335-2-21:2003 *Household and similar electrical appliances. Safety. Particular requirements for storage water heaters.*

Solar water heating

3.46 Factory-made solar water heating systems should comply with the provisions of BS EN 12976-1:2006 *Thermal solar systems and components. Factory made systems. General requirements.*

3.47 Other solar water heating systems should comply with the provisions of prEN/TS 12977-1:2008 *Thermal solar systems and components. Custom built systems. General requirements for solar water heaters and combi systems*, or BS 5918:1989 *British Standard Code of Practice for Solar heating systems for domestic hot water* as appropriate. Further guidance is available in *CIBSE Guide G, Public Health Engineering and CIBSE technical guide Solar Heating Design and Installation.*

3.48 Where solar water heating systems are used, an additional heat source should be available.

Note: The additional heat source should be used, when necessary, to maintain the water temperature to restrict microbial growth.

3.49 As some solar hot water systems operate at elevated temperatures and pressures, and so all components should be rated to the appropriate temperatures and pressures.

Discharge pipes from safety devices

Discharge pipe D1

3.50 Safety devices such as ***temperature relief valves*** or ***combined temperature and pressure relief valves*** (see paragraphs 3.13 or 3.18) should discharge either directly or by way of a manifold via a short length of metal pipe (D1) to a tundish.

3.51 The diameter of discharge pipe (D1) should be not less than the nominal outlet size of the safety device, e.g. ***temperature relief valve***.

3.52 Where a manifold is used it should be sized to accept and discharge the total discharge from the discharge pipes connected to it.

3.53 Where valves other than a ***temperature and pressure relief valve*** from a single unvented hot water system discharge by way of the same manifold that is used by the safety devices, the manifold should be factory fitted as part of the ***hot water storage system unit*** or package.

Tundish

3.54 The ***tundish*** should be vertical, located in the same space as the unvented ***hot water storage system*** and be fitted as close as possible to, and lower than, the safety device, with no more than 600mm of pipe between the valve outlet and the ***tundish*** (see Diagram 1).

Note: To comply with the Water Supply (Water Fittings) Regulations, the ***tundish*** should incorporate a suitable air gap.

3.55 Any discharge should be visible at the ***tundish***. In addition, where discharges from safety devices may not be apparent, e.g. in dwellings occupied by people with impaired vision or mobility, consideration should be given to the installation of a suitable safety device to warn when discharge takes place, e.g. electronically operated.

Discharge pipe D2

3.56 The discharge pipe (D2) from the ***tundish*** should:

a. have a vertical section of pipe at least 300mm long below the ***tundish*** before any elbows or bends in the pipework (see Diagram 1); and

b. be installed with a continuous fall of at least 1 in 200 thereafter.

3.57 The discharge pipe (D2) should be made of:

a. metal; or

b. other material that has been demonstrated to be capable of safely withstanding temperatures of the water discharged and is clearly and permanently marked to identify the product and performance standard (e.g. as specified in the relevant part of BS 7291-1:2006 *Thermostatic pipes and fittings for hot and cold water for domestic purposes and heating installations in buildings. General requirements).*

3.58 The discharge pipe D2 should be at least one pipe size larger than the nominal outlet size of the safety device unless its total equivalent hydraulic resistance exceeds that of a straight pipe 9m long, i.e. for discharge pipes between 9m and 18m the equivalent resistance length should be at least two sizes larger than the nominal outlet size of the safety device; between 18 and 27m at least 3 sizes larger, and so on; bends must be taken into account in calculating the flow resistance. See Diagram 1, Table 3.1 and the worked example.

Note: An alternative approach for sizing discharge pipes would be to follow Annex D, section D.2 of BS 6700:2006 + A1:2009 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.*

Diagram 1 **Typical discharge pipe arrangement**

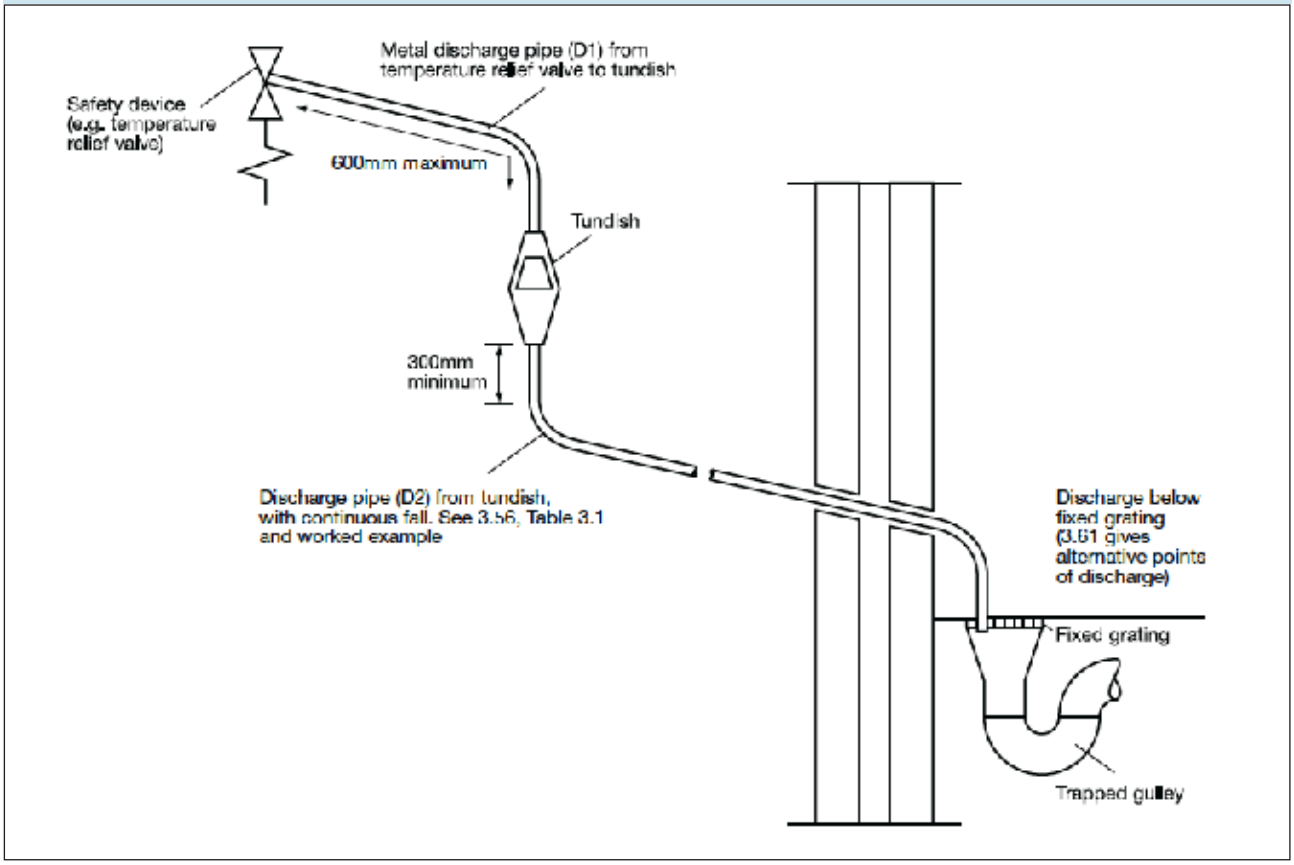


Table 3.1 **Sizing of copper discharge pipe 'D2' for common temperature relief valve outlet sizes**

Valve outlet size	Minimum size of discharge pipe D1*	Minimum size of discharge pipe D2* from tundish	Maximum resistance allowed, expressed as a length of straight pipe (i.e. no elbows or bends)	Resistance created by each elbow or bend
G½	15mm	22mm	Up to 9m	0.8m
		28mm	Up to 18m	1.0m
		35mm	Up to 27m	1.4m
G¾	22mm	28mm	Up to 9m	1.0m
		35mm	Up to 18m	1.4m
		42mm	Up to 27m	1.7m
G1	28mm	35mm	Up to 9m	1.4m
		42mm	Up to 18m	1.7m
		54mm	Up to 27m	2.3m

***see 3.51 and 3.58 and Diagram 1**

Note: The above table is based on copper tube. Plastic pipes may be of different bore and resistance.
Sizes and maximum lengths of plastic should be calculated using data prepared for the type of pipe being used.

Worked example:

The example below is for a G½ temperature relief valve with a discharge pipe (D2) having 4 No. 22mm elbows and length of 7m from the tundish to the point of discharge.

From Table 3.1:
Maximum resistance allowed for a straight length of 22mm copper discharge pipe (D2) from a G½ temperature relief valve is: 9.0m

Subtract the resistance for 4 No. 22mm elbows at 0.8m each = 3.2m

Therefore the maximum permitted length equates to 5.8m which, is less than the actual length of 7m therefore calculate the next largest size.

Maximum resistance allowed for a straight length of 28mm copper discharge pipe (D2) from a G½ temperature relief valve is: 18m

Subtract the resistance for 4 No. 28mm elbows at 1.0m each = 4m

Therefore the maximum permitted length equates to: 14m

As the actual length is 7m, a 28mm (D2) copper pipe will be satisfactory.

3.59 Where a single common discharge pipe serves more than one system, it should be at least one pipe size larger than the largest individual discharge pipe (D2) to be connected.

3.60 The discharge pipe should not be connected to a soil discharge stack unless it can be demonstrated that the soil discharge stack is capable of safely withstanding temperatures of the water discharged, in which case, it should:

a. contain a mechanical seal, not incorporating a water trap, which allows water into the branch pipe without allowing foul air from the drain to be ventilated through the ***tundish***;

b. be a separate branch pipe with no **sanitary appliances** connected to it;

c. if plastic pipes are used as branch pipes carrying discharge from a safety device, they should be either polybutalene (PB) or crosslinked polyethylene (PE-X) complying with national standards such as Class S of BS 7291-2:2006 or Class S of BS 7291-3:2006 respectively; and

d. be continuously marked with a warning that no ***sanitary appliances*** should be connected to the pipe.

Notes:

1. Plastic pipes should be joined and assembled with fittings appropriate to the circumstances in which they are used as set out in BS EN ISO 1043-1:2002 *Plastics. Symbols and abbreviated terms. Basic polymers and their special characteristics*.

2. Where pipes cannot be connected to the stack it may be possible to route a dedicated pipe alongside or in close proximity to the discharge stack

Termination of discharge pipe

3.61 The discharge pipe (D2) from the **tundish** should terminate in a safe place where there is no risk to persons in the vicinity of the discharge.

3.62 Examples of acceptable discharge arrangements are:

a. to a trapped gully with the end of the pipe below a fixed grating and above the water seal;

b. downward discharges at low level; i.e. up to 100mm above external surfaces such as car parks, hard standings, grassed areas etc. are acceptable providing that a wire cage or similar guard is positioned to prevent contact, whilst maintaining visibility; and,

c. discharges at high level: e.g. into a metal hopper and metal downpipe with the end of the discharge pipe clearly visible or onto a roof capable of withstanding high temperature discharges of water and 3 m from any plastic guttering system that would collect such discharges.

3.63 The discharge would consist of high temperature water and steam. Asphalt, roofing felt and non-metallic rainwater goods may be damaged by such discharges.

Prevention of excessive temperatures

3.64 Where the operating temperature of ***domestic hot water*** in the storage vessel in a dwelling is capable of exceeding 80°C under normal operating conditions (a situation that may occur in vessels used as heat stores and those connected to solar heat collectors or solid fuel boilers that do not have intervening controls between the boiler and the vessel containing the hot water) the outlet from the storage vessel should be fitted with a device, such as an in-line hot water supply tempering valve in accordance with BS EN 15092:2008 *Building Valves. In-line hot water tempering valves*, to ensure that the temperature supplied to the ***domestic hot water*** distribution system does not exceed 60°C.

Prevention of scalding

3.65 The hot water supply temperature to a bath should be limited to a maximum of 48°C by use of an in-line blending valve or other appropriate temperature control device, with a maximum temperature stop and a suitable arrangement of pipework.

EP11 - To prevent the risk of scalding to the consumer, the hot water supply temperature that can be delivered to any domestic outlet shall be limited to a maximum of 48°C by the same methods as detailed at 3.65.

3.66 The acceptability of in-line blending valves can be demonstrated by compliance with the relevant European Standard such as BS EN 1111:1999 *Sanitary tapware. Thermostatic mixing valves (PN 10). General technical specification* or BS EN 1287:1999 *Sanitary tapware. Low pressure thermostatic mixing valves. General technical specifications* to demonstrate that the maximum temperature of 48°C cannot be exceeded in operation and that the product will fail-safe (i.e. not discharge water above the maximum temperature). Such valves should not be easily altered by **building** users.

3.67 In-line blending valves and composite thermostatic mixing valves should be compatible with the sources of hot and cold water that serve them.

3.68 The length of supply pipes between in-line blending valves and outlets should be kept to a minimum in order to prevent the colonisation of waterborne pathogens. If intermittent use of the bath is anticipated, provision should be made for high temperature flushing to allow pasteurisation of the pipes and outlet fittings. Such events should be managed to prevent the risk associated with inadvertent use.

Notes:

1. Further guidance on the use of in-line blending valves can be found in BRE Information paper IP14/03 *Preventing hot water scalding in bathrooms: using TMVs*
2. In some buildings, e.g. care homes, in-line blending valves would need to meet the additional performance standards set out in NHS Estates Model specification D 08

Installation

3.69 Good workmanship is essential. Workmanship should be in accordance with appropriate standards such as BS 8000–15:1990 *Workmanship on Building Sites Code of practice for hot and cold water services (domestic scale).*

EP1 - The hot water supply shall be designed and installed in accordance with The Water Supply (Water Fittings) Regulations 1999 and BS EN 806.

EP2 - Any work that is undertaken is done so by suitably qualified and experienced persons for that specific work. Suitable qualifications include plumbing studies to NVQ Level 3 to unvented hot water storage systems. Qualifications shall be current, and copies of certificates held on file to demonstrate competence. Where persons are not suitably qualified or experienced, their works shall be supervised, checked and permanent records made and retained.

EP9 - Most unvented hot water storage cylinders have an inlet control group that includes a pressure reducing valve, limiting the hot water pressure to 3.0-bar. The reducing valve typically includes a cold-water draw off. This shall be utilised to ensure that the hot and cold-water supply pressures are balanced.

EP10 - Pipework upstream and downstream of the hot water storage cylinder shall be pressure tested accordingly per The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. Test requirements are detailed at Appendix D. A permanent record of every test shall be made and retained. An example of a test record form is at Appendix D.

EP9 - Where hot water is to be served by a combination boiler or similar, the supply pressure shall be limited to 3.0-bar. This can be achieved by the installation of a pressure reducing valve on the incoming supply.

EP10 - Where a system is to be changed from gravity fed to mains fed, and thus increasing the system operating pressure, the entire system is to be pressure tested per The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. Tests requirements are detailed at Appendix D. A permanent record of every test shall be made and retained. An example of a test record form is at Appendix D.

Commissioning of fixed building services

3.70 Water heaters require the input of energy to raise the temperature of water. It is therefore necessary to ensure their efficiency by proper installation and commissioning.

3.71 Fixed ***building*** services, including controls, should be commissioned by testing and adjusting as necessary to ensure that they use no more fuel and power than is reasonable in the circumstances.

3.72 Commissioning means the advancement of these systems from the state of static completion to working order to achieving compliance with Part L. For each system it includes setting-towork, regulation (that is testing and adjusting repetitively) to achieve the specified performance, the calibration, setting up and testing of the associated automatic control systems, and recording of systems and the performance test results that have been accepted as satisfactory.

3.73 Not all fixed ***building*** services will need to be commissioned. For example, with some systems it is not possible as the only controls are 'on' and 'off' settings. In other cases commissioning would be possible but in the specific circumstances would have no effect on energy use.

3.74 Where commissioning is carried out it must be done in accordance with a procedure approved by the Secretary of State. For new and existing dwellings the approved procedure for hot water systems is set out in the *Domestic Heating Compliance Guide*; for ***buildings*** other than dwellings in *CIBSE Commissioning Code M*.

3.75 Commissioning must be carried out in such a way as not to prejudice compliance with any applicable health and safety requirements.

3.76 Commissioning is often carried out by the person who installs the system. Sometimes it may be carried out by a subcontractor or by a specialist firm. It is important that whoever carries it out follows the relevant approved procedure in doing so.

Notice of completion of commissioning

3.77 The Building Regulations (regulation 20C(2)) and the Building (Approved Inspectors etc.) Regulations (regulation 20(1) and (6)) require that the person carrying out the work shall give a notice to the relevant BCB that commissioning has been carried out according to a procedure approved by the Secretary of State, unless testing and adjustment is not possible, or would not affect the energy efficiency of the fixed ***building*** service.

3.78 Where the work is carried out in accordance with a ***building*** notice, or full plans, or an initial notice or amendment notice, the notice of commissioning should be given not more than 5 days after the completion of the commissioning work. In other cases, for example where work is carried out by a person registered with a competent person scheme, it must be given not more than 30 days after the completion of work.

3.79 Where the installation of fixed building services which require commissioning is carried out by a person registered with a competent person scheme the notice of commissioning will be given by that person.

3.80 Until the BCB receives notice of commissioning it is unlikely to be satisfied that Part G has been complied with and consequently is unlikely to be able to give a completion/final certificate.

G4 Sanitary conveniences and washing facilities

The Requirement

This Approved Document deals with the following Requirement from Part G of Schedule 1 to the Building Regulations 2010.

Requirement	*Limits on application*
Sanitary conveniences and washing facilities	
G4 (1) Adequate and suitable sanitary conveniences must be provided in rooms provided to accommodate them or in bathrooms.	
(2) Adequate hand washing facilities must be provided in:	
(a) rooms containing sanitary conveniences; or	
(b) rooms or spaces adjacent to rooms containing sanitary conveniences.	
(3) Any room containing a sanitary convenience, a bidet, or any facility for washing hands provided in accordance with paragraph (2)(b), must be separated from any kitchen or any area where food is prepared.	

Guidance

Performance

In the Secretary of State's view Requirement G4 will be met if:

a. Sanitary conveniences of the appropriate type for the sex and age of the persons using the ***building*** are provided in sufficient numbers, taking into account the nature of the ***building***; and

b. hand washing facilities are provided in, or adjacent to, rooms containing ***sanitary conveniences*** and are sited, designed and installed so as not to be prejudicial to health.

General

4.1 Attention is also drawn to the requirements for accessible ***sanitary conveniences*** and hand washing facilities of Part M (Access to and use of buildings) of Schedule 1 to the Building Regulations 2010 and to Approved Document M and to the Regulators' performance specification made under the Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148 as amended) for WC suites.

4.2 Requirement for ventilation is in Part F (Ventilation) of Schedule 1 to the Building Regulations 2010. Guidance on ventilation of ***sanitary accommodation*** is given in Approved Document F.

4.3 The number, type and siting of ***sanitary conveniences***, including separate provision for men and women, for staff in workplaces are also subject to the Workplace (Health, Safety and Welfare) Regulations 1992. Attention is drawn to the Approved Code of Practice issued with respect to those Regulations.

4.4 Further guidance on washbasins associated with ***sanitary conveniences*** may be found in the Food Standards Agency's Code of Practice Food hygiene – a guide for businesses.

4.5 Guidance on the selection, installation and maintenance of ***sanitary appliances*** including composting toilets may be found in BS 6465-3:2006 Sanitary installations. Code of practice for the selection, installation and maintenance of sanitary and associated appliances.

4.6 Where hot and cold taps are provided on a ***sanitary appliance***, the hot tap should be on the left.

Scale of provision and layout in dwellings

4.7 Any dwelling (house or flat) should have at least one ***sanitary convenience*** and associated hand washing facility. This will include a ***WC*** provided in accordance with requirement M4(1) (Sanitary conveniences in dwellings) of Schedule 1 to the Building Regulations 2010 and with Approved Document M, Volume 1.

Note: Requirement M4(1) requires that a ***sanitary convenience*** should be located in the principal/entrance storey of a dwelling.

4.8 Where additional ***sanitary conveniences*** are provided, each should have an associated hand washing facility.

4.9 To allow for basic hygiene, hand washing facilities should be located in:

a. the room containing the ***sanitary convenience***; or

b. an adjacent room or place that provides the sole means of access to the room containing the ***sanitary convenience*** (provided that it is not used for the ***preparation of food***).

4.10 A place containing a ***sanitary convenience*** and/or associated hand washing facilities should be separated by a door from any place used for the ***preparation of food*** (including a ***kitchen***) (see Diagrams 2 and 3).

Note: In dwellings, a room containing both a ***sanitary convenience*** and a basin for hand washing does not need a separation lobby between this room and a ***kitchen*** or food preparation area (Diagram 2). The layout for a room containing a ***sanitary convenience*** only should be such that the room or space containing its associated hand washing facilities is accessed before entry to a food preparation area, and is separated from that area by a door (Diagram 3).

4.11 Guidance on the provision of activity space around ***sanitary appliances*** is given in BS 6465-2:1996 Sanitary installations. Code of practice for space requirements for sanitary appliances.

Diagram 2 **Separation between hand washbasin/WC and food preparation area – single room**

See para 4.10

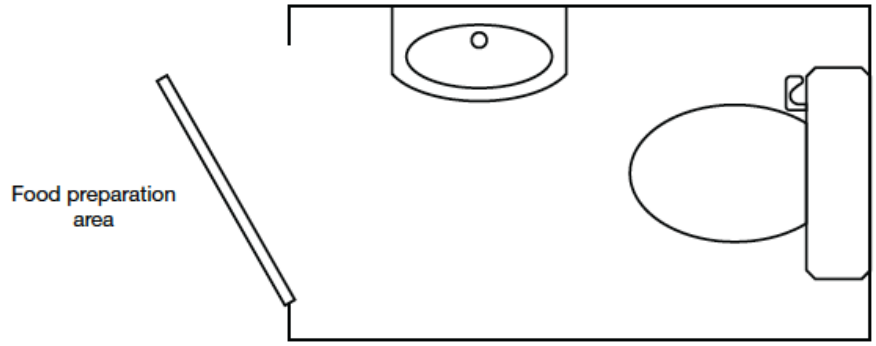
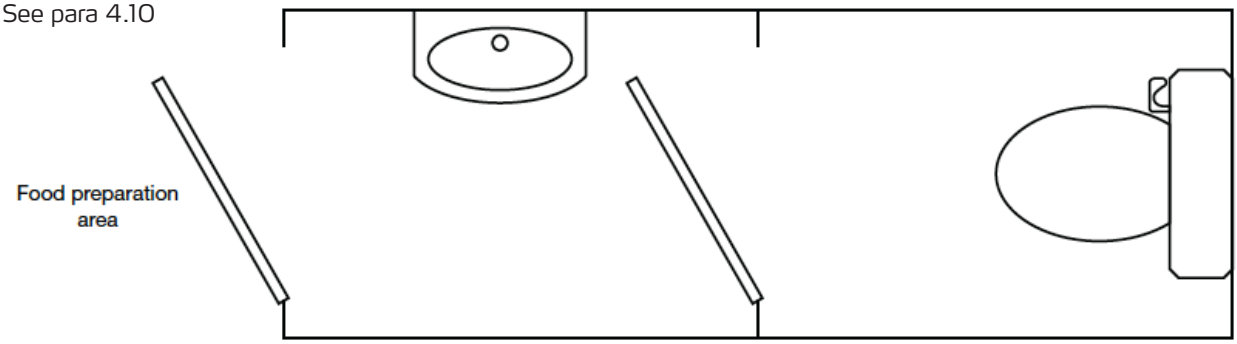


Diagram 3 **Separation between hand washbasin/WC and food preparation area – two rooms**

See para 4.10



Scale of provision and layout in buildings other than dwellings

4.12 The Workplace (Health, Safety and Welfare) Regulations 1992 require that a minimum number of sanitary conveniences must be provided in workplaces. The Approved Code of Practice (ACOP) that supports those Regulations sets out how to calculate that minimum requirement (guidance on those minimum numbers can be found at http://www.hse.gov.uk/pubns/indg293.pdf).

4.13 Part M of Schedule 1 to the Building Regulations 2010 sets out requirements relating to access to and use of buildings. Approved Document M provides guidance on the provision of suitable ***sanitary accommodation***. Such accommodation may form part of the total number of ***sanitary conveniences*** provided within a ***building***.

4.14 Further guidance on the provision of sanitary conveniences can be found in BS 6465-1:2006 + A1:2009 *Sanitary installations. Code of practice for the design of sanitary facilities and scales of provision of sanitary and associated appliances*. This may be used for those building types not set out in paragraph 4.12 above or for those workplaces where the applicant wishes to provide more than the minimum recommended in the Approved Code of Practice, for example, to deliver equivalent provision for men and women.

4.15 A ***sanitary convenience*** may be provided in:

a. a self-contained room which also contains hand washing facilities;

b. in a cubicle with shared hand washing facilities located in a room containing a number of cubicles; or

c. in a self-contained room with hand washing facilities provided in an adjacent room.

4.16 Urinals, WC cubicles and hand washing facilities may be in the same room.

4.17 A place containing a ***sanitary convenience*** and/or associated hand washing facilities should be separated by a door from any place used for the ***preparation of food*** (including a ***kitchen***).

Note: For workplaces, the Workplace (Health, Safety and Welfare) Regulations 1992 apply to the separation of a place containing a ***sanitary convenience*** and/or associated hand washing facilities and a workplace.

4.18 Guidance on the provision of activity space around ***sanitary appliances*** is given in BS 6465-2:1996 *Sanitary installations. Code of practice for space requirements for sanitary appliances.*

Chemical and composting toilets

4.19 Chemical toilets or composting toilets may be used where:

a. suitable arrangements can be made for the disposal of the waste either on or off the site; and

b. the waste can be removed from the premises without carrying it through any living space or food preparation areas (including a ***kitchen***); and

c. no part of the installation would be installed in any places where it might be rendered ineffective by the entry of flood water.

4.20 There are currently no British or European standards for composting toilets. Appropriate guidance can be found in ANSI/NSF 41:2005 as amended by Addendum 1:2007 *Non-liquid saturated treatment system*.

4.21 Composting toilets should not be connected to an energy source other than for purposes of ventilation or sustaining the composting process.

Discharges to drains

Note: See Approved Document for requirement H1 *Sanitary pipework* and *drainage* for guidance on provision for traps, branch discharge pipes, discharge stacks and foul drains.

4.22 Any ***WC*** fitted with flushing apparatus should discharge to an adequate system of drainage.

4.23 A ***urinal*** fitted with flushing apparatus should discharge through a grating, a trap or mechanical seal and a branch pipe to a discharge stack or a drain.

4.24 A ***WC*** fitted with a macerator and pump may be connected to a small bore drainage system discharging to a discharge stack if:

a. there is also access to a ***WC*** discharging directly to a gravity system; and

b. the macerator and pump meets the requirements of BS EN 12050-1:2001 *Wastewater lifting plants for buildings and sites. Principles of construction and testing. Lifting plants for wastewater containing faecal matter* or BS EN 12050-3:2001 *Wastewater lifting plants for buildings and sites. Principles of construction and testing. Lifting plants for wastewater containing faecal matter for limited applications*.

Note: *Where **greywater** recycling is used, lower overall flows are to be expected and this should* be taken into account in drain design. This is particularly relevant at the head of the drain where only one ***building*** is connected to the drain.

G5 Bathrooms

The Requirement

This Approved Document deals with the following requirement from Part G of Schedule 1 to the Building Regulations 2010.

Requirement	*Limits on application*
Bathrooms	
G5 A bathroom must be provided containing a wash basin and either a fixed bath or a shower.	Requirement G5 applies only to dwellings and to buildings containing one or more rooms for residential purposes.

Guidance

Performance

In the Secretary of State's view Requirement G5 will be met if a bathroom is provided containing a fixed bath or shower, and a washbasin.

General

5.1 The Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148) make provisions for appropriate backflow protection on taps including mixer fittings and hose connections.

5.2 Requirements for ventilation are in Part F of Schedule 1 to the Building Regulations 2010 (Ventilation). Guidance on ventilation of ***sanitary accommodation*** is given in Approved Document F.

5.3 Requirements for electrical safety are given in Part P of Schedule 1 to the Building Regulations 2010 (Electrical safety). Guidance is given in Approved Document P.

5.4 Guidance on the selection, installation and maintenance of ***sanitary appliances*** may be found in BS 6465-3:2006 *Sanitary installations. Code of practice for the selection, installation and maintenance of sanitary and associated appliances.*

5.5 Where hot and cold taps are provided on a ***sanitary appliance***, the hot tap should be on the left.

Scale of provision and layout in dwellings

5.6 Any dwelling (house or flat) must have at least one bathroom with a fixed bath or shower, and a washbasin.

5.7 Guidance on the provision of activity space around ***sanitary appliances*** is given in BS 6465-2:1996 *Sanitary installations. Code of practice for space requirements for sanitary appliances.*

Scale of provision and layout in buildings with rooms for residential purposes

5.8 The number of fixed baths or showers and washbasins in ***buildings*** with rooms for residential purposes should be in accordance with BS 6465-1:2006 and A1:2009 *Sanitary installations. Code of practice for the design of sanitary facilities and scales of provision of sanitary and associated appliances.*

Discharges to drains

Note: See Approved Document for Requirement H1 *Sanitary pipework and drainage* for guidance on provision for traps, branch discharge pipes, discharge stacks and foul drains.

5.9 Any ***sanitary appliance*** used for personal washing should discharge through a grating, a trap and a branch discharge pipe to an adequate system of drainage.

5.10 A ***sanitary appliance*** used for personal washing fitted with a macerator and pump may be connected to a small bore drainage system discharging to a discharge stack if:

a. there is also access to washing facilities discharging directly to a gravity system; and

b. the macerator and pump meets the requirements of BS EN 12050-2:2001 *Wastewater lifting plants for* ***buildings*** *and sites. Principles of construction and testing. Lifting plants for faecal-free wastewater.*

G6: Food preparation areas

The Requirement

This Approved Document deals with the following requirement from Part G of Schedule 1 to the Building Regulations 2010.

Requirement	*Limits on application*
Food preparation areas **G6** A suitable sink must be provided in any area where food is prepared.	

Guidance

Performance

In the Secretary of State's view Requirement G6 will be met if a ***sink*** is provided in any place used for the ***preparation of food*** (including a ***kitchen***).

Where a dishwasher is provided in a separate room, an additional ***sink*** need not be provided in that room.

Scale of provision in dwellings

6.1 A ***sink*** should be provided in any ***kitchen*** or place used for the ***preparation of food***.

6.2 Where a dishwasher is provided in a separate room that is not the principal place for the ***preparation of food***, an additional ***sink*** need not be provided in that room.

Scale of provision in buildings other than dwellings

6.3 In all ***buildings*** other than dwellings, there should be at least the same provision as described in 6.1.

6.4 In ***buildings*** where the Food Hygiene (England) Regulations 2006 (SI 2006/14) and the Food Hygiene (Wales) Regulations 2006 (SI 2006/31 W5) apply, separate hand washing facilities may be needed. This is in addition to any hand washing facilities associated with WCs in accordance with Requirement G4.

Discharges to drains

Note: See Approved Document for Requirement H1 *Sanitary pipework and drainage* for guidance on provision for traps, branch discharge pipes, discharge stacks and foul drains.

6.5 Any ***sink*** should discharge through a grating, a trap and a branch discharge pipe to an adequate system of drainage.

Appendix A – Water efficiency calculator for new dwellings

The water efficiency calculation methodology

A1 This appendix sets out the water efficiency calculation methodology for assessing the whole house potable water consumption in new dwellings. The calculation methodology is to be used to assess compliance against the water performance targets in Regulation 36 as set out below. It is not a design tool for water supply and drainage systems. It is also not capable of calculating the actual potable water consumption of a new dwelling. Behaviour and changing behaviour can also have an effect on the amount of potable water used throughout a home.

Performance target	Maximum calculated consumption of potable water (litres/person/day)
Regulation 36 para (2)a	125
Regulation 36 optional requirement para (2)b	110

A2 The calculation methodology requires the use of water consumption figures provided from manufacturers' product details. Before the assessment can be carried out, figures will need to be collected from manufacturers' product information to determine the consumption of each terminal fitting, including:

a. WCs
   i. Flushing capacity for the WC suite including consumption at full and part flush for dual flush WCs.
   ii. Where multiple WCs are specified with various flushing capacities, the average effective flushing volume must be used as set out in paragraphs A8 and A11.

b. Bidets
   i. Bidets are excluded from the water efficiency calculator for new dwellings due to their minimal water consumption, and although there is insufficient research to quantify this consumption, anecdotal evidence shows that there is evidence that bidets often displace other water consumption rather than increase consumption.

c. Taps
   i. Flow rate of each tap, at full flow rate in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) for high pressure (Type 1) taps, or at a dynamic pressure of 0.1±0.02 bar (0.01±0.002 MPa) for low pressure (Type 2) taps (BS EN 200:2008, sanitary tapware, single taps and combination taps for supply systems of type 1 and 2. General technical specifications) including any reductions achieved with flow restrictions.
   ii. Where multiple taps are to be provided (e.g. separate hot and cold taps) the flow rate of each tap will be needed in order to calculate an average flow rate in accordance with paragraphs A8 to A10.
   iii. For 'click taps' and other taps with a 'water break', the manufacturer's stated full flow rate should be used to perform calculations (measured as described above). Do not use the flow rate at the break point. A factor for percentage of flow rate is already assumed within the use factor for taps. There is currently no research to provide a separate use factor for 'click taps' so a standard use factor is applied.
   iv. Taps on baths should not be included in the calculation as the water consumption from bath taps is taken account of in the use factor for baths.

d. Baths
   i. Total capacity of the bath to overflow, in litres (excluding displacement, this is already included in the use factor for baths).
   ii. Where multiple baths are specified with various capacities, the average must be used as set out in paragraphs A8 to A10.
   iii. Spa hot tubs are not included in the water efficiency calculator as they are generally not filled on a daily basis and their water consumption over a year is minimal.

e. Dishwashers
   i. Litres per place setting derived from the value quoted on the EU Energy Label, i.e. annual water use ÷ (280 x number of place settings).
   ii. Where no dishwasher is to be provided and therefore consumption figures are unknown, a figure of 1.25 litres per place setting must be assumed.
   iii. Where multiple dishwashers are specified with various consumptions, the average must be used as set out in paragraphs A8 to A10.

f. Washing machines
   i. Litres per kilogram of dry load derived from the value quoted on the EU Energy Label, i.e. annual water use ÷ (220 x capacity in kg).

ii. Where no washing machine is to be provided and therefore consumption figures are unknown, a figure of 8.17 litres per kilogram must be assumed.

iii. Where multiple washing machines are specified with various consumptions, the average must be used as set out in paragraphs A8 to A10.

g. Showers

i. Flow rate of each shower at the outlet using cold water (T≤30°C), in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) for high pressure (Type 1) supply systems, or at a dynamic pressure of 0.1±0.05 bar (0.01±0.005 MPa) for low pressure (Type 2) supply systems (BS EN 1112:2008, Sanitary tapware. Shower outlets for sanitary tapware for water supply systems type 1 and 2. General technical specifications).

ii. Where multiple showers are specified with various flow rates, the average must be used as set out in paragraphs A8 to A10.

h. Water softeners (where present)

i. Percentage of total capacity used per regeneration cycle.

ii. Water consumed per regeneration cycle (litres).

iii. Average number of regeneration cycles per day.

iv. Number of occupants (based on two occupants in the first bedroom and one occupant per additional bedroom assuming two occupants in studio flats).

v. Water softeners that do not have a water consumption such as electromagnetic types, are not included in the calculation.

i. Waste disposal units (where present)

i. Where present, a standard consumption of 3.08 litres per person per day must be assumed.

j. External taps

i. Flow rates of external taps are not included in the calculation as a fixed allowance of five litres per person per day is assumed for external water use.

A3 In some cases rainwater harvesting and greywater recycling may be used as a means of reducing water consumption to achieve higher water efficiency performance levels. This may be needed where options for improving the efficiency of terminal fittings (taps, WCs etc.) have been maximised and further savings are still needed:

a. Greywater (in accordance with BS 8525)

i. Manufacturer or system designer details on the percentage of used water to be recycled, taking into account the storage capacity of the system.

ii. The volume of recycled water collected from waste bath, shower and washhand basin, dishwasher and washing machine usage, with the volume collected calculated in accordance with Table A1 or Tables A4.3, A4.4 and A4.5.

iii. The consumption of fittings where greywater is to be used in accordance with Table A1 which can include WCs and washing machines or Tables A4.1 and A4.2 where greywater is just being used in a proportion of fittings.

b. Rainwater (in accordance with BS 8515)

i. Collection area

ii. Yield co-efficient and hydraulic filter efficiency

iii. Rainfall (average mm/year)

iv. Daily non-potable water demand

A4 Large water consuming installations such as swimming pools and spa hot tubs where the water is replaced over a greater time interval do not need to be included as part of the water calculations.

Calculation tables

A5 Figures from manufacturers' product details should be entered into Table A1 to calculate the consumption of each fitting in litres per person per day. Where there are multiple fittings of the same type that have various flow rates or capacities (e.g. hot and cold taps with different flow rates), Tables A2.1 to A2.7 should be used to determine the average flow rate or capacity of such fittings. The consumption of water softeners in litres per person per day is calculated using Table A3. All values throughout the water efficiency calculator should be rounded to two decimal places with the exception of the total water consumption figures, which should be rounded to one decimal place.

A6 The total calculated use, resulting from Table A1, is the total consumption of all water consuming fittings per person. To calculate the litres of water consumed per person per day, any savings from grey or rainwater need to be deducted from the total calculated use using figures from Tables A4.6 and A5.5. The litres/person/day figure is then multiplied by a normalisation factor to determine the total water consumption per person.

A7 To calculate the total water consumption, an additional allowance for external water use is added on to the total water consumption. This figure is set at 5 litres/person/day.

Table A1: **The water efficiency calculator**

		(1)	(2)	(3)	(4)
Installation type	**Unit of measure**	**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/ person/day = [(1) × (2)] + (3)**
WC (single flush)	Flush volume (litres)		4.42	0.00	
WC (dual flush)	Full flush volume (litres)		1.46	0.00	
	Part flush volume (litres)		2.96	0.00	
WCs (multiple fittings)	Average effective flushing volume (litres)		4.49	0.00	
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		1.50	1.50	
Bath (where shower also present)	Capacity to overflow (litres)		0.11	0.00	
Shower (where bath also present)	Flow rate (litres/minute)		4.07	0.00	
Bath only	Capacity to overflow (litres)		0.50	0.00	
Shower only	Flow rate (litres/minute)		5.60	0.00	
Kitchen/utility room sink taps	Flow rate (litres/minute)		0.44	10.36	
Washing machine	Litres/kg dry load		2.1	0.00	
Dishwasher	Litres/place setting		3.6	0.00	
Waste disposal unit	Litres/use	If present = 1 If absent = 0	3.08	0.00	
Water softener	Litres/person/day		1.00	0.00	
	(5)	**Total calculated use = (Sum column 4)**			
	(6)	Contribution from greywater (litres/person/day) from Table 4.6			
	(7)	Contribution from rainwater (litres/person/day) from Table 5.5			
	(8)	Normalisation factor			0.91
	(9)	Total water consumption = [(5) – (6) – (7)] × (8)			
	(10)	External water use			5.0
	(11)	**Total water consumption = (9) + (10) (litres/person/day)**			

Consumption from multiple fittings

A8 Where terminal fittings with varying flow rates and capacities are specified (e.g. hot and cold taps with different flow rates, two types of shower etc.), the average consumption should be calculated as set out in Tables A2.1 to A2.7:

a) Enter the full flow rate or volume of each type of fitting into column (a) of the relevant table.

b) For taps, where there are separate hot and cold water taps, the flow rate of each tap should be entered separately as two tap types to calculate the average flow rate.

c) Calculate the total consumption per fitting type.

d) Calculate the average flow rate/volume of the fittings detailed.

e) Enter the flow rate/volume of the fitting with the highest flow rate/volume into box (f) with the exception of WCs, where this step is not relevant.

f) Calculate the proportionate flow rate/ volume by multiplying the highest flow rate/volume by a factor of 0.7 with the exception of WCs, where this step is not relevant.

A9 Where the average flow rate/volume is lower than the proportionate flow rate/volume, the proportionate figure must be entered into Table A1. The proportionate figure limits the flow rate/ volume that can be specified to a proportion equal to 70 per cent of the highest flow rate/ volume. This reduces the benefit of specifying ultra low fittings to bring the average flow rate/ volume down, where such ultra low fittings may not be acceptable to dwellings occupants.

A10 The figure which is the greater of the average or proportionate flow rate/volume should be used. This is so that, where the average flow rate/volume is significantly lower than the highest flow rate/volume specified, the calculation sets a limitation for what figure can be assumed.

Table A2.1: **Consumption calculator for multiple taps (excluding kitchen sink taps)**

	(a)	(b)	(c)
Tap fitting type	**Flow rate (litres/min)**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average flow rate (litres/min) = [(e)/(d)]			
(f) Maximum flow rate (litres/min)			
Proportionate flow rate (litres/min) = [(f) × 0.7]			

Table A2.2: **Consumption calculator for multiple baths**

	(a)	(b)	(c)
Bath fitting type	**Capacity to overflow (litres)**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average capacity to overflow = [(e)/(d)]			
(f) Highest capacity to overflow (litres)			
Proportionate capacity to overflow (litres) = [(f) × 0.7]			

Table A2.3: **Consumption calculator for multiple taps (kitchen/utility room sink)**

	(a)	(b)	(c)
Tap fitting type	**Flow rate (litres/min)**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average flow rate (litres/min) = [(e)/(d)]			
(f) Highest flow rate (litres/min) (litres)			
Proportionate flow rate (litres/min) = [(f) × 0.7]			

Table A2.4: **Consumption calculator for multiple dishwashers**

	(a)	(b)	(c)
Type of dishwasher	**Litres per place setting**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average litres per place setting = [(e)/(d)]			
(f) Highest litres per place setting			
Proportionate litres per place setting = [(f) × 0.7]			

Table A2.5: **Consumption calculator for multiple washing machines**

	(a)	(b)	(c)
Type of washing machine	**Litres per kg dry load**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average litres per kilogram of dry load = [(e)/(d)]			
(f) Highest litres per kilogram of dry load			
Proportionate litres per kilogram of dry load = [(f) × 0.7]			

Table A2.6: **Consumption calculator for multiple showers**

	(a)	(b)	(c)
Shower fitting type	**Flow rate (litres/min)**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average flow rate (litres/min) = [(e)/(d)]			
(f) Highest flow rate (litres/min)			
Proportionate flow rate (litres/min) = [(f) × 0.7]			

A11 Where more than one type of WC is provided, the average effective flushing volume is calculated using Table A2.7 below. The average effective flush volume should then be entered into Table A1 in the row 'WCs (multiple fittings)'.

Table A2.7: **Consumption calculator for multiple WCs**

	(a)	(b)	(c)
WC type	**Effective flushing volume* (litres)**	**Quantity (No.)**	**Total per fitting type = [(a) × (b)]**
1			
2			
3			
4			
(d) Total (Sum of all quantities)			
(e) Total (Sum of all totals per fitting type)			
Average effective flushing volume (litres) = [(e)/(d)]			

* The effective flushing volume for dual flush WCs is: (full flushing volume (litres) × 0.33) + (part flushing volume (litres) × 0.67)

Ion exchange water softener

A12 Ion exchange water softeners use water in order to clean the resin that is used to absorb the mineral content of the dwelling's water supply. This cleaning process is referred to as the regeneration cycle, which occurs on a frequency dependent on the type of water softener specified and the hardness of the water. The water efficiency calculator looks at the water consumed per regeneration cycle that is beyond a level of good practice. The good practice level has been determined at a level of water consumption as a percentage of the water softener's total capacity which is set at 4 per cent.

A13 The figure entered into the calculator is the volume of water consumed beyond this level of good practice to promote the use of more efficient water softeners. Where the water softener achieves a percentage that is equal to, or lower than this good practice benchmark figure, zero can be entered into Table A1 of the calculator for water softeners. The following formula is used to determine the litres of water consumed per person per day that is beyond the good practice level of 4 per cent.

A14 Litres of water consumed per person per day beyond the 4 per cent good practice level:
= [1 – (4/(a))] x ((b) x (c))
Where:
(a) = % of total capacity* used per regeneration
(b) = Litres of water consumed per regeneration
(c) = Average number of regeneration cycles per day

* the total capacity is the volume of water that flows through the water softener between regeneration cycles. This volume is dependent on the hardness of the water and the total capacity used in this calculation needs to reflect the hardness of water specific to the geographic location of the specific development. This figure should be determined from manufacturer's product details.

A15 To calculate the litres of water consumed per person per day beyond the 4 per cent good practice level, enter details of the water softener into Table A3. Where the result indicates zero or a negative figure, zero should be entered into Table A1 for water softeners. The number of occupants entered into the table should be based on two in the first bedroom and one in each additional room. Studio flats should assume for two occupants.

Table A3: **Water softener consumption calculation**

(a) Total capacity used per regeneration (%)	
(b) Water consumed per regeneration (litres)	
(c) Average number of regeneration cycles per day (No.)	
(d) Number of occupants served by the system (No.)	
(e) Water consumed beyond 4% (litres/day) = [1 - [4/(a)]] x [(b) x (c)]	
(f) Water consumed beyond 4% (litres/person/day) = [(e)/(d)]	

Greywater calculations

Greywater demand calculation

A16 Where all WCs and/or washing machines are being supplied with greywater, the consumption values should be copied from Column 4 of Table A1 and entered into Table A4.6 to calculate the greywater savings.

A17 Where greywater is only being supplied to a proportion of fittings such as just to one WC or washing machine, the proportion is calculated by entering details into Tables A4.1 and A4.2.

Table A4.1: **Greywater demand calculations - WCs**

(a) Effective flushing volume (litres)	**(b)** Number of fittings present	**(c)** Quantity using greywater	**(d)** Greywater demand = [(a) x (c)]
(e) Total fittings = Sum of (b)		**(f)** Total greywater demand = Sum of (d)	
Average greywater demand from WCs		= (f)/(e) x 4.42	

Table A4.2: **Greywater demand calculations - washing machines**

(a) Litres per kg	**(b)** Number of fittings present	**(c)** Quantity using greywater	**(d)** Greywater demand = [(a) x (c)]
(e) Total fittings = Sum of (b)		**(f)** Total greywater demand = Sum of (d)	
Average greywater demand from washing machines		= [(f)/(e)] x 2.1	

Greywater collection calculations

A18 Where greywater is to be collected from all fittings including the shower, bath and wash hand basin taps, the total water consumption of the fittings calculated in Table A1 represents the total greywater collected, the sum of the consumption figures for fittings from which greywater is collected (from column 4 of Table A1) should be entered into Table A4.6. Where greywater is only being collected from a proportion of fittings, such as just some of the taps, the calculations in Tables A4.3 to A4.5 should be followed and the results entered into Table A4.6.

Table A4.3: **Greywater collection calculations - taps**

(a) Litres per minute	(b) Number of fittings present	(c) Quantity supplying greywater	(d) Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from taps		= [(f)/(e)] × 1.58 +1.58	

Table A4.4: **Greywater collection calculations - showers**

(a) Litres per minute	(b) Number of fittings present	(c) Quantity supplying greywater	(d) Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from showers (where bath present)		= [(f)/(e)] × 4.37	
Average greywater supply from showers (shower only)		= [(f)/(e)] × 5.60	

Table A4.5: **Greywater collection calculations - baths**

(a) Litres per minute	(b) Number of fittings present	(c) Quantity supplying greywater	(d) Greywater supply = [(a) × (c)]
(e) Total fittings = Sum of (b)		(f) Total greywater supply = Sum of (d)	
Average greywater supply from baths (where shower present)		= [(f)/(e)] × 0.11	
Average greywater supply from baths (bath only)		= [(f)/(e)] × 0.50	

Greywater savings calculations

A19 Where greywater is to be reused within the dwelling, the savings from greywater can be calculated by entering the following details into Table A4.6:

a) Calculate the water to be recycled from Table A1 and/or using the method set out in section A18 where just a proportion of fittings are being collected from.

b) Determine the percentage of greywater collected to be recycled based upon manufacturer or system designer details of the system specified.

c) Determine the water demand of the fittings to be provided with greywater which can include WCs and washing machines depending on the quality of the treated water. This is determined from the WC and washing machine consumption from Table A1 or Tables A4.1 and A4.2 in paragraphs A16 and A17.

d) Multiply the volume of water to be recycled with the percentage of recycled water (determined in b. above) which will determine the actual volume of greywater available. Where the greywater supply is greater than the demand, the greywater savings are equal to the demand. Where the demand is greater than the greywater supply, the savings are equal to the supply.

e) Enter the greywater saving figure from Table A4.6 into Table A1.

Table A4.6: **Greywater collection calculation**

(a)	(b)	(c)	(d)	(e)
Bath, shower and wash hand basin usage (litres/person/day)	**Percentage of used water (a) to be recycled (%)**	**Greywater available for use (litres/person/day) = (a) × [(b)/100]**	**Greywater demand (litres/person/day) (from Table A1 or A4.2 and A4.3)**	**Greywater savings (litres/person/day) Where (c) is greater than (d), (e) = (d), otherwise (e) = (c)**

A20 Where a communal greywater system is to be provided supplying more than one home, Tables A4.1 to A4.5 can be used in the same way. The figures entered into Table A4.6 need to be entered on an individual dwelling basis and not using figures to reflect the communal system as a whole. The percentage collected figure will, however, need to be based on manufacturer or system designer details of the communal system specified.

Rainwater calculations

Rainwater collection calculations

A21 Where rainwater is to be used, the following calculation method should be followed by entering the relevant details into Table A5.1 or Table A5.2 to calculate the rainwater collection volume.

A22 For Table A5.1 using the intermediate approach from BS 8515:

a) Calculate the volume of water collected using the collection area, yield coefficient and hydraulic filter efficiency and average rainfall with guidance from BS 8515.

b) Calculate the daily rainwater collection in box (d) using the collection area, yield coefficient, hydraulic filter efficiency and rainfall.

c) Enter the number of occupants into box (e), which can be based on two occupants in the first bedroom and one occupant in each additional bedroom. A studio flat should assume two occupants.

d) Where a communal rainwater system is to be provided supplying more than one home, Table A5.1 can be used in the same way calculating the total volume collected for the communal system and dividing it by the total number of occupants served by the system. This figure should then be entered in Table A5.5.

Table A5.1: **Rainwater collection calculation - BS 8515 intermediate approach**

(a) Collection area (m^2)	
(b) Yield coefficient and hydraulic filter efficiency e.g. 0.7	
(c) Rainfall (average mm/year)	
(d) Daily rainwater collection (litres) = [(a) × (b) × (c)]/365	
(e) Number of occupants	
(f) Daily rainwater per person (litres) = [(d)/(e)]	

A23 For Table A5.2 using the detailed approach as described in BS 8515, enter details of the total daily rainwater collection (litres) and the number of occupants to calculate the daily rainwater per person (litres) and enter into Table A5.5.

Table A5.2: **Rainwater collection calculation - BS 8515 detailed approach**

(a) Daily rainwater collection (litres)	
(b) Number of occupants	
(c) Daily rainwater per person (litres) = [(a)/(b)]	

A24 The calculation detailed above in Table A5.2 is sufficient for evaluating the principles of the proposed system in the proposed development. However, for sizing of storage capacity and all other design and installation details, BS 8515 should be followed.

Rainwater demand calculations

A25 Where all WCs and/or washing machines are being supplied with rainwater, the consumption should be taken from Table A1 and entered into Table A5.5 to calculate the rainwater savings.

A26 Where rainwater is only being supplied to a proportion of fittings, such as just to one WC or washing machine, the proportion is calculated using Table A5.3 and A5.4. This rainwater demand can then be entered into Table A5.5 to calculate the rainwater savings.

Table A5.3: **Rainwater demand calculations - WCs**

(a)	(b)	(c)	(d)
Effective flushing volume (litres)	**Number of fittings present**	**Quantity using rainwater**	**Rainwater demand = [(a) × (c)]**
(e) Total fittings = Sum of (b)		(f) Total rainwater demand = Sum of (d)	
Average rainwater demand from WCs		= [(f)/(e)] × 4.42	

Table A5.4: **Rainwater demand calculations - washing machines**

(a)	(b)	(c)	(d)
Litres per kg	**Number of fittings present**	**Quantity using rainwater**	**Rainwater demand = [(a) × (c)]**
(e) Total fittings = Sum of (b)		(f) Total rainwater demand = Sum of (d)	
Average rainwater demand from washing machines		= [(f)/(e)] × 2.1	

Rainwater saving calculations

A27 Enter the total volume of rainwater collected per person per day from Table A5.1 or Table A5.2 depending on the BS 8515 approach followed. Enter the total consumption of fittings using rainwater (demand) from column 4 of Table A1, where rainwater is to be used in all WCs and/or washing machines. Where rainwater is only being used in a proportion of fittings, enter the total demand of WCs and washing machines from Table A5.3 and Table A5.4. This figure should then be entered into Table A1 to calculate the internal water consumption.

Table A5.5: **Rainwater saving calculations for new dwellings**

	Litres per person per day
(a) Rainwater collected	
(b) Rainwater demand	
(c) Rainwater savings* = [(a)/(b)] or (b)	

*where the amount collected (a) is greater than the demand (b), the rainwater savings (c) are equal to the demand (b)

Fittings approach

A28 The fittings approach given in G2 uses the methodology described in this appendix to calculate the water consumption of ranges of fittings that meet the performance targets.

Appendix B – Wholesome water

B1 For ease of reference, the provisions on the wholesomeness of water in legislation made under section 67 of the Water Industry Act 1991 are set out below. This legislation is subject to Crown copyright protection, and is available in its original form on www.legislation.gov.uk.

B2 For convenience, the relevant regulations and amendments concerned are reproduced here in a consolidated form with some deletions or additional text where it is considered it would assist comprehension. These are only extracts of the legislation, and in any case of doubt the original regulations and amendments should be consulted.

B3 For reasons of brevity the Schedules and Tables of these Regulations are not reproduced here.

Water Supply (Water Quality) Regulations 2000 (SI 2000/3184)

Note: The Water Supply (Water Quality) Regulations 2001 (SI 2001/3911) which apply in Wales contain equivalent requirements.

Wholesomeness

4. (1) Water supplied:

   a. for such domestic purposes as consist in or include, cooking, drinking, food preparation or washing; or

   b. to premises in which food is produced,

   shall, subject to paragraphs (4) and (5), be regarded as wholesome for the purposes of Chapter III [(quality and sufficiency of supplies) of Part III (water supply) of the Water Industry Act 1991], as it applies to the supply of water for those domestic purposes, if the requirements of paragraph (2) are satisfied.

   (2) The requirements of this paragraph are:

   a. that the water does not contain:

      i. any micro-organism (other than a parameter listed in Schedule I) or parasite; or

      ii. any substance (other than a parameter listed in Schedule I),

      at a concentration or value which would constitute a potential danger to human health;

   b. that the water does not contain any substance (whether or not a parameter) at a concentration or value which, in conjunction with any other substance it contains (whether or not a parameter) would constitute a potential danger to human health;

   c. that the water does not contain concentrations or values of the parameters listed in Tables A and B in Schedule 1 in excess of or, as the case may be, less than, the prescribed concentrations or values;

   d. that the water satisfies the formula [nitrate]/50 + [nitrite]/3≤1, where the square brackets signify the concentrations in mg/l for nitrate (NO_3) and nitrite (NO_2).

   (3) The point at which the requirements of paragraph (2), in so far as they relate to the parameters set out in Part I of Table A and in Table B in Schedule 1 are to be complied with, is:

   a. in the case of water supplied from a tanker, the point at which the water emerges from the tanker;

   b. in any other case, the consumer's tap.

   (4) Water supplied for regulation 4(1) purposes shall not be regarded as wholesome for the purposes of Chapter III if, on transfer from a treatment works for supply for those purposes:

   a. it contains a concentration of the coliform bacteria or E. coli parameter (items 1 and 2 in Part II of Table A in Schedule 1) in excess of the prescribed concentrations; or

   b. it contains a concentration of nitrite in excess of 0.1mgNO_2/l.

   (5) Subject to paragraph (6), water supplied for regulation 4(1) purposes shall not be regarded as wholesome for the purposes of Chapter III if, on transfer from a service reservoir for supply for those purposes, it contains a concentration of the coliform bacteria or E. coli parameter in excess of the prescribed concentrations.

   (6) Water transferred from a service reservoir for supply for regulation 4(1) purposes shall not be regarded as unwholesome for the purposes of Chapter III because the maximum concentration for the coliform bacteria parameter is exceeded if, as regards the samples taken in any year in which the reservoir in question is in use, the results of analysis for that parameter establish that in at least 95 per cent of those samples coliforms were absent.

Private Water Supplies Regulations 2009 (SI 2009/3101)

Note: The Private Water Supplies (Wales) Regulations (SI 2010/66) which apply in Wales contain equivalent requirements.

Wholesomeness

4. Water is wholesome if all the following conditions are met:

   a. it does not contain any micro-organism, parasite or substance, alone or in conjunction with any other substance, at a concentration or value that would constitute a potential danger to human health;

   b. it complies with the concentrations or values specified in Part 1 of Schedule 1; and

   c. in the water:

$$\frac{\text{nitrate (mg/l)}}{50} + \frac{\text{nitrate (mg/l)}}{3} \leq 1$$

Appendix C – References

Relevant legislation (available via www.opsi.gov.uk)

The Building (Approved Inspectors etc.) Regulations 2010 (SI 2010/2215).

The Building Regulations 2010 (SI 2010/2214).

The Food Hygiene (England) Regulations 2006 (SI 2006/14). HMSO, 2006.

The Food Hygiene (Wales) Regulations 2006 (SI 2006/31 W5). HMSO, 2006.

The Gas Safety (Installation and Use) Regulations 1994 (SI 1994/1886). HMSO, 1994.

The Private Water Supplies Regulations 2009 (SI 2009/3101). HMSO, 2009.

The Private Water Supplies (Wales) Regulations 2010 (SI 2010/66). HMSO, 2010.

The Water Supply (Water Fittings) Regulations 1999 (SI 1999/1148). HMSO, 1999.

The Water Supply (Water Quality) Regulations 2000 (SI 2000/3184). HMSO, 2000.

The Workplace (Health, Safety and Welfare) Regulations 1992 (SI 1992/3004). HMSO, 1992.

The Water Industry Act 1991 HMSO, 1991.

The Health and Safety at Work etc. Act 1974 HMSO, 1974.

The European Communities Act 1972 HMSO, 1972.

Standards

ANSI-NSF 41:2005 + A1:2007. *Non-liquid saturated treatment system.* NSF, 2007.

BS EN 257:1992 *Mechanical thermostats for gas-burning appliances.* BSI, 1992.

BS 417-2:1987 *Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders. Metric units.* BSI, 1987.

BS 853-1:1996 *Specification for vessels for use in heating systems. Calorifiers and storage vessels for central heating and hot water supply.* BSI, 1996.

BS EN ISO 1043-1:2002 *Plastics. Symbols and abbreviated terms. Basic polymers and their special characteristics.*

BS EN 1111:1999 Sanitary tapware. Thermostatic mixing valves (PN 10). General technical specification. BSI, 1999.

BS EN 1287:1999 Sanitary tapware. Low pressure thermostatic mixing valves. General technical specifications. BSI, 1999.

BS EN 1490:2000 *Building valves. Combined temperature and pressure relief valves. Tests and requirements.* BSI, 2000.

BS 1566-1:2002 *Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods.* BSI, 2002.

BS 3198:1981 *Specification for copper hot water storage combination units for domestic purposes.* BSI, 1981.

BS 4213:2004 *Cisterns for domestic use. Cold water storage and combined feed and expansion (thermoplastic) cisterns up to 500 l. Specification.* BSI, 2004.

BS 5918:1989 *Code of Practice for Solar heating systems for domestic hot water.* BSI 1989.

BS 6283-2:1991 *Safety and control devices for use in hot water systems. Specifications for temperature relief valves for pressures from 1 bar to 10 bar.* BSI, 1991.

BS 6283-3:1991 *Safety and control devices for use in hot water systems. Specification for combined temperature and pressure relief valves for pressures from 1 bar to 10 bar.* BSI, 1991.

BS 6465-1:2006 + A1:2009 *Sanitary installations. Code of practice for the design of sanitary facilities and scales of provision of sanitary and associated appliances.* BSI, 2006.

BS 6465-2:1996 *Sanitary installations. Code of practice for space requirements for sanitary appliances.* BSI, 1996.

BS 6465-3:2006 *Sanitary installations. Code of practice for the selection, installation and maintenance of sanitary and associated appliances.* BSI, 2006.

BS 6700:2006 + A1:2009 *Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Specification.* BSI, 2006.

BS 7291-1:2006 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. General requirements.*

BS 7291-2:2006 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Specification for polybutylene (PB) pipes and associated fittings.*

BS 7291-3:2006 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Specification for cross-linked polyethylene (PE-X) pipes and associated fittings.*

BS 7671:2008 *Requirements for electrical installations (IET Wiring Regulations 17th Edition).*

BS 8000-15:1990 *Workmanship on Building Sites Code of practice for hot and cold water services (domestic scale).* BSI, 1990.

BS 8515:2009 *Rainwater harvesting systems, Code of Practice.*

APPENDIX C – REFERENCES

BS 8525-1:2010, *Greywater system – Code of Practice*

BS EN 200:2008, (Sanitary tapware. Single taps and combination taps for water supply systems of type 1 and type 2. General technical specifications.)

BS EN 1112:2008, (Sanitary tapware. Shower outlets for sanitory tapware for water supply systems type 1 and type 2. General technical specification.)

BS EN 12050-1:2001 *Wastewater lifting plants for buildings and sites. Principles of construction and testing. Lifting plants for wastewater containing faecal matter.*

BS EN 12050-2:2001 *Wastewater lifting plants for buildings and sites. Principles of construction and testing. Lifting plants for faecal-free wastewater.* BSI, 2001.

BS EN 12050-3:2001 *Wastewater lifting plants for buildings and sites. Principles of construction and testing. Lifting plants for wastewater containing faecal matter for limited applications.*

BS EN 12897:2006 Water supply. Specification for indirectly heated unvented (closed) storage water heaters. BSI, 2006.

BS EN 12976-1:2006 *Thermal solar systems and components. Factory made systems. General requirements.* BSI, 2006.

prCEN/TS 12977-1:2008 *Thermal solar systems and components. Custom built systems. General requirements.* BSI, 2001.

BS EN 15092:2008 *Building valves. Inline hot water supply tempering valves. Tests and requirements. BSI, 2008.*

BS EN 60335-2-21:2003 *Household and similar electrical appliances. Safety. Particular requirements for storage water heaters.* BSI, 2003.

BS EN 60335-2-35:2002 *Specification for safety of household and similar electrical appliances.* BSI, 2002.

BS EN 60335-2-73:2003 *Specification for safety of household and similar electrical appliances. Particular requirements for fixed immersion heaters.* BSI, 2003.

BS EN 60730-2-9:2002 *Automatic electrical controls for household and similar use. Particular requirements for temperature sensing controls.* BSI, 2002.

Other documents

Water Regulations Advisory Scheme. *Water Regulations Guide.* WRAS, 2000.

WRAS IGN 9-02-04: Issue 1: 1994. *Reclaimed water systems.* WRAS, 1994. (www.wras.co.uk)

WRAS Information & Guidance Note No. 9-02-05 *Marking and identification of pipework for reclaimed (greywater) systems.* WRAS, 1999. (www.wras.co.uk)

Market Transformation Programme. *Rainwater and greywater: technical and economic feasibility.* MTP, 2007.

Market Transformation Programme. *Rainwater and greywater: a guide for specifiers.* MTP, 2007.

Market Transformation Programme. *Rainwater and greywater: review of water quality standards and recommendations for the UK.* MTP, 2007.

NHS D08 *National Health Service Model Engineering Specifications Thermostatic Mixing Valves (Healthcare Premises).* NHS.

BRE Information paper IP14/03 *Preventing hot water scalding in bathrooms: using TMVs.*

Food Standards Agency Code of Practice *Food hygiene – a guide for businesses. (www.food.gov.uk)*

English Heritage publication *Building Regulations and Historic Buildings, 2002 (revised 2004), (www.english-heritage.org.uk)*

HSC publication *Legionnaires' Disease: Control of Legionella Bacteria in Water Systems. Approved code of practice and guidance. L8*, Health and Safety Commission 2000. ISBN 0717617726

CIBSE Commissioning Code M: *Commissioning Management*, CIBSE, 2003. ISBN 1 90328 733 2

Health and Safety Commission, *Workplace health, safety and welfare, Approved code of practice*, HMSO 1992.

CIBSE Guide G: *Public health engineering*, CIBSE, 2004. ISBN 1 90328 742 1

CIBSE Domestic Building Services Panel: *Solar heating design and installation guide*, 2007. ISBN 978 1 90328 784 2

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LIST OF APPROVED DOCUMENTS

The following documents have been published to give guidance on how to meet the Building Regulations. You can find the date of the edition approved by the Secretary of State at www.gov.uk.

Approved Document A
Structure

Approved Document B
Fire safety
Volume 1: Dwellinghouses
Volume 2: Buildings other than dwellinghouses

Approved Document C
Site preparation and resistance to contaminants and moisture

Approved Document D
Toxic substances

Approved Document E
Resistance to the passage of sound

Approved Document F
Ventilation

Approved Document G
Sanitation, hot water safety and water efficiency

Approved Document H
Drainage and waste disposal

Approved Document J
Combustion appliances and fuel storage systems

Approved Document K
Protection from falling, collision and impact

Approved Document L1A
Conservation of fuel and power in new dwellings

Approved Document L1B
Conservation of fuel and power in existing dwellings

Approved Document L2A
Conservation of fuel and power in new buildings other than dwellings

Approved Document L2B
Conservation of fuel and power in existing buildings other than dwellings

Approved Document M
Access to and use of buildings
Volume 1: Dwellings
Volume 2: Buildings other than dwellings

Approved Document P
Electrical Safety – Dwellings

Approved Document Q
Security – Dwellings

Approved Document 7
Materials and workmanship

Appendices for property protection, safety and water-based fire suppression systems

Escapes of water and its effects are seldom fully considered by designers, installers and project managers. Best practice with respect to the design and the installation of various plumbing systems is well established. Despite the quality and the technical detail available, escape of water incidents remain the largest peril faced by insurers in the domestic and residential sectors. This appendix reinforces what should already be happening during the various project stages by collating pertinent Regulations and guidance in a single document. Insurers' essential requirements outlines the basic principles that all designers, installers and commissioners should follow throughout a project.

Whilst leak detection and prevention technologies have existed for several years, it is still considered to be in its infancy. Nevertheless, insurers expect consideration to be given to the inclusion of such technologies especially where a risk assessment identifies an escape of water incident being significant in terms of cost and displacement impact. For example, in hotels, and multi-storey residential apartment blocks.

Appendix D: Roles and responsibilities

Appendix E: Escape of water risk assessment

Appendix F: Qualifications

Appendix G: Methods, protection, automatic isolation devices and testing

Appendix H: Lifting plant (sump pumps)

Appendix I: Water-based fire suppression systems

Appendix D: Roles and Responsibilities

A matrix can be used to set out the individual roles within a project, the associated responsibilities and what actions are required from individuals and groups. No two projects are alike; therefore, it is the role of the Project Manager to identify the various roles and responsibilities within the project and to identify gaps and the additional resources that may be needed. Figure 1.1 gives an overview of the possible stakeholders and Table 1.2, a possible RACI Matrix. As an example, per the matrix, the subcontractor is responsible for undertaking the pressure test, but the main contractor accountable for its completion, i.e. ensuring the test is completed properly and that a permanent record is made and retained. The designer, the competent authority, should be consulted and the Project Manager informed, allowing project progress to be monitored.

Figure 1.1: **Stakeholder chart**

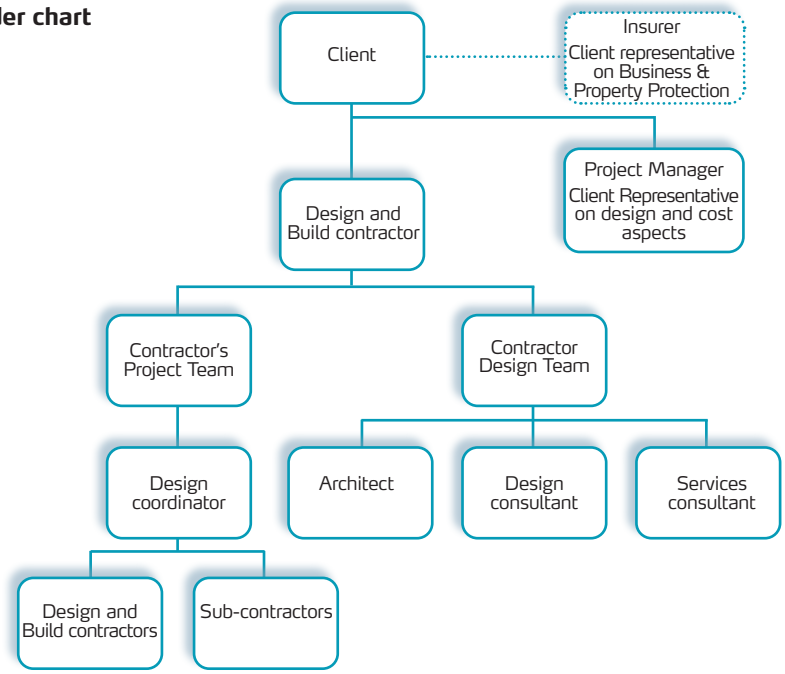


Table 1.2: **Example RACI Matrix**

DELIVERABLE	Project Manager	Designer	Main Contractor	Subcontractor
Design				
The system outlet temperatures shall be limited to 48°C.				
The system pressure shall be limited to 3.0-bar				
First Fix				
The system must include a 3.0-bar pressure reducing valve				
Pressure testing (1st Fix)				
Test Recording				

	Responsible	Assigned to complete the task or deliverable
	Accountable	Has final decision-making authority and accountable for completion
	Consulted	An advisor, stakeholder or expert who consulted before a decision or action
	Informed	Must be informed after decision or action

Appendix E: Escape of water Risk Assessment

E.1 Forward

In order to provide a structured approach to the risk management of the water service systems, a formal Water Services Management Plan should be developed as part of the design and installation process. The plan is usually based on a risk assessed approach for all the water systems, considering the potential impact of failure and corresponding mitigation measures. This can also incorporate other water damage exposures such as weather and flooding related risks. The format and content of the plan will vary in relation to the specific project, although should normally include the following sections:

E.2 Introduction

This should include the objective and scope of the plan, issue and revision record.

There should be a list of designated individuals with the defined roles and responsibilities for the control and execution of pipework installation, testing, inspection and commissioning. There should be a designated responsible person with regards to the overall supervision and application of the Water Services Management Plan.

E.3 Water Damage Risk Assessment

List and summary of the various sources of water services, including permanent fire protection systems, and assessment of the likelihood of them causing a loss together with the impact in terms of financial cost of damage that could result and delays to the contract programme.

E.4 Management and Mitigation

For each system list the risk controls being taken to remove the hazard or at least minimise the risk further, making reference to the Essential Principle (EP) and Appendices F, G, H and I, and including:

- System design features, including:
  - water monitoring and shut off devices
  - accessible isolation valves
  - water tanks at lower levels with adequate bunds and suitable drainage
  - avoiding combined service risers (electrical/data cabling routed together)
  - avoiding combined domestic and sprinkler systems to allow for separate isolation
- Quality control, including relevant standards, contractor management and operative qualifications, training and supervision
- Installation risk management measures including sequencing, method statements/permits, ITPs and defect monitoring.

PERMIT TO WORK - WATER WORKS	
Form number	
Organisation	
Project	
Issue date	
Expiry date	
Instructions	Each permit is valid for *NUMBER (N)* days
Activity	*Brief description of work*

ALL QUESTIONS TO BE ANSWERED

Question 1	Are all operatives and supervisors suitably qualified and have the necessary experience?	Yes / No
Question 2	Are all tools and materials necessary to complete the works available (and calibrated where appropriate)?	Yes / No
Question 3	Are there any manufacturer's guidelines/instructions for the pipework, fittings and/or systems to be worked on?	Yes / No
Question 4	Will the system be isolated post works?	Yes / No
Question 5	Will the works be tested and/or commissioned?	Yes / No
Question 6	Has the work been risk assessed and the water management plan updated?	Yes / No
Question 7	Have all joints been photographed following connection and submitted to the main contractor to keep on record?	Yes / No
If NO please provide details	*Details*	

Operatives	
Supervisor(s)	

E.5 Emergency Response Plan and Team

An emergency response team should be put in place to deal specifically with an escape of water incident supported by a formal written emergency plan and procedures with spill kits and emergency pumps provided. Specific training and instruction should be given to the relevant staff.

Where guards are in place outside project work hours their duties and assignment Instructions should be extended to include routine patrols to check for escape of water where wet services are live. They should be made aware of the location of isolation valves and are given instructions on how to isolate in an emergency.

The plan should include emergency procedures and responses for dealing with the immediate effects of an incident and the recovery strategies to minimise the impact on the contract programme plus post incident investigation and actions, including salvage and restoration.

Each plan will of course be bespoke, although an example of typical information included would be:

- list of a nominated emergency response team (both during site hours and outside site hours)
- cascade call out list with contact details
- list of emergency procedures to deal with a) the initial detection and response, b) the immediate effects of the incident, and c) the recovery/restoration
- plans identifying isolation valve locations and the areas that they isolate with method statement for the isolation of water services
- details of spill kits and emergency pumps and locations on site and how water can be removed
- details of specialist contractors to provide additional salvage and restoration services and equipment such as pumps, dehumidifiers, wet-dry vacuums etc.

This should be supported with appropriate training and instruction to the relevant parties.

E.6 Test and Commissioning

Formal test and commissioning plans and protocols for pre-test, test and post test procedures i.e. for visual inspections and parameters for pneumatic and hydrostatic based testing, should meet the relevant industry standards i.e. The Water Supply (Water Fittings) Regulations 1999, BS EN 806 and BESA (Building Engineering Services Association) Guide to good practice: Site Pressure Testing of Pipework TR.

The plan and associated risk assessments should be reviewed periodically due to the changing nature of projects to ensure they remain adequate and effective.

Appendix F: Qualifications

F.1 Qualifications and training

Installation contractors should be required to only use qualified, trained plumbers with appropriate skill sets to work on water distribution systems. Installers/supervisors should be competent with relevant experience. Further, they should be members of an appropriate body. For example, The Chartered Institute of Plumbing and Heating Engineering ('CIPHE'). Relevant qualifications include:

- Level 3 NVQ (or equivalent)
- Advanced Craft Gold CSCS (Construction Skills Certification Scheme) card as issued by the Joint Industry Board for Plumbing and Mechanical Engineering Services (JIB-PMES).

Apprentices, trainees and those operatives holding only a blue CSCS card should be under the direct supervision of qualified plumbers. Unqualified operatives should never be engaged to work on water services unsupervised.

Any operatives working on a system should have also received on-site training by the system supplier/manufacturer in accordance with the installation manuals. Standards specified by the manufacturer often go beyond those laid down in the British Standards and other guidance documents so can often be regarded as 'best practice'. The training courses will often be vetted by bodies such as the CIPHE.

Where new systems are employed using different techniques or bespoke machinery, all operatives should be fully trained by the manufacturer supplying the system and training records kept verifying this training has been completed. As a minimum, it should be confirmed that operatives have received verified training on the proposed system within the last 12 months.

Training records should be retained by the Main Contractor.

Appendix G: Methods, Protection, Automatic isolation devices and Testing

G.1 Background

Investigations into escape of water incidents have identified joint failure to be the predominant source. Whilst changes in supply pressure tend to precipitate the failure of a joint, there is overwhelming evidence to indicate that in the majority of cases, the pressure variation was not excessive and so the joint was likely defectively made in the first instance. The damage caused by such incidents can often be compounded by the location of the joint. For example, buried in floor screed or concealed within a void.

The majority of manufacturers provide jointing guidance and test requirements that is intended to identify defectively made joints. This is in addition to the installation and test requirements set out in The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. A test will more likely than not identify a defectively made joint. There is overwhelming evidence to indicate that in most cases, the supply was not properly tested. To that extent, the majority of escape of water incidents could have been avoided had the manufacturers guidance been followed and the supply installed and tested in accordance with the Regulations and Standards.

G.2 Scope

This guidance note provides information to assist designers, installers and commissioners on the most vulnerable parts of a supply. It gives guidance on how supplies should be installed, protected along with how joints should be assembled. Further, the test requirements as set out in The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. The main purpose of the guidance is to prevent the likelihood of an escape of water incident.

G.3 Isolation and shut-off valves (also see section G.9)

Provision should be made for the installation of strategic isolation and shut-off valves. These should be fitted at the mains perimeter intake points, on riser branch pipe connection points on each floor, storage cistern pumps and any breaker tank booster pumps. For very large floors, multiple valves may be required. Isolation and shutoff valves on both permanent and temporary water services should be readily accessible. Schematic plans identifying isolation valves should be displayed and valves clearly tagged showing the areas that they isolate.

G.4 Pressure management

Investigations into escape of water incidents have identified that changes in supply pressure tend to precipitate the failure of a joint, the predominant source of escapes of water. To that extent, consideration has to be given to the system operating pressure. Insurers' expect that for every incoming supply, where applicable, the pressure shall be controlled via the use of a pressure reducing valve rated at 3.0- bar. For boosted risers, the supply pressure to each individual apartment shall be similarly reduced to 3.0-bar. Booster sets shall also include suitable sized expansion vessels and surge arrestors to mitigate the effects of hydraulic shock ("water hammer").

G.5 Fitting location

Schedule 2 Paragraph 7.-(1) of the Water Supply (Water Fittings) Regulations 1999 states that no water fitting shall be embedded in any wall or solid floor. Whilst concealed water fittings are permitted, they should be located in purpose made ducts or chases where the removal of the covering is achievable for inspection and repair purposes. Joints should be kept to an absolute minimum. Similar guidance is in BS EN 8558:2015, a supplementary guide to BS EN 806. Paragraph 4.3.37 and Figures 12 and 13 are extracts from BS 8558:2015.

4.3.37 Accessibility of pipes and water fittings

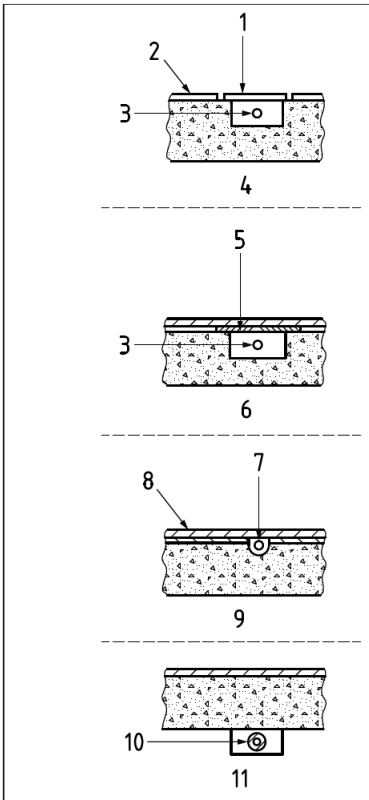
The following factors should be assessed (see Figure 12).

a) The purpose for which the building is to be used: importance of aesthetic considerations, consequences of leakage from inaccessible parts of the pipework and whether or not the system is subject to routine inspection and maintenance.

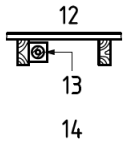
b) The pipework materials and jointing methods: reliability of joints, resistance to both internal and external corrosion and the flexibility of pipe when inserted in curved ducts or sleeves.

BRITISH STANDARD **BS 8558:2015**

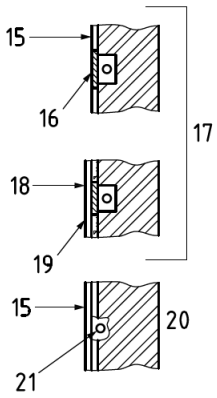
Figure 12 **Accessibility of pipework** *(1 of 2)*



a) Accessibility of pipes under solid floors

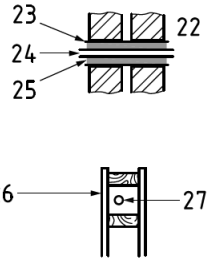


b) Accessibility of pipes under suspended floors

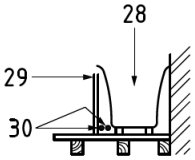


c) Accessibility of pipes in solid walls (see Note 1)

NOTE 1 This is only permitted in an internal wall and if pipe can be capped off or isolated if a leak becomes apparent.

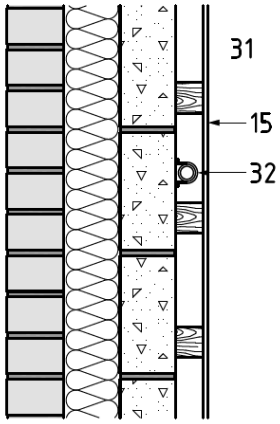


d) Accessibility of pipes in cavity walls [A)]



e) Accessibility of pipes behind bath panels

Figure 12 – Accessibility of pipework *(2 of 2)*



f) Accessibility of pipes in studded internal walls

NOTE 2 Copyright is claimed in Figure 12f). Reproduction of this figure and making products from it might infringe that copyright. Details of the copyright owner can be found in the Foreword, Information about this document.

Key

1 Removable cover (recommended)
2 Floor finish
3 Pipes in purpose-made chase
4 Thermally insulated if an unheated building
5 Tiling or other surface finish over wood or metal cover
6 Acceptable only where few joints are enclosed and pipe can be withdrawn for examination
7 Void maintained around pipe located in purpose-made chase/duct within screed, i.e. pipe not bedded or set into the chase and does not contain any screed/concrete
8 Surface finish to floor
9 Only acceptable where few joints are enclosed
10 Pipe thermally insulated in purpose-made duct under floor
11 Acceptable only where pipes are of continuous length and can be withdrawn for inspection and/or replacement
12 Ground floor
13 Pipe thermally insulated
14 Boards removable at intervals of not more than 2 m and at every pipe joint or inspection of whole length of pipe
15 Surface finish
16 Removable cover over purpose-made duct
17 Pipes fixed on external face of an external wall, or located within the internal face of a wall with no in-built thermal insulation (i.e. a solid wall), to be thermally insulated
18 Wood or metal cover
19 Plaster or tiling
20 Internal wall
21 Pipe in chase
22 Cavity wall
23 Duct/sleeve
24 Pipe in duct
25 Thermal insulation
26 Plaster board and studding wall (internal)
27 Pipe run within wall
28 Bath
29 Removable bath panel
30 Correct position for pipes [B)]
31 Dry lining or studding on external wall
32 Pipe located within wall

[A)] No pipes should be laid within a cavity.

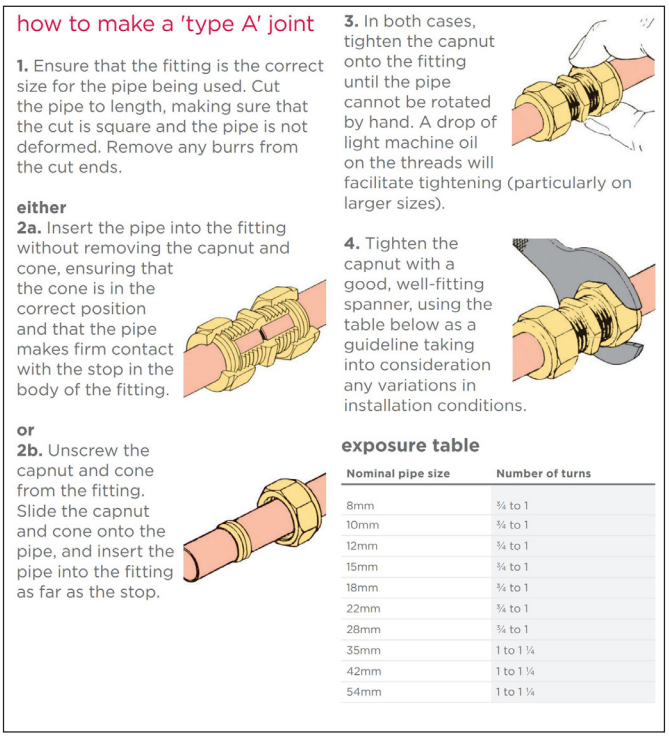
[B)] The pipes should be laid on the side of the bath adjacent to the removable panel.

G.6 Jointing Methods

The Regulations and Standards do not provide guidance on how to "assemble" the various joint types, only that the manufacturer's instructions should be referred to. When making a joint, it is imperative to consider what type of joint is being assembled. For example, for a compression joint, is it being made to copper, chromeplated copper or plastic. This will affect the constituent parts used and how the joint is assembled.

The following is an extract from guidance published by Peglar Yorkshire concerning compression fittings when making a joint to copper pipe. However, when making a joint to John Guest barrier pipe, per the extract from guidance published by John Guest, brass olives are not recommended and a specific insert must be used.

To that extent, manufacturers' guidance should always be sought and if in doubt, the manufacturers' technical support department should be contacted.



how to make a 'type A' joint

1. Ensure that the fitting is the correct size for the pipe being used. Cut the pipe to length, making sure that the cut is square and the pipe is not deformed. Remove any burrs from the cut ends.

either

2a. Insert the pipe into the fitting without removing the capnut and cone, ensuring that the cone is in the correct position and that the pipe makes firm contact with the stop in the body of the fitting.

or

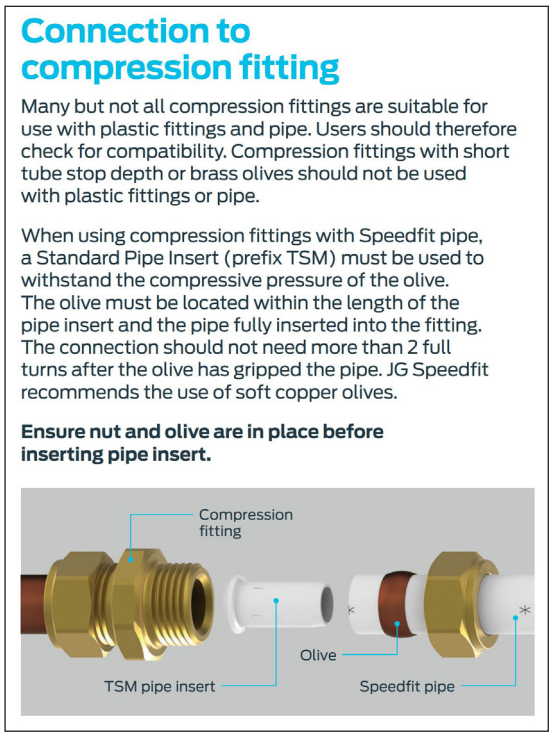
2b. Unscrew the capnut and cone from the fitting. Slide the capnut and cone onto the pipe, and insert the pipe into the fitting as far as the stop.

3. In both cases, tighten the capnut onto the fitting until the pipe cannot be rotated by hand. A drop of light machine oil on the threads will facilitate tightening (particularly on larger sizes).

4. Tighten the capnut with a good, well-fitting spanner, using the table below as a guideline taking into consideration any variations in installation conditions.

exposure table

Nominal pipe size	Number of turns
8mm	¾ to 1
10mm	¾ to 1
12mm	¾ to 1
15mm	¾ to 1
18mm	¾ to 1
22mm	¾ to 1
28mm	¾ to 1
35mm	1 to 1 ¼
42mm	1 to 1 ¼
54mm	1 to 1 ¼



Connection to compression fitting

Many but not all compression fittings are suitable for use with plastic fittings and pipe. Users should therefore check for compatibility. Compression fittings with short tube stop depth or brass olives should not be used with plastic fittings or pipe.

When using compression fittings with Speedfit pipe, a Standard Pipe Insert (prefix TSM) must be used to withstand the compressive pressure of the olive. The olive must be located within the length of the pipe insert and the pipe fully inserted into the fitting. The connection should not need more than 2 full turns after the olive has gripped the pipe. JG Speedfit recommends the use of soft copper olives.

Ensure nut and olive are in place before inserting pipe insert.

Compression fitting
Olive
TSM pipe insert
Speedfit pipe

The use of plastic fittings is becoming more prevalent. The use of plastic pipe can reduce, and in some instances negate, the need for joints due to the available coil lengths. Plastic fitting joints offer comparable performance to metal compression joints when made correctly. Plastic fittings can be joined to plastic or copper pipe. It is imperative that the joining pipe-end is prepared correctly as to avoid damage to the internal components of the fitting. Further, that the pipe-end is pushed sufficiently far enough into the joint. As the jointing techniques for each manufacturer is slightly different, manufacturers guidance should be sort and if in doubt, the manufacturers technical support department should be contacted.

The following extracts is from guidance published by John Guest and Polypipe

MAKING A GOOD CONNECTION

Fittings and pipe should be kept clean, bagged and undamaged before use.

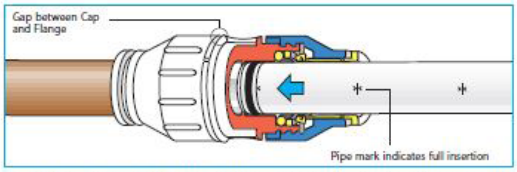
PREPARE THE PIPE

Ensure the pipe is free of score marks. Cut the pipe square. When using Speedfit Barrier Pipe cut along an insertion mark. We recommend the use of JG Pipe Cutters.

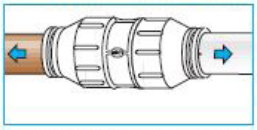
To prevent damage to the 'O' ring remove all burrs and sharp edges. When using Speedfit Pipe use a Superseal Pipe Insert. A twisting motion will aid insertion. The insert should only be used with Speedfit Pipe.

NEW TWIST AND LOCK FITTINGS

The fitting should be in the 'unlocked' position, this is shown by a small gap between the screwcap and the body flange.



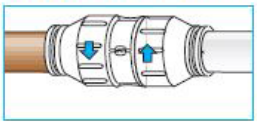
Push the pipe into the fitting, up to the pipe stop. If the Speedfit Pipe has been cut correctly the insertion mark on the pipe will be level with the collet head. The 'O' ring on the Superseal Pipe Insert provides a secondary seal against the bore of the fitting. **A good connection has been made.**



If you are not using collet clips, (see page 32) ensure that the screwcaps are in the locked position.

Pull to check it is secure. It is good practice to test the system prior to leaving the site or before use. Our recommended test procedure is shown in our Technical Checklist.

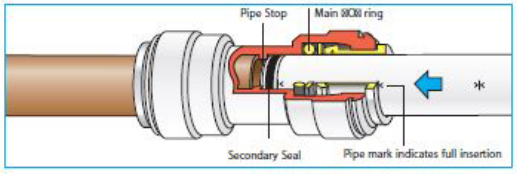
ADDED BENEFIT OF TWIST AND LOCK

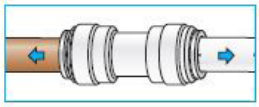


Twist the screwcap until it touches the body flange. This locks the pipe into position and increases the 'O' ring seal around the pipe for greater security.

STANDARD FITTINGS

Standard Speedfit connections are made in the same way as Twist and Lock.





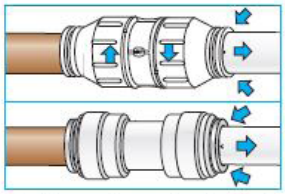
Pull to check the connection is secure. It is good practice to test the system prior to leaving the site or before use.

Our recommended test procedure is shown in our Technical Checklist.

TO DISCONNECT

Ensure the system is depressurised.

The screwcap on Twist and Lock fitting will need to be turned back to the unlocked position.



Push the collet square against the face of the fitting by using fingers or with the help of our collet release tool.

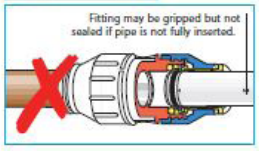
With the collet held in this position the pipe can be removed.

The fitting can be used again without the need for replacement parts.

WHAT NOT TO DO

Don't use damaged or scored pipe.

Don't use hacksaws to cut the pipe or leave burrs on the end of the pipe.



Don't forget to push the pipe fully into the fitting, past both the collet (gripper) and the 'O' ring.

Do not insert fingers into the fitting as the stainless steel teeth may cause injury.

Remember to pressure test the completed installation according to the recommendations in our Technical Checklist.

Jointing

There are **five** vital steps to successfully jointing the PolyPlumb system.

Step 1a: Cutting PolyPlumb pipe

Check the pipe is not scored or scratched in any way and if it is, cut back to a point where there is no damage. Using a Polypipe pipe cutter, cut the pipe squarely using the "K" marks on the pipe as a guide. These marks indicate when the pipe has been inserted into the fitting correctly.

Step 1b: Cutting copper pipe for insertion in a PolyPlumb fitting

Wherever possible, use a rotational pipe cutter when cutting copper pipe. Ensure that all cut ends have a rounded lead in, with burrs removed. Never use a hacksaw. You will need to mark the insertion depth on the pipe as below.

Pipe Diameter (mm)	10	15	22	28
Insertion Depth (mm)	22	27	30	35

Step 2: Use of pipe stiffener

Insert a pipe stiffener into the pipe (not required on copper pipe). Pipe stiffeners are an integral part of the joint when using Polypipe grey pipe with either PolyPlumb fittings or compression fittings and need to be fully inserted into the pipe end.

Polypipe offer two types of pipe stiffener to be used with PolyPlumb fittings - metal and plastic. When using a pipe stiffener, ensure it is fully inserted before applying the fitting.

Step 3: Visually check fitting and fitting components

Visually check that all components are present, undamaged and free from contamination.

Lubricants

All Polypipe fittings are supplied with pre-lubricated EPDM 'O' rings. If any further lubrication is required only Polypipe silicone lubricant should be used. Substances such as solder flux must not be used.

Step 4: Insert pipe fully into fitting

Insert pipe into the fitting, ensuring it is inserted to the full socket depth denoted by the next "K" mark on the pipe.

Step 5: Check joint security

A quick tug on the pipe will confirm that the pipe is inserted past the grab ring and that a grab ring was present in the fitting. It does not however ensure that the pipe is fully inserted as this can only be confirmed by using the depth insertion mark.

IMPORTANT NOTE: Do not re-joint

On no account should a pipe be removed from a jointed PolyPlumb fitting by dismantling. If the same fitting is then re-jointed, there is real risk that the outer edge of the grab ring will have become damaged and this will reduce the pull-out performance of the joint when subjected to pressure. The joint will almost certainly fail prematurely and potentially cause serious injury.

Dismantling a PolyPlumb joint

PolyPlumb fittings must not be dismantled for any reason prior to jointing.

Step 1: Procedure for using the component pack of spares. Dismantling the joint

If it is necessary to remove a joint pipe from a fitting, the cap-nut should be unscrewed and the pipe with all the socket components present on the pipe end should be pulled out of the socket of the fitting. The pipe end complete with all the socket components should be cut off and discarded. A complete component pack of socket spares should be fitted to the socket as described below and pipe jointing should be carried out as described.

Step 2: Replacement components

The component pack (Code: PB95XX) is supplied as a cap-nut with all the socket components present in the correct order and retained by a retaining cap.

Step 3: Preparing components

Completely remove the retaining cap, ensuring that the socket components remain within the cap-nut.

Step 4: Replacing the components

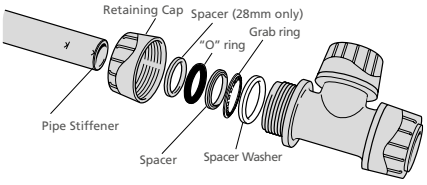
Without removing any of the socket components from the cap-nut, introduce the cap-nut and socket components to the socket of the fitting and tighten up the cap-nut by hand, ensuring that the components enter the socket without snagging.

Step 5: Checking the fitting

Carry out a visual check to ensure that all socket components are present in the correct order as shown in the diagram and that the rubber 'O' ring is lubricated. If in doubt, the 'O' ring should be re-lubricated using PolyPlumb silicone lubricant.

Step 6: Fitting the joint

Carry out pipe jointing as described previously.



PolyPlumb fittings general arrangement

Reduced component fittings

Changes have been made to 15mm PolyPlumb couplers, elbows and tees and 22mm PolyPlumb elbows, tees and couplers (or connectors), which need to be considered when using PolyPlumb spares kits with these fittings, as follows:

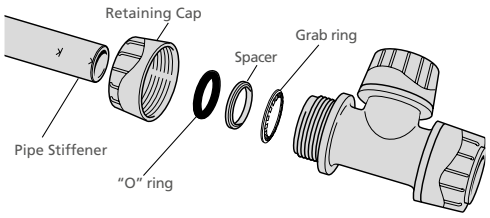
Step 1: Original PolyPlumb fittings

If the bottom white washer is present in the fitting below the grab-ring, then the spares kit can be used as supplied without making any changes.

Step 2: New PolyPlumb fittings

If there is no bottom white washer present below the grab ring with one of the five listed fittings, then this is one of the fittings which has been modified.

Before the spares kit is used, the carrier moulding should be carefully removed from the cap-nut and the bottom white washer should be removed and discarded without changing the order of any of the other components. After this has been done, the spares kit should be offered up to the socket of the fitting, inserting the components into the socket in the order they are within the kit and then screwing down the cap-nut onto the outside of the socket.



15mm couplers, elbows and tees and 22mm elbows, tees and couplers (or connectors)

G.7 Thermal protection

The Regulations and Standards require water fittings and pipework etc. to be thermally protected. This not only increases thermal efficiency of a system, but also protects fittings and pipework from the damaging effects of freezing action. Insulation does not keep the "cold out", but rather, assists the pipework and fittings in retaining the "heat energy" in the water in the pipe. Investigations into escape of water incidents as a result of freezing action has identified that in most instances, the insulation thickness was inadequate. The following insulation thickness table is an extract from guidance published by WRAS, which concerns The Water Supply (Water Fittings) Regulations 1999 and BS EN 1057, the pertinent British Standard that concerns insulating pipework.

Table 3.1: Recommended minimum commercial thicknesses of thermal insulation for copper water pipes of minimum wall thickness complying with BS EN 1057 in normal conditions of exposure.

External diameter of pipe	Thermal conductivity of insulation material at 0^0 C in W/(m.K)				
	0.02	0.025	0.03	0.035	0.04
mm	mm	mm	mm25* (45) 19 (15)	mm	mm
15 22 28 35 42 and over	20 (20) 15 (9) 15 (6) 15 (4) 15 (3)	30 (30) 15 (12) 15 (8) 15 (6) 15 (5)	13 (10) 9 (7) 9 (5)	25* (70) 19 (19) 19 (12) 9 (8) 9 (5)	32* (91) 25 (24) 22 (14) 13 (10) 9 (8)

Notes

1. Except for 15 mm pipes with thermal conductivities of 0.030, 0.035 and 0.040 W/(m.K), shown with a *, which are limited to 50% ice formation after 9, 8 and 7 hours respectively, the above recommended commercially available minimum thicknesses of insulation should limit ice formation to under 50% after 12 hours for the remainder of the pipe sizes, when based on an air temperature of -6^0 C and a water temperature of $+7^0$ C. The minimum calculated insulation thicknesses for 12 hours protection under the above conditions are shown in the appropriate location in brackets.

   Commercial thicknesses of insulation with the higher thermal conductivities are generally limited to a minimum of 9 mm. Materials with a lower thermal conductivity, such as rigid phenolic foam, polisocyanurate foam and rigid polyurethane foam are installed by specialist firms and are usually limited to a minimum thickness of about 15 mm.

2. Normal conditions to frost exposure are considered to be when water fittings are installed inside buildings within the thermal envelope, but within rooms or voids which are not heated for a minimum period of 12 hours each day for the whole of the winter period. Examples could include the following:

   a. Unheated cloakrooms, store rooms, utility rooms, etc.
   b. Below the ceiling insulation in a roof space

It is also worth noting that the freezing of external taps can result in a substantial increase in system pressure internal to the building. This is primarily because supplies to taps must include a double-check valve. This prevents system contamination as well as any increases in pressure from "backing up". Insurer's expect that external fittings to be thermally protected per the requirements as set out in The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. Providing a means to isolate and "drain-down" is not in itself compliant. An example of readily available and affordable protection is depicted below.

G.8 Material compatibility

Plastic pipe and fittings material compatibility

The chemical compatibility of plastic pipe to other materials that they may transport, or externally come into contact with, is complex but requires very careful consideration during design, installation and through-life maintenance if network failure and the associated escape of water is to be avoided. The route to failure is usually 2-part; a weakening at the molecular level by environmental contaminants which in turn reduces the strength of the pipe to below the mechanical forces it is being asked to handle. As such the contributing factors can include:

- Mechanical stressing of the pipe or fitting from poor installation
- Abrasion/pitting of the surface that encourages contaminant ingress and cause structural weakening
- Contact with incompatible materials and poor bonding

The potential impact that contact with common materials can have on the longevity of the system must not be underestimated and as such requires considerable research and expertise on the part of those installing and maintaining the system. It is imperative that those installing plastic pipe networks are OEM trained in the design, installation and maintenance of the specific products used within the system.

For some plastic pipe types the list of materials that they are sensitive to might even seem counter-intuitive, and include many very common associated construction products such as:

- Caulks and fire stopping materials
- Leak detection fluids
- Mould inhibitors
- Pipe clamps
- Pipe tapes
- Thread sealants
- Paints
- Insulating materials

Manufacturers keep up-to-date chemical compatibility guides on their website. These must be regularly reviewed as their contents change regularly.

It is essential that all documentation pertinent to the system design is available to others to ensure future actions by others or re-evaluation of material compatibilities do not damage the system. Handover documentation must include:

- Product and manufacturer details
- System design
- Commissioning and test records
- Material sensitivity datasheets

An example manufacturer's Chemical Compatibility and Installation Information datasheet is provided for CPVC pipe for information.

CHARLOTTE PIPE AND FOUNDRY COMPANY®

FLOWGUARD GOLD® CPVC

Updated: August 14, 2020
Supersedes: June 9, 2020

Chemical Compatibility and Installation Information for FlowGuard Gold CPVC Products

CPVC domestic water and industrial piping systems are designed for use in new construction, re-pipe and repair applications due to their outstanding corrosion resistance. Reasonable care needs to be taken to insure that products coming into contact with CPVC systems are chemically compatible. If a product coming into contact with CPVC is not listed, it is recommended that chemical compatibility be confirmed with the manufacturer of the product. If chemical compatibility with CPVC is in question, it is recommended to isolate the suspect product from contact with CPVC pipe or fittings.

The products listed below are NOT COMPATIBLE with Charlotte® CPVC systems and should NOT be used. Chemically incompatible products are added to this list as they are brought to our attention. A product's absence from this list does not imply or ensure CPVC chemical compatibility. **Always consult http://www.charlottepipe.com for the most up-to-date chemical compatibility listings.**

NOTICE

All pipe thread sealants must conform to the requirements of IAPMO's PS 36 and with the thread sealant manufacturer to confirm that these sealants are chemically compatible with ABS, PVC, and CPVC. Incompatible pipe thread sealants may result in the degradation of plastic pipe or fittings resulting in product failure and property damage.

- Verify that paints, thread sealants, lubricants, plasticized PVC products, foam insulations, caulks, leak detectors, insecticides, termiticides, antifreeze solutions, pipe sleeve, firestop materials or other materials are chemically compatible with ABS, PVC or CPVC.
- Do not use edible oils such as Crisco® for lubricant.
- Read and follow chemical manufacturer's literature before using with piping materials.
- Confirm compatibility of pipe marking adhesive tape with the manufacturer of the tape to ensure chemical compatibility with CPVC pipe and fittings.

NOTICE: This information is not a guarantee, and any piping systems using products made of these materials should be tested under actual service conditions to determine their suitability for a particular purpose.

Products NOT Compatible with FlowGuard Gold CPVC:

(Manufacturer)	(Product Name)
Caulks	
British Gypsum	• Gyproc Sealant
DAP	• Alex Plus Acrylic Latex Caulk Plus Silicone
HUBER Engineered Woods	• ZIP System™ Liquid Flash
ITW Polymers Sealants	• Permathane SM7108 Polyurethane Sealant
John Wagner Associates	• Grabber Acoustical Sealant GSCS
No Nonsense Limited	• Nemesis Fire Rated Hybrid Sealant 290 ML
OSI Sealants (Dartworth Company) / (Ohio Sealants)	• Polyseamseal All Purpose Adhesive Caulk
	• Polyseamseal Tub & Tile Adhesive Caulk
	• Pro Series PC-158 Caulk
Pecora	• AC-20 Acrylic Latex Caulk & Silicone
Polyseam Ltd	• Protecta FR Acrylic Caulk • Protecta FR Graphite Caulk
Silka Corporation	• Silkaflex® Self-Leveling Sealant
Tremco®	• Dymonic® 100
United States Gypsum	• Sheetrock Brand Acoustical Sealant
White Lightning	• 3006 All Purpose Adhesive Caulk
Fire Stopping Systems	
3M	• Fire Barrier 2003 Silicone • Fire Barrier CP25WB+
	• Fire Barrier Sealant FD 150+
	• Fire Barrier Tuck-in-Wrap Strips
BritChem Limited	• FR Intumescent & Acoustic Acrylic Sealant
Everbuild	• Everbuild Fire Mate Sealant C3
Firetherm	• Intumastic HP
Fireus Ltd.	• Safire Intumescent Mastic
Fischer	• Fischer FFB-ES Elastoseal
Flame Stop	• Flame Stop V
Hilti	• CP506 Smoke and Acoustic Sealant
	• CP606 Flexible Firestop Sealant
No Nonsense Limited	• No Nonsense Intumescent Acrylic Sealant
Promat	• GrafitexProset • Proseal Plug, Black, Proseal Plug, Red
Speedline	• Speedline Intumescent Fire Protection & Acoustic Sealant

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FLOWGUARD GOLD® CPVC

Products NOT Compatible with FlowGuard Gold CPVC (Updated August 14, 2020)

(Manufacturer)	(Product Name)
Leak Detector	
Federal Process Company	• Gasoila Leak Tech
G.F. Thompson Co. Ltd.	• Masters Leak Detector
Radnor Welding Products	• Radnor® Leak Test Regulator Temperature
Rector Seal®	• RectorSeek™ Low Temp
Unipak A/S	• Multitec Leak Detecting Spray
Mold Cleaners/Inhibitors	
Anabec Systems	• Anabec Advanced Cleaning Solution • Anasphere Plus™
Betco Corporation, LTD	• Betco ph7Q Dual
Coating Systems Laboratories, Inc.	• Zoonocide
Daycon Products Company, Inc.	• MDRO/MRSA One Step Disinfectant
	• Spectra System 4 404 1:28 Neutral Disinfectant
Fiberlock Technologies, Inc.	• Shock Wave (Disinfectant)
	• IAQ Advanced Peroxide Cleaner No. 8314
	• Fiberlock IAQ200
Fire Retardant Coatings of Texas	• FX Lumberguard
Great Lakes Laboratories	• Clean 'n Etch
H.B. Fuller Construction Products	• Foster First Defense 40-80 Disinfectant
Microban Systems	• Microban QCG
ProRestore Products	• Mediclean Germicidal Cleaner Concentrate
	• Dri-EAz Milgo Plus • Microban Milgo Plus
	• ProRestore QGC • MediClean QGC
Red Devil, Inc.	• Red Devil Painter's Caulk
Serum Products, LLC	• Serum 1000
Wepak National	• Non-Acid Bath Disinfectant
X-M Industries	• Structure-Guard Mold and Mildew Resistant Coating
Miscellaneous Materials	
Carlisle HVAC Products	• CCWI Duct Sealant
Various Sources	• Peppermint Oil • Roofing Tar •Vaseline • Vegetable Oils
Victaulic	• Silicone Pipe Lubricant
WD-40 Company	• WD-40 Lubricant
Pipe Clamps	
Naylon Products	• Naylon Vinyl-Coated Wire Pipe Hangers
Pipe Tape	
Christy's	• Pipe Wrap Tape
Pasco	• All Weather PVC Pipe Wrap
Pro Pak, Inc.	• Pipe Wrap Tape (black)
Wonder	• No. 413 Pipe Wrap Tape
Thread Sealants	
Allied Rubber and Gasket Co. (ARGCO)	• Super Dope
Anti-Sieze Technologies	• TFE Paste
Devcon	• Super Lock Hi-Strength, Stud Lock Grade 2271
G.F. Thompson Co. Ltd.	• Masters™ Pro-Dope™ with Teflon®
General Sealant	• GS-600
Hercules	• Brush-On/Blue Block
Hernon Mfg., Inc.	• Powerseal #932
J.C. Whitlam Mfg. Co	• Seal Unyte Thread & Gasket Sealer
Jet Lube, Inc.	• Jet Lube V-2
Jomar	• Tighter-than-Tite
Loctite	• Threadlocker 242 • Loctite 577
Lyn-Car Products, Ltd.	• Proseal
National Starch & Chemical Permabond Division	• Permabond LH-050, Permabond LH-054
Permatex Company, Inc.	• Permatex 14H
Rule	• High Performance Teflon Thread Sealing Compound
Saf-T-Lok Chemical	• Saf-T-Lok TPS Anaerobic Adhesive/Sealant, Indus. Grade TPS
SOS Products	• Teflon Pipe Dope
Swagelock Company	• SWAK
Waterproofing	
Tremco	• TREMproof 250GC single component polyurethane

CHARLOTTE PIPE AND FOUNDRY COMPANY®

FLOWGUARD GOLD® CPVC

(Updated August 14, 2020)

OTHER CHEMICAL COMPATIBILITY CONCERNS and INSTALLATION INFORMATION

NOTICE

Prior to installation, check with the manufacturer of the HVAC equipment to confirm the compatibility of residual oils and refrigerants with CPVC, ABS, or PVC.

Prior to installing PVC or CPVC piping in hydronic applications, it is important to flush the interior of the heat exchangers and the exterior of the evaporator coils thoroughly with a mild ionic detergent solution to remove incompatible oils. Failing to do so could result in system failure and property damage.

Verify that all boiler cleaning and sealing chemicals used in hydronic radiant heating systems are compatible with PVC or CPVC. Failure to do so could result in system failure and property damage.

Equipment leaks in refrigeration or HVAC systems may release POE oils or other contaminants into the piping system. These oils and contaminants are incompatible with PVC or CPVC and such exposure may result in pipe or fitting failure regardless of flushing.

NOTICE

To reduce risk of property damage from chemical incompatibility with CPVC read and follow these instructions before using any chemical with pipe or fittings.

Acetone in Primers, Cleaning and Solvent Cements:

- Primers, cleaners, and solvent cements containing appreciable amounts of acetone may cause rapid environmental stress cracking of CPVC metal insert parts during installation at freezing temperatures. Contact your primer/cleaner/solvent cement manufacturer for more information or recommendation of alternatives.

Adhesives:

- Pipe sleeves, insulation and tapes manufactured with adhesives may contain incompatible chemicals which can harm CPVC systems. Consult with the manufacturer of these products to determine if the adhesives used are compatible with CPVC systems.

Antifreeze, Glycerin from Biodiesel:

- Crude glycerin from biodiesel manufacturing is not recommended for use as an antifreeze or heat transfer fluid in CPVC piping systems. Crude glycerin from biodiesel manufacturing may be contaminated with the biodiesel, its intermediary chemicals, and/or waste products from the biodiesel manufacturing process.

Cleaning CPVC Pipe:

- While common ordinary soaps are not detrimental to CPVC, most modern dishwashing liquids contain synthetic detergents, some of which may cause environmental stress cracking of fittings. A mild ionic detergent solution to remove incompatible oils or chemicals is recommended. A rinse with clean water to completely clean the system is advisable as a final flushing. Contact your dishwasher detergent manufacturer for more information or a recommendation of alternatives.

Flexible Wire and Cable:

- Direct contact with flexible wire and cable jacketing that utilize insulation containing plasticizers is not recommended. Section 334.30 of the National Electric Code (2002 Edition) requires wire and cable to be secured by staples, cable ties, straps, or hangers. Air ducts, pipes and ceiling grid are not acceptable supports for wire and cable. Also see section titled "Rubber and Flexible Materials Containing Plasticizers."

Fragrances–Perfumes:

- Scented products such as cologne, perfumes, or essential oils (peppermint oil, orange oil, spearmint oil, etc.) should not be put into a CPVC piping system for the purpose of being able to detect leaks by odor. Most fragrance chemicals and essential oils are strong solvents and/or environmental stress cracking agents for CPVC.

Fungicides and Mold Inhibitors:

- When performing repairs to leaks in existing systems, care should be taken to isolate CPVC pipe from direct contact with heavy concentrations of fungicide products which may be applied during cleanup of water damage. Vinyl piping materials such as PVC or CPVC may be damaged by fungicides when fungicides are sprayed on surrounding drywall and wood framing to prevent the growth of mold and mildew in the affected area. Common sense precautions will prevent problems with repairs to existing systems. When repairs are made to an existing system, and the possibility exists that fungicides will be applied to treat damp drywall and wood framing surrounding the repair site, exposed piping should be sleeved with a compatible plastic sleeving or pipe insulation material to prevent direct contact of the fungicide with the plumbing systems.

Grease and Cooking Oils:

- When CPVC pipe is installed in kitchen areas the pipe must be protected from contact with grease or cooking oils. Consideration must be given to not only protecting the pipe from direct contact with grease or oil as well as contact that may occur from airborne grease or oil.

Insulation:

- Tubing insulation for use with CPVC should be fiberglass or foamed polyolefin (polyethylene). Foamed rubber tubing insulation may contain incompatible plasticizers and is not preferred. Foamed polyolefin insulation should not have any oil lubrication applied to the interior surface.

Leak Detectors (Soaps Used):

- While common ordinary soaps are not detrimental to CPVC, most modern dishwashing liquids contain synthetic detergents, some of which may cause environmental stress cracking of CPVC.

Mastics for Use with Pipe and Duct Insulation:

- Some mastic products have a thin paint-like consistency and can be applied with a spray gun, brush, or roller in thin coats similar to paint. For these type of mastic products, follow our paint guidance.
- Other mastic products are thicker pastes or caulk-like products that are applied with brushes, trowels or caulking guns. While Charlotte Pipe is not aware of any pipe or fitting failures that have been directly attributable to insulation mastics, a review of formulation information indicates that some of these products contain ingredients that are incompatible with CPVC.
- Always confirm compatibility with the mastic manufacturer.

(Note: Shading indicates updated information.)

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(Updated August 14, 2020)

Metal Piping Connected to or Installed Alongside CPVC Piping:

- CPVC may be damaged by torches and/or chemicals used to install metal piping. When metal piping is installed in proximity to CPVC piping systems, care should be taken to protect the CPVC from burning with torches or contact with molten solder or solder flux, as well as incompatible thread sealants, leak detectors, lubricants, or other chemical products which may be used on metal piping.
- Transitions from metal pipe to CPVC pipe can be made through a variety of methods such as threaded connections, flanges, and grooved adapters. Occasionally the metal pipe may contain residual oils that were used to aid in the cutting process. Some of the oils used for this purpose, especially those marketed as "environmentally friendly" or "vegetable based" may be incompatible with CPVC. If a cutting oil is used, consult with the manufacturer of the cutting oils for a specific recommendation as to compatibility with CPVC.
- Dye penetrants used to test the quality of welds in metal piping may contain plasticizers or other chemicals incompatible with CPVC. Dye penetrants left on the inside surface of welded metal pipes may later wash into CPVC piping connected to it. This situation could create environmental stress cracking in CPVC wherever collections of the penetrant chemical might lodge. These penetrants should be removed from the metal pipe prior to connecting to CPVC, or the manufacturer of the dye penetrant should be consulted with regard to recommending a proper penetrant to use with metal/CPVC systems.

Paint:

- Water-based acrylic latex paint is the preferred and recommended paint to use on CPVC pipe and fittings. Oil or solvent-based paints may be chemically incompatible.

Polyurethane (Spray-on) Foams:

- In understanding spray polyurethane foams, there are two general areas of concern for CPVC pipe and fittings; (1) chemical compatibility and (2) potential damage to pipe and fittings due to high temperatures generated as a result of the exothermic chemical reaction during the installation and curing process. It is possible to apply polyurethane foam insulation properly without damage to CPVC pipe and fittings. However, the use of polyurethane foam insulation in conjunction with CPVC has resulted in the failure of CPVC pipe and fittings and property damage. Therefore, Charlotte Pipe and Foundry does not recommend the use of polyurethane spray-on foam insulation in conjunction with its CPVC pipe and fittings.

Residual Oils with HVAC Applications:

- Some heat exchangers or condenser coils may contain residual oils from the manufacturing process which can cause cracking of CPVC. Caution should be exercised when installing CPVC in combination hot water/air heating units or as condensate drain lines for air conditioning systems. Confirm the compatibility of CPVC with residual oils prior to installation. The interior of heat exchangers or the exterior of condenser coils may be thoroughly flushed with mild detergent solution to remove incompatible oils prior to piping installation. A rinse with clean water to completely clean the system is advisable as a final flushing.

Rubber and Flexible Materials Containing Plasticizers:

- CPVC is not compatible with some rubber and flexible vinyl materials containing certain types of plasticizers. Incompatible plasticizers include, but are not limited to, phthalates, adipates, trimellitates, dibenzoates, etc. Compatibility should be confirmed before selecting rubber for flexible vinyl materials for direct contact with CPVC. Examples of materials which may contain incompatible plasticizers include, but are not limited to, caulks, rubbery hanger padding, vinyl dip coating on metal parts, rubber gaskets, electrical wire jacketing, electrical tape, flexible hose or tube, etc. Further, plasticizers may leach from rubber or flexible vinyl materials, such as hoses or tank linings, into the process fluid which contacts them. Plasticizer contamination in the process fluid may also cause environmental stress cracking of CPVC used elsewhere in the system. This can include both CPVC process piping, through which contaminated fluid may flow, or CPVC ducting drawing fumes from contaminated fluid.

Sleeving Materials:

- In situations where sleeving is required, the pipe should be protected with a compatible sleeving material extending at least 12" above and below the soil. The top of the sleeving should be securely taped to the pipe with a compatible tape product. Backfill over underground piping prior to termiticide spraying.

Spray-on Coatings:

- Certain types of spray-on coatings which form a peelable film to protect fixtures during construction may be incompatible with CPVC. Care should be used to protect exposed piping from overspray when this type of protective coating is applied.

Steel Pipe with Antimicrobial Coating:

- Contractors should not use steel pipe with antimicrobial coating, such as Allied's ABF 11, in conjunction with CPVC pipe and fittings, unless the factory-applied coated steel pipe has been approved by the pipe manufacturer.

Teflon® Tape:

- Charlotte Pipe® recommends Teflon tape as the preferred thread sealant.

Termiticides and Insecticides:

- When performing an under-slab installation, or where the presence of insecticides or termiticides is likely, care should be taken to isolate CPVC pipe from direct contact with large quantities of these chemicals. Vinyl piping materials such as PVC or CPVC may be damaged when termiticides or insecticides are injected into the annular space between the pipe wall and sleeving material trapping the termiticide against the pipe wall. Termiticide applications per label instructions in an open-air environment, such as slab pretreat applications, should not pose a problem. However, puddling of termiticides on or near CPVC may cause failure. In areas where puddling is more likely, such as near tub boxes and retreat applications, extra care should be taken to avoid puddling of termiticides. Exercising caution and common sense should prevent installation problems. For more information, review your manufacturer's installation guide.
- Additional precautions need to be taken when retreat applications are required. Termiticide retreatment is usually required when the concrete slab has been broken to relocate a pipe. The following recommendations should be followed in retreat applications:
  - Remove all the plastic barrier material that was installed prior to the initial concrete pour from the area to be retreated. Do not reinstall the plastic barrier material.
  - After the pipe has been relocated, the soil should be pretreated before it is placed in hole around the pipe. Do not apply termiticide directly to the retreat area.
  - Termiticides that contain cypermethrin should not be used in retreat applications.
- Note: Many insecticides and termiticides are incompatible with CPVC. Assume that all are aggressive and not compatible with FlowGuard Gold CPVC pipe and fittings.
- When installing CPVC where the presence of insecticides or termiticides is likely, confirm compatibility prior to application. Exercise caution. For more information, review your manufacturer's installation guide.

Installation Notes:

- Use CTS CPVC male threaded adapters for cold water only.
- Protect CPVC from long term exposure to direct sunlight.
- Space CPVC more than 6 inches from gas flue.
- Allow for thermal expansion and contraction.

G.9 Automatic shut off valves

Water leak detection systems can be immensely beneficial to the curtailment and prevention of property damage and interruption resulting from escape of water (EoW) events especially in the multi-storey, residential and commercial environment. They are able to detect potential uncontrolled water loss by a range of mechanisms including:

- Detecting uncharacteristic usage of water (flowrate & duration) from a flow sensor mounted at the point of entry to the building/business/property/apartment,
- Detecting water in places that it should not be by the use of specifically placed sensors

Triggering by any method should result in the automatic isolation of the system at source and notification of the property/business owner or appointed representative. The point of isolation for individual properties might be at the point of water entry; for multi-storey buildings, at the supply to floor or the apartment; and for larger business might be zoned to protect specific assets.

The specification of the system type and installation detailing must be appropriate to the property being protected and its risk profile. EoW events range from rapid losses of high volumes of water from pipe bursts and overflows, to much slower events from i.e., leaking shower trays – both can be highly destructive but obviously have very different detection requirements.

The equipment specification, system design, and installation must be carried out by someone with OEM training for the equipment used and have a good understanding of what EoW risks the installation of the system is seeking to mitigate.

It should be noted that these systems do not prevent escape of water but can significantly reduce the total amount of water that is lost to cause damage. Some systems, by additionally measuring temperature and/or humidity, can also forewarn of potential freezing events, enabling mitigation measures to be taken, and preventing an EoW event altogether, or slow release events that might cause damp and rot or manifest later as a major release.

Earlier systems might only have been capable of working in one of these modes due to wiring connection complexity, but wireless communication, including use of local wireless networks, has overcome this hurdle thereby allowing exploitation of all methods to create the best overall solution for the application.

Recent advances exploiting internet connectivity means some of these systems may automatically reconfigure themselves at times when the building/business/property/apartment is occupied or unoccupied, allowing refinement of the decision-making algorithms to optimise water saving potential. Other benefits allow for remote notification, configuration, and resetting. Many manufacturers offer additional management services that monitor system health and ensures embedded software is always up to date.

Challenges with false alarms on early systems often led to systems being disabled or set with thresholds ineffective for distinguishing between a leak and normal usage. Improvements in algorithms and internet connectivity have resolved many of these issues, and better sensor designs are similarly less likely to falsely trigger.

The decision to employ water leak detection/isolation technologies can be driven by many factors but might include:

- Insurance requirement/discount
- How many floors the individual property has (EoW events will impact all floors below)
- Whether it is an apartment block (EoW events can displace many families)
- Whether it is a hotel (for business resilience purposes)
- Property with an adverse experience of escape of water events
- Protection to high risk areas, such as electrical riser cupboards, IT rooms, areas with sensitive equipment, stock and other business critical locations
- The sensitivity of the building's construction method to water damage
- If the building is 'normally unoccupied' (and the water supply cannot be isolated and drained during unoccupancy periods).

It is essential that the installation of these systems do not impair the function of other critical systems where deployed, such as fire sprinklers. If the operation of the sprinkler system is recognised as an uncharacteristic demand (as it will be), without appropriate override, water supply will be inappropriately stopped. Although it can be possible to sort this problem through signalling, the supply of water to a fire sprinkler system via pressure-robbing water meters and the water leak detection system flow meter is highly undesirable. As such the incoming household supply should be split with the sprinkler supply line remaining unmonitored aside from the alarm systems inherent in the sprinkler/watermist system design.

G.10 Pressure testing

The manufacturers of fittings, for example John Guest and Polypipe, publish guidance on how to test systems that include parts made by them. John Guest require the system to be pressure test at 2.0-bar for 10-minutes followed 10-bar for 10-minutes. Polypipe require the system to be pressure tested to 18-bar for no less than 15-minutes and no longer than 1-hour. The manufacturers' guide should be followed and a record made.

System testing

On completion of the plumbing and heating system it is essential that system checking and a hydraulic wet test takes place. Connections to boilers, radiators and sanitary ware should first be capped or plugged. Testing should be carried out at 2 bar for 10 minutes followed by 10 bar for 10 minutes. This testing combined with other relevant checks, should reveal most system problems. Any components within the system not designed to take these pressures should be disconnected.

Before carrying out a pressure test ensure all Speedfit pipe and fittings are installed correctly. Speedfit Barrier Pipe is printed with insertion marks to help ensure full insertion has been achieved.

Remember pressure testing is NOT a substitute for making sure fittings are clean and free of any grit, dirt or swarf and the pipe is correctly inserted (see Making a Good Connection).

First fix installations

Pipe and fittings only should be tested. The system should be completely filled using water at no more than 20°C at a test pressure of 18 Bar which should be applied for no less than 15 minutes and no longer than 1 hour. Joint security can be checked visually and by tugging at joints.

Second fix installations

Complete installations including appliances should be tested with water to the maximum test pressure allowed by manufacturers of the appliances and fittings.

Please note, due to Health and Safety reasons Polypipe products must not be air tested.

This is in addition to requirement to pressure testing the system per The Water Supply (Water Fittings) Regulations 1999 and BS EN 806. Dependant on the system, the test requirements vary. For example, metal or plastic systems. Alternatively, a combination of both. The following is an extract from Schedule 2 of the Regulations. Per BS EN 806, the record of any test shall be made. An example record is overleaf. Where supplies form part of a boosted system, the test pressure is a multiple of the closed head pump pressure.

12.—(1) The water system shall be capable of withstanding an internal water pressure not less than 1½ times the maximum pressure to which the installation or relevant part is designed to be subjected in operation ("the test pressure").

(2) This requirement shall be deemed to be satisfied–

(a) in the case of a water system that does not include a pipe made of plastics, where–

(i) the whole system is subjected to the test pressure by pumping, after which the test continues for one hour without further pumping;

(ii) the pressure in the system is maintained for one hour; and

(iii) there is no visible leakage throughout the test;

(b) in any other case, where either of the following tests is satisfied–

TEST A	*TEST B*
(i) the whole system is subjected to the test pressure by pumping for 30 minutes, after which the test continues for 90 minutes without further pumping;	(i) the whole system is subjected to the test pressure by pumping for 30 minutes, after which the pressure is noted and the test continues for 150 minutes without further pumping;
(ii) the pressure is reduced to one third of the test pressure after 30 minutes;	(ii) the drop in pressure is less than 0.6 bar (60kPa) after the following 30 minutes, or 0.8 bar (80kPa) after the following 150 minutes; and
(iii) the pressure does not drop below one third of the test pressure over the following 90 minutes; and	(iii) there is no visible leakage throughout the test.
(iv) there is no visible leakage throughout the test.	

13. Every water system shall be tested, flushed and where necessary disinfected before it is first used.

PROJECT NAME _____

NUMBER/REF _____

PRESSURE TEST CERTIFICATE

ITEM	TEST DETAILS	TEST RESULTS
1	Test Medium	
2	Pipework Material & Size	
3	Service	
4	Drawing reference	
5	Test pressure	
6	Total Test duration	
7	Test Satisfactory	
	If YES proceed to item 11	
	If NO proceed to item 8	
8	Reason for failure	
9	Remedial action taken	
10	Re-Test result	
11	Comments	
12	Date of test	
13	Print Name	
	Signature	
14	Witnessed by	
	Signature	

Guidance for items 5 and 6

The following is in addition to the manufacturer's requirements which should be recorded separately.

Metal pipework systems

A requirement of the Water Supply (Water Fittings) Regulations 1999 is that the system shall be pumped to 1.5 times the maximum pressure the system is designed to be subjected to whilst in operation ("the test pressure"). Once stabilised, the test continues for one hour without further pumping. The test is satisfactory if the pressure in the system is maintained for one hour and there is no visible leakage throughout the test.

Plastic or mixture

TEST A	TEST B
(i) the whole system is subjected to the test pressure by pumping for 30 minutes, after which the test continues for 90 minutes without further pumping;	(i) the whole system is subjected to the test pressure by pumping for 30 minutes, after which the pressure is noted and the test continues for 150 minutes without further pumping;
(ii) the pressure is reduced to one third of the test pressure after 30 minutes;	(ii) the drop in pressure is less than 0.6 bar (60kPa) after the following 30 minutes, or 0.8 bar (80kPa) after the following 150 minutes; and
(iii) the pressure does not drop below one third of the test pressure over the following 90 minutes; and	(iii) there is no visible leakage throughout the test.
(iv) there is no visible leakage throughout the test.	

G.11 References

1. The Water Supply (Water Fittings) Regulations 1999.
2. Water Regulations Guide – Second Edition.
3. BS EN 806-2:2005 Specification for installations inside buildings conveying water for human consumption – Part 2 Design.
4. BS EN 806-4:2010 Specification for installations inside buildings conveying water for human consumption – Part 4 Installation.
5. BS 8558:2015 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806.
6. Pegler Yorkshire Compression Plumbing Solutions.
7. John Guest Speedfit Trade Guide – May 2018.
8. Polypipe Plumbing & Heating Installation Guide – June 2017.
9. Chubb Technical Lines Guidance Document for Construction Projects Water Service Systems Risk Management.
10. BESA (Building Engineering Services Association) Guide to good practice: Site Pressure Testing of Pipework TR/6

Appendix H: Lifting plant (Sump pumps)

Lifting plant (sump pumps) for faecal and non-faecal matter are used for a variety of applications. For example: in basements for pumping out incoming groundwater; in plantrooms – for pumping out boiler condensate water to lightwells – for rainwater. Overflow pipes from water storage cisterns to swimming pools can also discharge into a sump pump. Sump pumps are often poorly designed, installed and maintained. Failure, or insufficient warning of a failure, can result in an escape of water. Guidance on lifting plants is detailed within BS12056-4[1], BS12050-1/2[2] and PCA Best Practice Guidance[3]. The following is a list of pertinent points, which if properly implemented, should reduce the risk and consequence of plant failure.

H.1 Warning devices

Lifting plants for faecal matter require a warning device. However, it is best practice that a warning device is fitted for all applications. Where a warning device is specified, it shall be installed so as to warn all premises served by the lifting plant in the event of a failure. In that regard, an audible alarm in a plantroom that is infrequently accessed may not be sufficient. Alarms can be linked to building management systems ('BMS') and/or remote monitoring stations.

There are a variety of warnings that a lifting plant can generate. For example, pump failure and/or high-level. It is best practice to include warnings for both. See Figure 1 for an example panel. However, a warning alone may not be sufficient to prevent an escape of water. For example, where a pit has limited capacity (useful volume), the time between failure and flood may be short. This is especially so for plants that only contain a single pump and no pump failure alarm. Therefore, due consideration should be given to capacity and redundancy. Moreover, where possible, linking the alarm to the relevant application. For example, the alarm could operate a stop-valve to prevent any further incoming water.

[1] BS EN 12056-4:2000 - Gravity drainage systems inside buildings. Wastewater lifting plants. Layout and calculation.

[2] BS EN 12050-1:2015 and BS EN 12050-2:2015 - Wastewater lifting plants for buildings and sites (faecal and non-faecal matter).

[3] PCA Best Practice Guidance, Groundwater pumping stations serving Type C Waterproofing Systems

Photograph 1: **A pump panel**

H.2 Capacity

The lifting plant shall have sufficient capacity to pump out all incoming water. This includes incoming water in the event of a discharging application fault. For example, overflow from a cold-water storage cistern. If plant serves more than one overflow, due consideration shall be given to multiple failures. Plant functionality should be tested during commissioning, e.g. a simulation of all possible faults.

The *useful volume* of a lifting plant is the volume of water in the pit (or tank) between the switch-on and the switch-off level. Where this volume is relatively small in comparison to the volume of water it may have to store in the event of a fault with the plant, due consideration shall be given to plant redundancy.

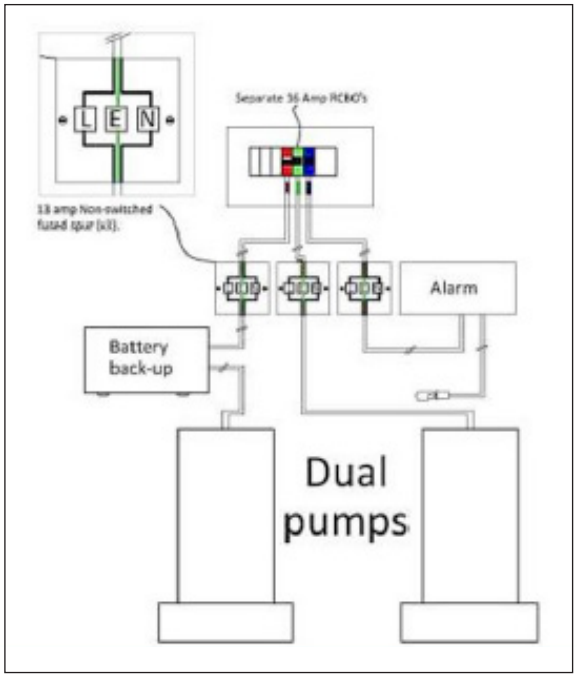
H.3 Redundancy

Duplicate pumps shall be installed in plants where the wastewater inflow cannot be interrupted. However, it is best practice to install duplicate pumps (duty-assist arrangement), with a single pump capable of pumping-out all incoming water. This is especially so where there is a risk that pump failure may go unnoticed and/or the useful volume of the pit or tank is relatively small. Consideration should also be given to power failure and the associated risk. It may be deemed necessary to install a battery back-up where power failure, even for a short period, could result in an escape of water.

H.4 Discrimination

If the plant is linked to a single fuse or RCD, an overcurrent and/or earth leakage fault at any pump will result in the remaining pump being isolated, rendering the plant inoperable. Therefore, it is best practice for each pump to have its own fuse-spur and RCD (or equivalent) see Figure 1. This is because the operation of a safety device (e.g. an RCD or a fuse) must not discriminate against

Figure 1. **Extract from the PCA Best Practice Guidance**



H.5 References

11. BS EN 12056-4:2000 - Gravity drainage systems inside buildings. Wastewater lifting plants. Layout and calculation.
12. BS EN 12050-1:2015 - Wastewater lifting plants for buildings and sites. Lifting plants faecal-free wastewater.
13. BS EN 12050-2:2015 - Wastewater lifting plants for buildings and sites. Lifting plants for wastewater containing faecal matter.
14. PCA Best Practice Guidance, Groundwater pumping stations serving Type C Waterproofing Systems.
15. CIBSE Guide K – Electricity in Buildings.
16. Approved Document H – Drainage and waste disposal.

Appendix I: Water-based fire suppression systems

I.1 Background

This advice is based upon the RISCAuthority Technical Guidance Note (TGN): *'Residential Sprinkler Systems to BS9251 – Guidance and recommendations for the implementation of Residential Sprinkler Systems'* which is freely distributed from the RISCAuthority website (www.RISCAuthority.co.uk).

Whilst specific to residential sprinkler systems, for the purposes of this document guidance pertaining to the curtailment of Escape of Water (EoW) events has been extracted and made generic to any water-based fire suppression system that might be deployed in the domestic and residential environment.

The principle types of water-based fire suppression system are sprinklers, and watermist. The objective of this section is to highlight factors that are known to lead to EoW events and make recommendations, similar to those proposed for other building water systems, to both reduce the likelihood of unwanted water releases, and limit damage if one does occur.

Whilst many of the issues outlined are easy to understand, the control of these risks can be difficult due to the impact that other trades and actions may have on the overall resilience of the system to escape of water events.

I.2 Types of water-based fire suppression system

Fire suppression systems are typically employed in domestic and residential settings for the purposes of assuring the life-safety of the building's occupants. They may be installed, as an additional protection feature to an already compliant building; as a requirement of national building codes; or be an additional requirement to compensate for other building design features. The dominant types of water-based fire suppression systems are Sprinkler Systems, and Watermist Systems. The principle differences between the types of system are described below. Designs and methods can vary greatly. Systems of a type that might be used for the protection of business and property in the commercial environment are not considered here.

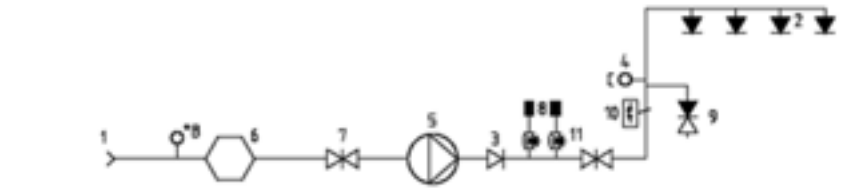
Generically, both sprinkler systems, and watermist systems have the same components, but watermist systems seek to deliver water at lower flowrates but at much higher pressure.

The principle components of a system are:

- Sprinkler/watermist heads – fire detection (usually) and water distribution
- Detection system (if not performed by the head) – smoke/heat/flame detection/manual call point
- Pipe network – connecting sprinkler/watermist head in each protected space to pump/water source
- Control sets – for testing and isolation of the water supply, alarm connection, and fault monitoring
- Pumps – which may be specific to the sprinkler/watermist system or shared with the domestic water supply
- Tanks – which may be specific to the sprinkler/watermist system or shared with the domestic water supply
- Isolation valves – which should be monitored to ensure the system is correctly configured for operation
- Non-return valves – which should be installed to be maintainable
- Passive firestopping products – to ensure that the fire resisting capability of the compartment is maintained after sprinkler/watermist system installation.

Typical schematics for mains and tanked water systems are shown below, pumped and mains driven:

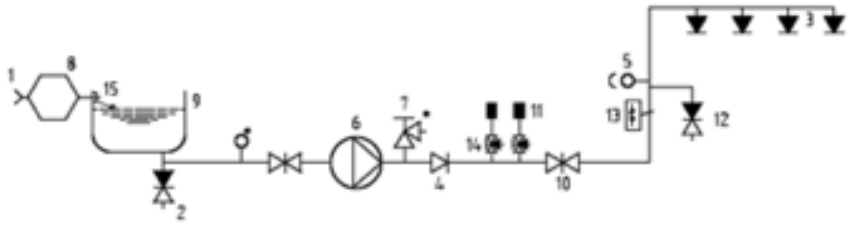
Figure 1 **Typical arrangement for a mains fed sprinkler/watermist system with pump**



Key

1	water supply	6	backflow prevention
*	optional	7	stop valve (normally open)
2	sprinkler	8	pressure switch / pump start device
3	non-return valve	9	test and drain valve (normally closed)
4	pressure gauge	10	water flow alarm device
5	pump	11	3-way valve

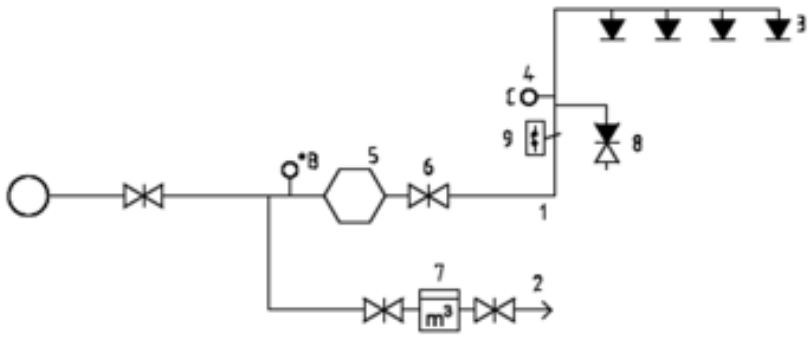
Figure 2 **Typical arrangement for a tank fed sprinkler/watermist system with pump**



Key

1	water supply	8	backflow prevention
2	tank drain	9	storage tank
*	optional	10	stop valve (normally open)
3	sprinkler	11	pressure switch / pump start device
4	non-return valve	12	test and drain valve (normally closed)
5	pressure gauge	13	water flow alarm device
6	pump	14	3-way valve
7	relief valve	15	inlet flow device

Figure 3 **Typical arrangement for a mains fed sprinkler system with no pump (sprinkler systems only)**



Key

1	sprinkler system	5	backflow prevention
2	domestic service	6	stop valve (normally open)
*	optional	7	water meter
3	sprinkler	8	test and drain valve (normally closed)
4	pressure gauge	9	water flow alarm device

I.2.1 Domestic fire sprinkler systems

Domestic and residential sprinkler system operate at lower pressures than watermist systems (as low as 0.5 bar at the operating head) and as such can often be implemented using the mains water pressure alone. In multi-storey blocks the building's own supply pumps may be used. Where water pressure is insufficient, booster pumps may be used direct from the mains, or attached to a separate tanked water supply.

In the domestic and residential environment, the system will be actuated at the sprinkler head by a thermally actuated device that holds the valve in place. These are usually small glass bulbs that fracture when heated above a calibrated threshold. Sensors within the pipework will detect a pressure drop and/or flow, and this will act to sound an alarm, and activate pumps if it is a pumped system. The use of plastic pipe is common within these systems and chemical sensitivities of the materials used means extreme care and good knowledge is required if escape of water issues are to be avoided. At these low pressures, accidental operation of the pump is unlikely to cause component failure, but inadvertent, and unnoticed operation at a sprinkler head can cause large volumes of water to be released as the supplies are essentially infinite.

I.2.2 Domestic watermist systems

Domestic and residential water mist systems can operate at very much higher pressures than sprinkler systems (14-50 bar). These systems will always comprise a pump, that if operated inadvertently in a closed system can have the potential to burst pipework and operate closed spray heads. The method of activating these systems is usually performed at the head via a temperature sensitive element (as for sprinkler systems), but can also be electronically activated through open heads by other detection devices such as smoke, heat, flame and gas, singly or in combination to reduce the likelihood for false alarms. Upon detection, an electrical signal from the device is used to sound and alarm and instruct the pump to operate.

I.2.3 General comments

Whilst the specifications and approvals of products for sprinkler systems are more highly developed than watermist systems having been around for very much longer, any system poorly designed, specified, installed, maintained, and reliant of unproven equipment has the potential to lead to escape of water problems.

Experience to date tells us that problems associated with domestic and residential sprinkler system mostly result from poor installation, whilst equipment malfunction and incorrect installation is prevalent for watermist systems.

I.3 Fire suppression system unwanted escape of water causes and reasons for high consequential loss

Insurer and forensic experiences of escape of water events stemming from water-based suppression systems are tabulated and described below in Table 1. Additional reasons that have contributed to the scale of the damage done by the escaping water are given in Table 2.

The mitigations described are referenced and elaborated on in the remainder of this document.

Cause ID	Escape of water cause	Description	Mitigation
C-1	Incorrect installation and configuration of watermist system pump unit	Forensic evidence demonstrates that a number of escape of water events from domestic watermist systems are associated with the incorrect installation of the pump unit and its associated pressure and flow sensors	▪ Training ▪ Labelling ▪ Installer 3rd party accreditation ▪ Post installation discharge testing
C-2	Faulty watermist pump/sensor unit	Forensic evidence demonstrates that a number of escape of water events from domestic watermist systems are associated with faulty pump / sensors units that may trigger when not required to do so, or not function when they should	▪ Equipment certification ▪ Post installation discharge testing
C-3	Wrong thermal rating for heads operated by temperature sensitive bulb	Where the sprinkler or watermist system is actuated via heads with thermally sensitive bulbs, it is essential that the thermal rating of the bulb is appropriate to its location. Heads located near heaters, skylights, and other areas of high heat can cause the sprinkler/ watermist heads to discharge by accident and will require a higher thermal rating. If new heat sources are added to an existing building, the sprinkler/watermist heads should consequently be adjusted	▪ Designer qualification ▪ Installer 3rd party accreditation ▪ Building owner guidance

C-4	System freezing	Most sprinkler and watermist systems will have pumps and pipes that contain captive water somewhere within the feed or delivery sections of the system. If this water is allowed to freeze, the expanding ice can easily produce pressures high enough to break fittings and pipes. When the system thaws, water may discharge from the system or damaged sensors may malfunction at a later date	▪ Designer qualification ▪ Installer 3rd party accreditation ▪ Insulation ▪ Building owner guidance
C-5	Water hammer	Water hammer in any pipe system has the potential to cause pressure spikes of a scale that can exceed to pressure handling capability of the system leading to damage of pipework, valves and sensors. The escape of water may manifest as it happens (broken pipe or head actuators), or later due to misreporting from damaged sensors. Water hammer is typically avoided by control of water velocities (pipe diameters) and valve closure times (control systems)	▪ Designer qualification ▪ Equipment certification ▪ Installer 3rd party accreditation
C-6	Water supply pressure changes	Fluctuations of pressure within water supplies are commonplace and can be sizeable. Forensic evidence has shown situations within some water-based suppression systems where these changes have been interpreted as a flow associated with the activation of the sprinkler/watermist head, and the system's pump has been instructed to start. Some watermist systems operate at such high pressure that if the pump operates against still-closed pipe work, the pipes or the heads fail leading to an unwanted escape of water. Such issues have been associated with missing, faulty, or incorrectly fitted non-return valves	▪ Designer qualification ▪ System approval ▪ Equipment certification ▪ Installer 3rd party accreditation
C-7	Power supply interruption	Interruption of power supply has been known to cause false actuation of systems due to false messaging from fire sensors (where used as the means of system actuation), or false messaging of fluid flow suggesting that a thermally actuated head has ruptured	▪ Designer qualification ▪ System approval ▪ Equipment certification ▪ Installer 3rd party accreditation
C-8	False detector actuation	Where the sprinkler or watermist system is actuated by means other than heads with temperature sensitive elements, such as smoke, heat, flame, or gas detectors, if the system has been designed with insufficient controls in place to guard against actuation on false stimuli, the system will inadvertently operate. Examples of known false and unwanted alarms include deodorant and shower steam being mistaken for smoke, and cigarette smoke and flash photography, being mistaken for fire challenges that demand actuation of the system	▪ Designer qualification ▪ System approval ▪ Equipment approvals ▪ Installer 3rd party accreditation
C-9	Damage to temperature sensitive bulb in sprinkler and watermist heads	If the bulb in a watermist or sprinkler head is accidently broken, the drop in pressure is taken as a need for the system to operate and water will be supplied. Physical damage is known to be caused by thrown objects in the room, such as balls, by furniture moving, and even crashes with toy remote control helicopters. Sprinkler heads are often guarded against this by use of concealed head types but in watermist systems the heads and bulbs are often exposed	▪ Equipment selection ▪ Designer qualification ▪ System approval ▪ Equipment approvals ▪ Installer 3rd party accreditation
C-10	Leakage at joints	Slow escape of water events over long periods of time can be equally destructive especially when they occur in areas hidden from sight	▪ Equipment approvals ▪ Installer 3rd party accreditation ▪ OEM product / component training ▪ Post installation discharge testing ▪ Pressure testing

C-11	Material incompatibility between system's plastic pipe and mastic type agents used	Many fire suppression systems now use plastic pipe. Escape of water experience shows that many plastic pipe systems have critical sensitivities to other materials and chemicals that may cause them to fracture without warning. Specifically, there are strict restrictions on mastic compatibility that must be observed when sealing pipe penetrations through walls (see section G.8)	▪ Equipment approvals ▪ Installer 3rd party accreditation ▪ OEM product/ component training ▪ Passive installer 3rd party accreditation ▪ Material compatibility check
C-12	Material compatibility between system's plastic pipe and other materials, such as insulation, that may contact it	Contamination of plastic pipe by materials not associated with the system may also lead to premature failure of the pipe. Control of routing to avoid contact with unauthorised/unknown materials is essential (see section G.8)	▪ Installer 3rd party accreditation ▪ OEM product/ component training ▪ Passive installer 3rd party accreditation ▪ Material compatibility check
C-13	Pipe connections not made (crimped, bolted, and plastic glued systems)	Many pipe systems used in both sprinkler and watermist systems (metal and plastic) can be assembled before the joint is made. These may take the form of deep sleeves that must be completed by gluing, crimping, or bolting. Where joints have been left unmade, these have failed and led to escape of water events at the time of commissioning, or even later in the system's life	▪ Installer 3rd party accreditation ▪ OEM product/ component training ▪ Post installation discharge testing ▪ Pressure testing
C-14	Too much/too little glue used on jointing of plastic pipe systems	Some systems using glued pipe systems are known to have failed for the reasons of using too little, or even too much glue in the joints construction. Specific training in the use of the proprietary piping system deployed is considered essential	▪ Installer 3rd party accreditation ▪ OEM product/ component training
C-15	Product mixing incompatibilities	Escape of water has occurred where plumbing components from proprietary piping system have been mixed between manufacturers products	▪ Installer 3rd party accreditation ▪ OEM product/ component training
C-16	Pipe stress breaking	Escape of water events in water-based suppression systems have occurred due to pipe rupture resulting from the pipe network being overly constrained against necessary thermal expansion and contraction. Fixing at wall penetrations and overly tight clamping can cause failure over time from stress fracture	▪ Designer qualification ▪ Installer 3rd party accreditation
C-17	Pipe and joint stress from insufficient support	If the pipe network is insufficiently supported inappropriate stress my result at the fittings which may fail over time due to creep fracture, or at the time of deployment when weakened	▪ Designer qualification ▪ Installer 3rd party accreditation
C18	Hidden pipe location awareness and marking – damage from refurbishment and DIY	Hidden components and an associated lack of awareness of their position has resulted in escape of water events resulting from inadvertent damage from water drilling and DIY refurbishment	▪ Documentation ▪ Building owner guidance
C19	Installation differs from design	Good designs, poorly executed on site due to product substitution and layout change can result in systems prone to escape of water issues	▪ Installer 3rd party accreditation

Cause ID	High escape of water consequential loss	Description	Mitigation
C-20	Insufficient labelling, identification, and knowledge around the location and operation of isolation valves	Following accidental, or purposeful activation of the system there will be a need at the right time to isolate the system. For this to be manageable in a timely fashion there needs to be good knowledge of the location and function of isolation valves, and they must be appropriately marked and assessable	▪ Designer qualification ▪ Signage ▪ Builder owner guidance ▪ Documentation ▪ Training
C-21	Insufficient alarming to notify of system activation	Many of the most damaging escape of water events occur when the property is unoccupied and local alarming is not enough to gain a response in the event of a real or accidental discharge of the system	▪ Connect to building alarm system ▪ Connect to local FRS or ARC ▪ Internet enable reporting to homeowner's phone ▪ Use of water detection devices

I.4 Suppression system escape of water prevention and limitation mitigations

From the analysis of escape of water events and reasons for high consequential loss made my insurers and forensic experts in Section 3, the potential mitigations may be summarised as follows:

Quality	Design	Training	Testing	Maintenance	Signalling	Information Sharing
For suppliers of BOTH active and passive system components:	Thermal activation device temperature selection appropriate to head location	▪ Designer ▪ Installer ▪ Maintainer ▪ Building owner ▪ Occupant	▪ Pressure testing ▪ System discharge testing ▪ Periodic function checks	▪ Upkeep ▪ Schedule	▪ Building alarm system ▪ Alarm Receiving Centre (ARC) ▪ FRS connection	▪ Component labelling ▪ Valve signage ▪ Pipe signage ▪ Pipe routing
3rd Party accreditation for: ▪ Design ▪ Installation ▪ Maintenance	Protection against: ▪ Freezing ▪ Water hammer ▪ Pressure changes ▪ Power outages	OEM product training for: ▪ Piping systems ▪ Non standard equipment			System health	System documentation
System approvals	Detection system vulnerability to false reporting					
Product approvals	System health reporting					

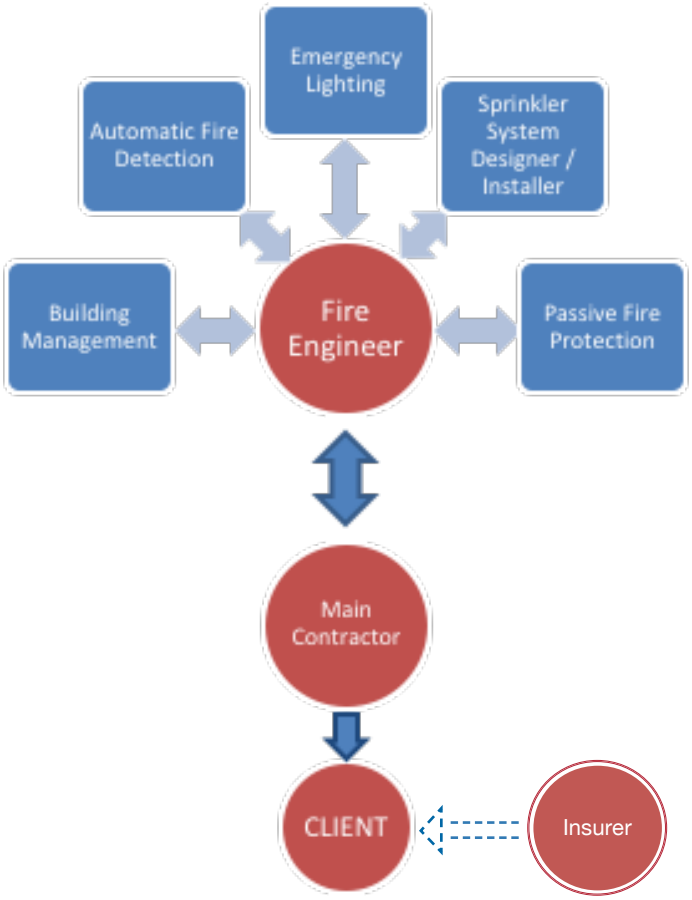
The following sections provide guidelines to support all identified necessary mitigations.

I.4.1 Roles and responsibilities

A clear remit of roles and responsibility addresses in whole or in part EoW causes:

- C-11 Material compatibility issues
- C-19 Designed and installed system incompatibilities
- C-21 Alarm notification shortcomings

The sprinkler or watermist system design brief must originate from the Client, their Main Contractor, or their appointed Fire Engineer as they are the only participants with the knowledge required of the building and occupancy risks, and the overall Fire Safety Plan and the role that the sprinkler/watermist system plays in assuring safety: this responsibility must not be devolved to the sprinkler or watermist system Installer. For any system installed to meet its life-safety or property protection objective, it must be resilient against 'down-time' and the consideration of escape of water must form part of the overall design.



The key roles and functions in the design and installation of a residential sprinkler/watermist systems are:

Client's/Designer's/Lead Contractor's appointed Fire Engineer

- Development of the Building's Fire Safety Plan (FSP)
- Specification of the sprinkler/watermist system to achieve its role in the FSP

Sprinkler/Watermist System Design Installing Company

- Design of the system in accordance with the Fire Engineer's requirements and in accordance with the relevant standards
- Installation and hand-over of the system with all relevant commissioning test records, demonstrations, documentation and client/user training.
- Where the sprinkler/watermist system installer has responsibility for the passive fire protection associated with the compartment breaching required by the sprinkler/watermist system to undertake the bulleted functions described below.

Passive Fire Protection company

In addition to their obligations to ensure the fire resistance and fire stopping of the fabric of the building complies fully with the building design requirements and appropriate regulations:

- To make good compartment breaching made during sprinkler/watermist system installation (if not done by the sprinkler installing company)
- Ensure all fire stopping products are approved as compatible with sprinkler/watermist system pipework materials (selection of incompatible sealing products is known to critically denature some types of plastic pipe used in residential sprinkler/watermist systems which can lead to brittle fracture, escape of water, and impairment of the system) (see section G.8)
- Ensure all fire stopping products are mechanically compatible with sprinkler/watermist system pipework – intumescent devices and products have the potential to crush and close plastic pipe during a fire event thereby potentially disabling parts of the system at their time of requirement (see section G.8).

Note: On completion of the passive protection works, the responsible person should be notified/ alerted to any other trade completing their works that would compromise the compartmentation or function of the suppression system. Any works completed post passive fire protection, will need to be made good and achieve fire resistance for the compartment and be certified.

As the only authority with jurisdiction over providers that may otherwise operate quite separately, information is provided to support the Designer and their appointed representatives to achieve a coherent solution specific to residential sprinkler/watermist system provision.

I.4.2 Competency, training, financial wellness, and equipment and product certification

I.4.2.1 Sprinkler/watermist system design and installation

Selection of 3rd party approved contractors for suppression system supply addresses in whole or in part EoW causes:

- C-1 Poor quality of install
- C-3 Incorrect head thermal rating selection
- C-4 System freezing
- C-8 False detector actuation
- C-11/12 Material incompatibility with mastics and other materials
- C-13/14/15 Unmade and poorly made pipe joints
- C-16/17 Pipe stress and insufficient support
- C-19 Installation differing from design
- C-20 Inadequate labelling and signage for rapid isolation
- C-21 Insufficient notification of system operation

Selection of a contractor is the first, and in many ways, the most important step with regards to quality assurance. Whilst not mandatory in the UK, it is highly recommended that a contractor is sought that is third party certified (TPC) as recognised within Approved Document B. At the time of writing there are 3 approval bodies that undertake accreditation of sprinkler and watermist installing companies:

- LPCB – Loss Prevention Certification Board LPS 1285 Scheme (watermist) - www.redbooklive.com
- LPCB – Loss Prevention Certification Board LPS 1301 Scheme (sprinklers) - www.redbooklive.com
- FIRAS – Scheme for Residential Sprinkler Systems - www.warringtoncertification.com/firas.html
- FIRAS – Scheme for Watermist System Installation - www.warringtoncertification.com/firas.html
- IFC – International Fire Consultants - www.ifccertification.com/certification/installer-certification.html

Each of the above Third Party Approved schemes covers the requirements for the assessment, approval and regular review of sprinkler system contractors in the UK and Ireland in respect of compliance with relevant 'best practice' industry standards.

Selecting a contractor should not be limited to the contractor being third party accredited alone. Each Third Party Approved company registers their contractors at various levels and therefore, it is of paramount importance that the Third Party Approved company's website is checked to see if the contractor is accredited to the required level for the project in hand. For example, a contractor may be registered for BS EN 12845 sprinkler system at a level that does not include full hydraulic calculations where all Residential BS9251:2014 systems require full hydraulic calculations. It is important to ensure the contractor selected has Residential and Domestic sprinkler systems as part of the listing scope of their third-party accreditation.

1.4.2.2 Passive fire protection installation

Product third party certification schemes for passive fire protection product installation are run by the following organisations:

- BM TRADA - www.bmtrada.com
- LPCB - www.redbooklive.com/index.jsp
- FM Approvals - www.fmapprovals.com
- IFC Certification Ltd - www.ifccertification.com
- Warrington Certification Ltd - www.warringtonfire.net

1.4.2.3 Sprinkler/watermist system installation and products - ancillary training

Specific OEM training on proprietary pipe system products and methods addresses in whole
or in part EoW causes:

- C-10 Leaking joints
- C-11 Material incompatibility with mastics
- C-12 Material incompatibilities with other materials
- C-13/14/15 Unmade and poorly made pipe joints
- C-16/17 Pipe stress and insufficient support

All installers must be specifically trained in the use of the proprietary piping system deployed. The principle current proprietary piping systems used include, but are not limited to:

- CPVC
- Lightweight crimped metal systems

Strict adherence to the manufacturers installation methodologies has been demonstrated to be critical to ensuring the performance of the pipe system as the potential pitfalls are many and often less than obvious. Training courses specific to the system's use in sprinkler/watermist systems are provided by the pipe system supplier or manufacturer, and evidence of satisfactory completion of a 'hands-on' training course for all installing operatives must be sought by the Designer or their appointed representative (e-learning type training in the use of these systems is not considered adequate).

Where the passive fire protection of compartment breaches made during the installation of the sprinkler/watermist system is not conducted by the system installer, there should be a similar expectation on the passive fire protection company conducting the work to have been appropriately trained in the fire-stopping methods and materials appropriate to the piping system used. Incorrect methods and materials used during fire stopping of sprinkler/watermist systems using certain pipe materials are known to extensively damage the pipe network.

1.4.3 Contractor financial wellness check

In addition to the sprinkler/watermist contractor's technical competency to undertake a project, the contractor should have the commercial capacity to undertake and complete the project.

Details held at Companies House may help in this contractor selection assessment as the records held will give information on:

- the length of time a contractor has been in business
- the turnover of the company, relative to the value of the contract to be placed.

Additionally, it may be beneficial to seek references for the company's other clients of similar size projects.

I.4.4 Equipment and product certification

Equipment certification addresses in whole or in part EoW causes:

- C-2 Equipment design fault
- C-5 Damage by water hammer
- C-6/C7 Inadvertent operation due to pressure surges and power supply interruptions
- C-8 False detector actuation

I.4.4.1 Sprinkler/watermist system components

The principle components of a residential fire sprinkler/watermist system are:

- Sprinkler/watermist heads – fire detection and water distribution
- Fire detectors (where not part of the sprinkler/watermist head)
- Pipe network – connecting sprinkler/watermist head to pump/water source
- Control sets – for testing and isolation of the water supply, alarm connection, and fault monitoring
- Pumps – which may be specific to the sprinkler/watermist system or shared with the domestic water supply
- Tanks – which may be specific to the sprinkler/watermist system or shared with the domestic water supply
- Isolation valves – which should be monitored to ensure the system is correctly configured for operation
- Non-return valves – which should be installed to be maintainable
- Passive firestopping products – to ensure that the fire resisting capability of the compartment is maintained after sprinkler system installation.

All components should be certified as being fit for purpose for performing their specific roles as part of the sprinkler/watermist system. Certification of sprinkler/watermist equipment in the UK and internationally include:

- LPCB - https://bregroup.com/products/lpcb/
- FM - https://www.fmapprovals.com/
- UL - https://www.ul.com/
- VdS - http://vds-global.com/en/certifications/lists/vds-approvals/

Where non-certificated equipment is used, the Designer or their appointed representatives, will need to consider carefully the case made for use of the equipment in the context of impact upon the through-life performance of the system; its meaning within the constraints of the relevant approved installers scheme, and accept responsibility for these decisions.

I.4.4.2 Passive fire protection products

Product third party certification schemes for passive fire protection product installation are run by the following organisations:

- BM TRADA - www.bmtrada.com
- LPCB - www.redbooklive.com/index.jsp
- FM Approvals - www.fmapprovals.com
- IFC Certification Ltd - www.ifccertification.com
- Intertek Testing & Certification Limited - www.intertek.com
- Underwriters Laboratories UK Ltd - www.ul.com
- Warrington Certification Ltd - www.warringtonfire.net

I.4.5 Maintenance

A good maintenance regime addresses in whole or in part EoW causes:

- C-3 Incorrect head thermal rating selection (change management)
- C-8 False detector actuation
- C-9 Damaged parts
- C-10 Leaking joints
- C-18 Damage from modification and refurbishment

It is vital that any installed system is accompanied by a maintenance and servicing regime provided by an accredited company. Servicing should be conducted at least annually and be accompanied by a comprehensive test regime that demonstrates correct system performance behaviour of every element of the system and leaves it in a fully operational state. The key tests considered to be a minimum are as follows:

- The system should be inspected to determine whether all components are functioning as designed
- The system should be inspected for leaks
- The system should be inspected to determine whether any or all modifications have been carried out in accordance with the appropriate standard
- Where there has been material alteration to the building, an increase in fire loading or a change to include vulnerable occupants, an assessment should be made as to whether the category of system is still appropriate .
- The sprinklers and their cover plates, or watermist heads should be inspected to determine whether they have been tampered with, painted or whether their spray pattern has been impeded.
- Valves should be exercised to ensure free movement and any locking mechanism should be checked and reinstated.
- The test valve should be operated to determine whether the system's design flow rate and pressure, as hydraulically calculated is achieved.
- Alarms should be tested to determine whether they function as designed .
- Backflow prevention devices should be maintained in accordance with the manufacturer's recommendations
- Any remote monitoring arrangements should be tested to determine whether they are being transmitted and received correctly.
- Where trace heating is installed, its operation should be checked.
- Correct and verified fire stopping around sprinkler/watermist pipework has been employed

I.4.6 Pressure and discharge testing

Pressure and discharge testing of the system addresses in whole or in part EoW causes:

- C-1/2 Poor quality of install and faulty equipment
- C-8 False detector actuation
- C-10 Leaking joints
- C-13/14/15 Unmade and poorly made pipe joints
- C-21 Insufficient notification of system operation

a Correct protocol would require this assessment to be made by the Client or their Representative (Fire Engineer), and not the sprinkler/watermist system installer/engineer.

b To include all flow switches, valve monitoring, power monitoring, and tank level alarms.

Common to some of the piping systems used in residential sprinkler and watermist systems is their ability to attain a level of rigidity and water sealing at the time of pre-assembly, before the joint has been made sound by gluing (i.e. CPVC), crimping (Crimp light metal system), or bolting (Swagelok type fittings). Whilst specific training in the use of these systems provides recording and marking methods to avoid this occurring, it has been noted in some cases that unmade joints can hold even at the 5-bar test pressure. It is recommended that the sprinkler/watermist system pipe network is pressure tested with water to a minimum of 8 Bar or 1.5 times working pressure, whichever is the higher figure, to confirm all joints are satisfactorily made and no leaks exist within the system before pipe work is covered with wall and ceiling lining finishes.

Only when all pipe work is completed, or a section of the building has been completed, should the sprinkler/watermist engineer then revisit each joint and sign the joint with initials to indicate he/she has carried out a pressure test to ensure the joint was glued/crimped/tightened correctly. This process has been demonstrated to be effective at reducing water losses associated with incorrect pipe network manufacture.

Discharge testing of the installed system additionally confirms

I.4.7 Material compatibility

Understanding the material compatibility issues around proprietary plastic pipe system products addresses in whole or in part EoW causes:

- C-10 Leaking joints
- C-11 Material incompatibility with mastics
- C-12 Material incompatibilities with other materials
- C-13/14/15 Unmade and poorly made pipe joints

There have been reports from the USA that certain plasticisers can degrade CPVC pipe. Most of these plasticisers are not allowed in Europe. However, there are Fire Mastics available in the UK that can degrade CPVC but these are easily avoided if the guidance provided through the CPVC specific training is followed. Manufacturers have compatibility lists of products such as fire mastic that is suitable for use with CPVC and many mastic manufacturers carry out their own testing for use with CPVC. It is highly recommended that only third-party accredited fire stopping companies should be used to install the fire seals around CPVC pipes as accredited companies should be up to date with compounds that can cause problems to CPVC. But in any case, paperwork should be supplied proving that any fire mastic to be used has been tested for use with CPVC by either the manufacturer of the mastic or by the manufacturer of the CPVC pipe (see section G.8).

I.4.8 Monitoring systems

Informative monitoring systems addresses in whole or in part EoW causes:

- C-21 Inefficient/slow system isolation following discharge

The sprinkler/watermist system should be monitored at all times both locally and remotely (where not full-time staffed) to provide awareness of:

- Its operational health (all monitored alarm valves open)
- Its operation in the event of fire
- Its operation in the event of accidental water release
- Insufficient water supply (tank level) to meet the design requirement
- Power supply failure to systems should be monitored when a dedicated sprinkler/watermist pump is used.

Integration with the fire alarm panel should enable rapid identification of:

- System activation
- The location of the water release via the flow switches
- The location of system impairment by closed monitored valves

I.4.9 Isolation valve locations, identification, and accessibility

Good isolation valve design, accessibility, and identification addresses in whole or in part EoW causes:

- C-21 Inefficient/slow system isolation following discharge

Efficient reduction of water damage in the event of accidental release demands that those attending, who may be unfamiliar with the building, are able to quickly locate where the release is, and identify and find where the relevant isolation valve is that will impair the least amount of system protection. This should be ensured by:

- At the entrance to the building, or at the fire alarm/system alarm panel when in the main entrance area, there MUST be signage that clearly indicates where the isolation valves are located within the building.
- The alarm panel electronic labelling of flow switch referencing should be recognisable in association with the isolation valve location signage

In multi-storey building, at each floor/location suitable signage should clearly show where the system isolation valve is housed

I.4.10 Building manager training

A well-training building manager addresses in whole or in part EoW causes:

- C-3 Incorrect thermal rating of heads following change
- C-9 Damaged components
- C-10 Leakage at joints
- C-20 Poor labelling and knowledge management
- C-21 Inefficient/slow system isolation following discharge

The building manager requires good knowledge of the sprinkler/watermist system and its operation. In the event of a fire, control of the system should be left as a responsibility of the Fire and Rescue Services. In all other situations the Building Manager should receive appropriate training in the system to include:

- The role of the sprinkler/watermist system in supporting the overall Fire Safety Plan
- Ability to advise/train occupants
- How the system operates and where all key components are located
- How the system is integrated with the alarm panel
- Fault identification and meaning
- Maintenance requirements
- Alternative safety procedures for the building and its occupant to cover periods when the sprinkler/watermist system is disabled for any reason (power outage, insufficient water, maintenance, isolated etc.)
- Who to notify when:
  - There is a fire
  - Any part of the system shows fault
  - Any part of the system is disabled
- How to isolate parts of the system when an un-intentioned release of water has occurred

I.4.11 Occupier training

A well-trained occupier addresses in whole or in part EoW causes:

- C-3 Incorrect thermal rating of heads following change
- C-4 System freezing
- C-9 Damaged components
- C-10 Leakage at joints
- C-20 Poor labelling and knowledge management
- C-21 Inefficient/slow system isolation following discharge

Occupiers may or may not have direct access to the system's isolation valve depending upon the type of system installed. Where the occupier does have access, full training must be given in the isolation and system resetting process. Where they do not have access, they must be provided with an emergency contact number of the Building Manager or sprinkler/watermist systems engineer.

Within the protected space, the occupants must be given training to ensure:

- They understand the life-safety benefit of the system and its importance to their protection
- They understand where the key components are, how they are routed, and what they do
- Sprinkler/watermist heads are not tampered with or used for support/hanging
- Structural modifications do not impact upon the pipe network routing or sprinkler/watermist head locations
- Operations within protected space are not moved in such a way to expose the heads to high temperatures
- Structural modification does not impair water distribution around the protected space

Policies will need to be put in place to ensure that responsibilities for training are clearly understood and that the training requirement propagates through all potential occupation/letting/sub-letting/ownership configurations.

I.4.12 Access to information

Access to information addresses in whole or in part EoW causes:

- C-9 Damaged to components
- C-18 Damage to hidden pipes and fittings
- C-20 Poor labelling and knowledge management
- C-21 Inefficient/slow system isolation following discharge

In complex buildings it is recommended that provision of an information storage box at the point of building entry will assist Fire Services and others gain a rapid understanding of the sprinkler/watermist system layout and location of all key components. The documentation provided should include location of Isolation Valves on block-plans.

I.4.13 Labelling and signage

Labelling and signage addresses in whole or in part EoW causes:

- C-1 Incorrect installation
- C-18 Damage to hidden pipes and fittings
- C-21 Inefficient/slow system isolation following discharge

All key components of the sprinkler/watermist system should be appropriately labelled to assist with maintenance and use.

I.5 Suppression system water damage limitation checklist

Residential Sprinkler/Watermist System Design Checklist for Water damage mitigation

1. Are all providers in the sprinkler/watermist system supply chain 3rd party accredited? ☐
2. Is all possible available equipment certificated? ☐
3. Is the sprinkler/watermist installer specifically trained in the use of the pipe system technology deployed? ☐
4. Is the Passive Installer aware of potential material compatibility issues with CPVC pipe? ☐
5. Has the sprinkler/watermist system been pressure tested with water at 8 Bar or 1.5 times working pressure (whichever is the higher)? ☐
6. Has the system been successfully discharge tested ? ☐
7. Is there an appropriate servicing agreement in place for the sprinkler/watermist system? ☐
8. Are all valves that could stop the flow of water to any part of the system monitored? ☐
9. Are all flow switches monitored and linked to the alarm panel? ☐
10. Can the location of water discharge be readily understood from the details on the alarm panel? ☐
11. Without prior knowledge, is the information available at the building's entrance and on the alarm panel enough to readily know where to locate the appropriate isolation valve? ☐
12. Is the signage clear showing where all isolation valves are? ☐
13. Has training been given to the building manager about the operation and location of key equipment for the sprinkler/watermist system? ☐
14. Has sufficient training been given to occupants on the function of the system and factors that may impair its performance or lead to unwanted discharge? ☐

I.6 References

BS EN 12845:2015+A1:2019 Incorporating corrigenda December 2015 and January 2016 Fixed firefighting systems: Automatic sprinkler systems. Design, installation and maintenance

LPC Rules for Automatic Sprinkler Installations 2015 incorporating BS EN 12845

BS 9251:2014 Fire sprinkler systems for domestic and residential occupancies – Code of practice

BS 9251:2021 Fire sprinkler systems for domestic and residential occupancies – Code of practice

BS EN 16925:2018 Fixed firefighting systems – Automatic residential sprinkler systems – Design, installation and maintenance

BS EN 12259 – 1:1999 Components for sprinkler and water spray systems (part 1 – sprinklers)

BS 9252:2011 Components for residential sprinkler systems – Specification and test methods for residential sprinklers

N.F.P.A 13 Standards for the installation of sprinkler systems 2019

F.M.Global Data Sheet 2-0 Installation guidelines for automatic sprinklers

RISCAuthority Technical Guidance Note :Residential sprinkler systems to BS 9251

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Insurer Requirements for Enhanced Escape of Water Protection and Safety in Building Plumbing and Water-Based Fire Suppression Systems

based on

The Building Regulations 2010

Sanitation, hot water safety, water efficiency

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FPA Fire Protection Association