British Plastics Federation
PIPES GROUP

Domestic hot & cold water supply and central heating systems

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Contents

Note: Images and diagrams used in this document are for illustrative purposes only.

Introduction

Plastic pipes are widely used in domestic hot and cold water supply and central heating systems. Their flexibility aids handling and installation. They are available in both straight lengths and coils, which enables threading around obstructions and through joists, reducing the number of joints required and hence the potential for leaks. Where joints are required, the extensive range of fittings available for each pipe system enables reliable, watertight joints to be made.

This guide provides information on materials, service conditions, design and installation of plastic pipes primarily for domestic hot and cold water systems and central heating systems for residential properties (excluding patient accommodation).

Overview

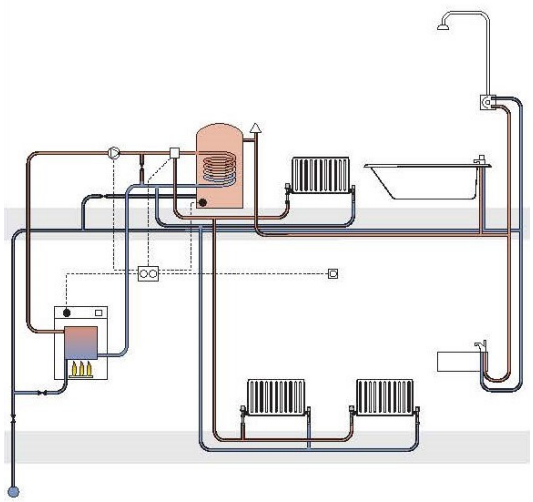
Systems

Cold water supply - pipework carrying water for domestic purposes including drinking, washing and operation of sanitary appliances.

Hot water supply - pipework carrying heated water for domestic purposes including washing. Additional guidance for continuously operated hot water systems is given in Annex A.

Central heating systems - pipework carrying heated water for space heating, see note below.

Note: Guidance on use of plastic pipes for warm water underfloor heating systems is available from the BPF Pipes Group website.



Pipes

Pipes may be solid wall or include a polymer oxygen barrier or metal layers.

Barrier pipes have plastic inner and outer walls with an adhesively bonded intermediate layer of plastic that forms an oxygen barrier.

Multi Layer Composite (MLC) pipes have inner and outer plastic walls with a bonded intermediate layer such as aluminium.

For hot and cold water supply and heating systems, typical pipe materials are polybutylene (PB, also known as Polybutene, Polybut-1-ene and Polybutene-1), cross-linked polyethylene (PEX) and Polyethylene of raised temperature (PE-RT).

In this guide, the term 'plastic pipes' is used to cover all of these pipe types, unless otherwise explained.

Pipes are generally available in nominal diameters of 10mm to 110mm in straight lengths or coils.

Note 1: Other materials may be offered for specific applications such as ABS and PVC-U (cold water supply), C-PVC and PP-R (hot and cold water supply). Guidance should be sought from the manufacturer on application and installation.

Note 2: Guidance on specifications for plastic pipes for domestic hot and cold water supply and domestic heating systems is available from the BPF Pipes Group website. The guidance is regularly updated as changes to standards are published.

Fittings

To ensure the jointing system is compatible with the pipe being installed, the relevant manufacturer's literature should be consulted. Jointing systems include:

- Push-fit fitting – where a support sleeve is inserted into the pipe end and the pipe pushed firmly into the fitting to an insertion mark or specified depth. Push fit joints incorporate a rubber seal and a gripping mechanism to provide a secure mechanical connection. They are generally 'demountable' either by unscrewing or by using a special tool
- Press fit jointing – the fitting comprises a metal outer sleeve or band and plastic or metal body, which may include integral inserts. Using a special pressing tool, the outer sleeve is formed to grip the pipe to the fitting body.
- Socket fusion – the outside of the pipe and the inside of the fitting are heated to a sufficient temperature. The two parts are then quickly pushed together, held for a determined length of time and, in cooling, the two parts combine to create a joint.

- Butt fusion - the parts to be jointed are pressed against a heating element and a bead is formed. The parts are then brought together and held under pressure. Pressure is also maintained during the cooling time. After jointing a bead should have formed around the whole circumference.
- Electrofusion - in this method the pipe and special fittings are heated by means of electrical resistance and fused together. The power and heating time is supplied through an electrofusion control unit.
- Shrink-fit - once a support ring is added to the end of the tube, either a hand operated or an electric expansion tool is used to swage open the pipe to allow the fitting to be inserted. The elastic memory of the pipe shrinks back onto the fitting making the permanent watertight seal.
- Mechanical compression jointing - the fitting compresses the pipe when mechanically tightened by the installer. These fittings may be supplied with / without a seal depending on design. Special tools may be required, and a support sleeve would usually be required.

Manufacturers may also offer their own range of accessories such as pipe-in-conduit, pre-insulated pipes, pipes clips and spacers, cold forming bends, pipe cutters etc. The manufacturer's literature should be consulted for the full range of fittings and accessories available for each system.

Note: Guidance on specifications for fittings for plastic piping systems for domestic hot and cold water supply and domestic heating systems is available from the BPF Pipes Group website. The guidance is regularly updated as changes to standards are published.

Advantages

The market's transition to plastic pipes for these applications has been driven by the practical advantages over traditional materials.

In-service: smooth internal bore, low thermal conductivity, low noise transmission.

Installation: lightweight compared to equal lengths of other materials, long lengths supplied in coils reduces the number of joints saving time and reducing the risk of leaks; flexibility means pipes can navigate obstructions; wide range of fittings which permit connection to existing metal pipework and avoids the use of solder or naked flames.

Physical: inherent properties combined with well-chosen joints allow thermal expansion; impact resistance means pipes are not easily damaged during installation or service.

Note: BPF Pipes Group recommend products which meet the relevant standard and which have third party evidence. Always refer to manufacturers' specific product data sheets to qualify the above characteristics for a particular product.

UK Service Conditions

The service conditions in UK hot and cold water supply and heating applications during routine operation and system malfunction are shown in the table below.

	Nominal System Flow Temperature (T_f)	Maximum System Service Temperature (T_s)	System Malfunction Temperature (T_m)	System Maximum Working Pressure
Indirect cold water systems	20	20	-	3.5
Direct mains-fed cold water systems	20	20	-	12.5
Subsurface heating systems	60	83	100	3.5
Vented hot water systems	65	83	100	3.5
Unvented hot water systems including instantaneous heaters and/or incorporating storage (excluding continuously operated systems)[a]	65	95	100	6
Vented central heating systems and indirect hot water primary circuits[b]	82	95	100	3.5
Sealed central heating systems and indirect hot water primary circuits	82	105	114	3

a) Continuously operated recirculating domestic hot water systems and waste discharge from unvented hot water systems are excluded from these applications. Guidance on use of plastic pipes for discharge from unvented heating systems is available from the BPF Pipes Group website https://www.bpfpipesgroup.com/technical-information/technical-guidance/.

b) Plastic pipes are not suitable for boiler vent pipes.

Guidance on specifications for plastic pipes for domestic hot and cold water supply and domestic heating systems is available from the BPF Pipes Group website.

BS 7291 covers piping systems specifically for the UK applications. Pipes and fittings are assessed against all of the service conditions in the table above (designated as Class S to Table 1, BS 7291-1:2010+A1:2023).

There are six British Standards (BS EN ISO's) for water for human consumption in domestic systems and for heating systems which have been developed collaboratively in CEN and ISO.

Products included in these standards necessarily cater for a wide range of operating systems. They

do not cover the service conditions in Table 1 of BS 7291-1: 2010 for sealed central heating systems and indirect hot water primary circuits. They cover products for the transportation of hot and cold water at a design pressure (system maximum working pressure) of 10 bar and up to a maximum malfunction temperature of 100°C (Class 5).

For products conforming to one of these BS EN ISO standards, but not to BS 7291, check that the following additional requirements are met (as applicable):

- Suitability for use on sealed central heating systems and indirect hot water primary circuits with a malfunctioning temperature of 114°C
- Suitability for use on direct mains-cold water system with a working pressure of 12.5 bar
- Suitability for use on unvented hot water supply system with a working pressure of 6 bar

Codes (design, installation and commissioning)

Approved Document G to the Building Regulations.

Approved Document L to the Building Regulations.

BS EN 14336:2004 *Heating systems in buildings. Installation and commissioning of water based heating systems.*

BS EN 12828 :2012+A1:2014 *Heating systems in buildings. Design for water-based heating systems.*

BS EN 12831-1:2017 *Energy performance of buildings. Method for calculation of the design heat load. Space heating load, Module M3-3*

BS EN 806-1:2000 *Specifications for installations inside buildings conveying water for human consumption. Part 1: General*

BS EN 806-2:2005 *Specifications for installations inside buildings conveying water for human consumption. Part 2: Design*

BS EN 806-3:2006 *Specifications for installations inside buildings conveying water for human consumption. Part 3: Simplified Method*

BS EN 806-4:2010 *Specifications for installations inside buildings conveying water for human consumption. Part 4: Installation*

BS EN 806-5:2012 *Specifications for installations inside buildings conveying water for human consumption. Part 5: Operations and Maintenance*

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.*

CIBSE Guide B Heating, Ventilating, Air Conditioning and Refrigeration. Guide B1 Heating, Chartered Institute of Building Services Engineers.

CIBSE Commissioning Code W: Water distribution systems

Domestic Building Services Panel (DBSP), HVDH Domestic Heating Design Guide (available from CIBSE).

NHBC Standards Chapter 8 Services (for relevant applications).

The dated editions above are correct at time of issue of this guidance document – always check that editions are the latest.

Design

Conventional design methods for hot and cold water supply and heating systems still apply when using plastic pipes. However, the properties of plastic pipe may provide a wider range of design options. In all cases, health and safety obligations and national regulations need to be observed. Prior to designing and installing plastic pipe systems, it is important to read the relevant manufacturer's health and safety and installation guidelines.

Modular design

Many manufacturers supply manifolds for use in heating systems. These provide an opportunity for modular system design. One manifold is used in the flow pipework, and a second, matching unit, is provided in the return line. Individual manifolds can be joined together to provide multiple flow/return circuits. Manifolds are also available for distribution of hot and cold water directly to each outlet.

Pipe sizing

In small, simple installations such as those in single dwellings, pipes can be sized using experience and convention. The internal diameter will remain consistent through the pipe lifetime and long radius bends reduce frictional losses.

In all other cases the potential flow rates and pipe sizes required should be calculated using a recognized method such as that in BS 8558:2015.

Expansion control – heating systems

In typical domestic applications, special provision for thermal movement is not normally required, due to the inherent flexibility of the pipe material. However, reference should always be made to individual manufacturer's instructions.

Where long runs of pipe are to be installed, it is important to assess the amount of thermal movement on the pipe run. Provisions should be made to control thermal movement by using anchor points. To retain the proper alignment of the system, guide brackets should be used which allow the pipe to slide within them during thermal movement.

Anchor points should be formed at couplings or tees and would normally be formed by locating two guide brackets directly against the opposing socket face of the fitting. This might vary if the anchor point is near an elbow or movement is only in one direction.

Provision for pipe expansion should be incorporated between each anchor point. There are two ways of allowing for pipe expansion: Flexible arm or Expansion loop. A flexible arm needs to be long enough to allow the pipe to flex naturally without causing any damage. An expansion loop allows for pipe expansion in the middle of a pipe section, alternatively pipes can be laid on a continuous support such as a cable tray to accommodate expansion by 'snaking' of the pipe. Where snaking is used, it is necessary to prevent upward movement of the pipe to prevent it

coming into contact with pipe at a different temperature or with electrical wiring.

Where a cold water pipe is installed in high ambient temperature conditions, provision for thermal movement due to contraction should also be considered.

Design limitations / considerations

Plastic pipes should not be used inside a property to carry fluids used as a fuel source (such as gas, fuel oil, or petroleum fluids which are part of the heating system), or water containing high levels of chlorine such as swimming pool installations.

Plastic pipes should not be installed in locations where they are likely to be exposed to excessive levels of ultraviolet (UV) light, such as in direct sunlight or where artificial sources of UV are in use. If such exposure is unavoidable, the pipes should be encased in a protective ducting or similar.

Consideration of necessary clearances from any heat generating equipment (e,g. lamps, refrigerators, chimneys) shall be given. Necessary distances may be given in the equipment literature.

Plastic pipes shall not be used for the primary circuit of solar heating systems where the temperature cannot be thermostatically controlled.

When in doubt, or for additional guidance, the advice of the manufacturer should be sought.

Design parameters

The design parameters of a hot water system must be reviewed when any changes are made.

For example, extension of the system, change of use, refurbishment or replacement of the water heater.

Installation

Connecting To Other Systems

To ensure the validity of manufacturers warranties, the manufacturers' recommendations as to the correct method of jointing should be followed. In addition, when transitioning to a different system type the following should be noted:

Copper pipe

Connection of plastic pipes to metric copper pipe to BS EN 1057 can be made using push-fit connectors or transition adapters that are available for the plastic system. The manufacturer should be consulted for guidance. Care needs to be taken when selecting a fitting to prevent a galvanic reaction and corrosion.

Chrome-plated copper and stainless steel pipe

Connection of plastic pipes to chrome-plated copper and to stainless pipe can be made using compression fittings or suitable adaptors. Push-fit fittings are not suitable due to the differences in surface hardness of the materials.

Connection to heat generators and relief valves

General

Independent of the pipe material, each heat generator shall be served by a safety temperature lockout device which prevents the heat generator flow temperature exceeding the maximum temperature rating of any component in the primary heating circuit.

This can be a factory fitted safety temperature lockout built into the heat generator (e.g. boiler), or a safety temperature lockout fitted on the generator flow pipe as near as possible to the heat generator.

Plastic pipe and fittings shall not be used on gravity circulation (non-pumped) primary heating circuits.

Note: A lockout device is not required if the heat generator intrinsically cannot exceed the maximum temperature rating of any component (e.g. low temperature heat pumps).

- **Boilers and instantaneous water heaters (gas and oil fired, or electric)**

Connections shall be outside of the boiler and a minimum of 350mm from the boiler casing. A transition piece i.e. metal to plastic can be used for this purpose.

This requirement also covers circulators, an appliance that directly heats the domestic hot water that is circulated between the appliance and a cylinder.

Plastic pipe and fittings shall not be connected directly to a back boiler or be used within the fire opening, or within or extending out of a chimney wall.

- **Solid fuel boilers**

Connections shall be outside of the boiler and a minimum of 350mm from the boiler casing. A transition piece i.e. metal to plastic can be used for this purpose.

The distance of the plastic pipe and / or fitting from the boiler shall also take into consideration the boiler manufacturers clearances due to potentially higher radiant heat from this type of boiler.

Note: Solid fuel boiler product standard BS EN 16510-2-4 does not require a water temperature safety device if operating outside of the declared temperature range does not cause damage to the boiler.

- **'Solar thermal' water heating systems**

Plastic pipes and fittings shall not be used for the primary heating circuit. Plastic pipes may be used for the secondary circuit.

- Heat pumps

Connections shall be outside of the heat pump.

Notes:

Heat pump product standard BS EN 14511-4 does not require a water temperature safety device if operating outside of the declared temperature range does not cause damage to the heat pump.

A lockout device on the system is not required if the heat pump intrinsically cannot exceed the maximum temperature rating of any component (e.g. low temperature heat pumps) – see 'General' above.

- Temperature relief valves

Plastic pipe should not be connected directly to safety pressure relief valves or combined temperature/pressure relief valves.

In all cases (including instantaneous water heaters, caravan heaters etc.), care should be taken to ensure that the appliances have the appropriate thermostatic controls and cut outs in accordance with Part G of the Building Regulations to ensure that operating conditions do not exceed the temperature and pressure limits laid down for Class 'S' pipes.

Routing And Laying

Bending

A bend is made by installing a fixing at one end and gently curving the pipe by hand (using an appropriate tool where necessary) to the required shape, and then installing a second fixing at the other end. Alternatively, bends can be supported with an appropriate bend former. MLC pipe will retain its shape after bending due to the metal layer, the manufacturer's literature should be consulted. Care should be taken not to bend the pipe beyond its recommended bending radius as this can cause kinking. Pipes that have been damaged during bending should not be used. Details of the bending radius can be obtained from the manufacturer's literature. It is generally 12 times the pipe diameter for unsupported pipe and 8 times the pipe diameter for supported pipe.

The thermal expansion / contraction of the pipe (especially in intermittent hot pipe) must be considered and accommodated at changes of direction of the pipe.

Fixing

Plastic piping shall be secured by suitable metal or plastic clips or brackets. Except for anchor points, brackets should allow for free axial movement.

BS EN 806-4:2010 provides general information on the bracketing of different material types, and also in different situations. Guide bracket maximum distances and other expansion compensation requirements are given in Annex B of BS EN 806-4. The maximum pipe diameter allowed for in Annex B is OD 110mm.

Different methods include allowing for expansion with continuous support and guide brackets and without continuous support. Installation of pipes allowing expansion and with guide brackets are given in Table B.7 of BS EN 806-4.

Some manufacturers allow for pipework to 'snake' upon expansion in cable trays. In this type of installation care must be taken to not impede other services.

Manufacturers specific pipework bracketing instructions should be followed on how to make anchor points and allow for correct spacing.

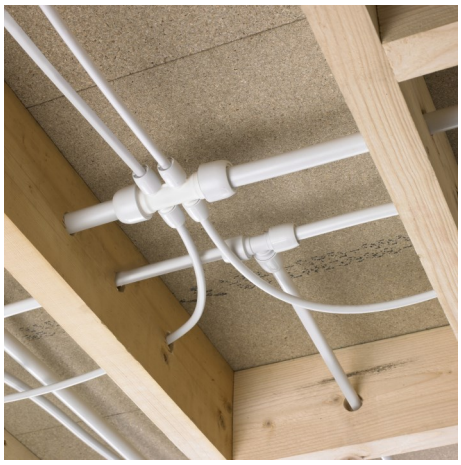
Where piping is adequately supported or is run within concealed spaces (e.g. through suspended timber floors), the number of clips can be reduced or omitted provided that:

- The pipe will not be subjected to vigorous movement.
- The pipe does not form a distribution pipe or circuit where effective air venting might be impaired by poor pipe alignment.
- Hot pipes will not touch cold pipes.
- The pipe will not come into contact with sharp, abrasive or other potentially damaging surfaces.
- The pipe will not come into contact with hot surfaces or transmitted heat that may melt the pipe e.g. inset lighting.
- The pipe will not come in contact with materials that may suffer damage or discoloration from transmitted heat.

Pipe routing

The flexibility of these systems allows pipes to be threaded through the fabric of the building: – through stud partitions, dry walling, steel structural members and drilled holes in joists.

Requirements for pipe routing are included in BS 8558:2015. Further guidance is given in NHBC Standards Chapter 8.6.

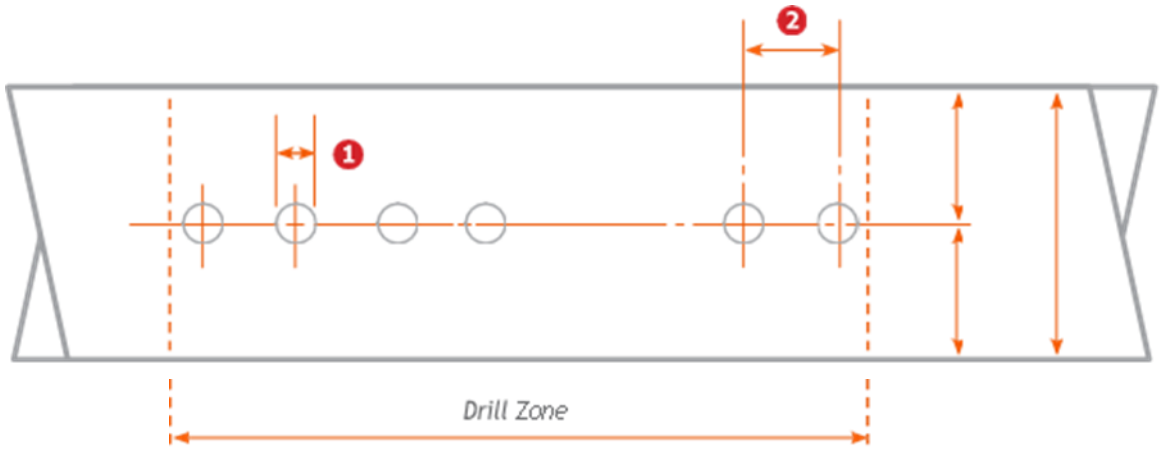


Threading through joists

Flexible pipe can be threaded through holes drilled in the joists allowing pipework to be installed from below, after the flooring has been laid

- Traditional Timber Joists

Holes shall be located in the correct zones of the joist span, which is different from the notching zone. The permitted zone for holes is between 0.25 and 0.4 of the joist span (see diagram below)



1 Maximum diameter of hole = Joist height x 0.25
2 Minimum distance between hole centres = Largest hole diameter x 3

Within the drilling zone, the holes must be located on the central axis of the joist, with the centre lines spaced no closer than three times the largest diameter apart. The maximum size of hole must not exceed one quarter of the joist height.

Once the drill positions have been determined and marked on the first joist, a batten can be used as a quick measuring template to transfer the position of the hole to other joists.

Holes can be drilled by using a drill with an angle chuck (suitable eye protection should be worn). When the holes have been drilled, the flexible pipe can be threaded into position.

When pipework is installed in notches in the joists, structural timbers should be notched only with the permission of the architect or a structural engineer.

- Threading through engineered joists

Plastic pipe systems are ideal in buildings incorporating engineered 'I' section composite timber joists. The piping can be installed through holes in the web section without damaging flange members.

- Threading through steel structural members

In fabricated steel framing systems, plastic pipes can be threaded through the open webs of the framework. Some mechanical protection should be provided to prevent chaffing of the pipe walls where these rest on the steel members.

Laying pipes in concrete floors

Plastics are not affected by cement, limes, mortars, concrete and general corrosion. The Water Supply (Water Fittings) Regulations 1999 require pipework to be accessible to facilitate its repair and replacement. Therefore, pipe-in-conduit systems supplied by many manufacturers are ideal for installation directly into screeded concrete floors.

These comprise a flexible plastic pipe for use in a water supply or heating system inside a slightly larger conduit pipe. This allows the pipe to be withdrawn and replaced in case of damage whilst avoiding the need for a pipe ducting system that requires continuous timber access boarding.

The pipe-in-conduit system should be installed so that the pipe in the conduit may be removed, by disconnecting the exposed ends and withdrawing it through the conduit. For further installation recommendations refer to the manufacturer. The system should be pressure tested before the screed is laid. The thickness of the screed will depend upon the loading requirements of the floor and the screed should be laid in accordance with the relevant requirements of BS 8204-1:2003+A1: 2009 Screeds, bases and in-situ Floorings. Concrete bases and cement sand levelling screeds to receive floorings. Code of Practice.

Wall and floor penetrations

The impacts on the following should be considered:

- structural integrity of the penetrated element
- fire safety
- resistance to the passage of sound
- waterproofing / seal

Requirements for penetrations are included in BS 8558:2015. Further guidance on how to penetrate building elements such as ground slabs, waterproof membranes, joist, concrete floors are given in NHBC Standards 2024, Chapter 5 - *Substructure, Ground Floors, Drainage and Basements)* and Chapter 6 – *Superstructure as well as in Chapter 8.6-Installation and commissioning.*

Requirements for fire safety of pipe openings are given in Building Regulations Part B and more detailed guidance in Approved Documents B1 and B2. Consultation of a competent fire safety expert is strongly recommended.

Building Regulations Part E together with Approved Document E provide some recommendations on possible constructions of separating floor and wall penetrations for various floor types to control and minimise the transmission of sound.

Installing pipes in walls

Plastic pipe systems up to 10mm can be accommodated behind ‘dot and dab’ plasterboard walls to give a pipe free appearance within the room.

When installing pipes in dry lined walls care should be taken to avoid running the pipework along any obvious fixing zone i.e. at skirting level or where curtain rails may be fixed. Lateral pipes should be run horizontally in line with plasterboard penetrations and radiator drops should be run vertically, side by side, at one end of the radiator position.

Plastic pipe systems can be easily threaded through studwork and within wall systems during construction. This method is often used for running feeds to radiators or where concealed plumbing is required.

Note: Guidance on sealing gaps around pipes in buildings is available from the BPF Pipes Group website.

Protection

Electrical bonding

Refer to BS 7671:2018+A2:2022 *Requirements for Electrical Installations IET Wiring Regulations.* Further Guidance can be found in CIPHE *Electrical Earthing and Bonding of Building Services.*

Where the pipe forms a break in the continuity of existing metal pipe, which may have been used for earthing or bonding, the electrical continuity should be reinstated. The bonding lead should be fixed permanently to both ends of the existing metal pipework.

Insulation

As for all piping systems, uninsulated pipes do not provide any resistance to freezing of the conveyed water. Freezing may prevent the system from functioning and may cause damage. Therefore it is always advisable to provide insulation in accordance with Part L of the Building Regulations in situations where there is any likelihood of freezing. More information can be found in Approved Document L1A and the Domestic Building Services Compliance Guide. Trace heating may be used as part of frost protection measures. Please always refer to the pipe manufacturer.

Insulation of pipes for temperature maintenance

Reasonable provision should be made to limit heat losses from the pipes. More information can be found in Approved Document L1A and the Domestic Building Services Compliance Guide.

Painting

Most plastic pipe systems may be painted. It is advisable to consult the pipe manufacturer's literature for acceptable paints, but these will generally be in the form of an emulsion paint, with a suitable undercoat. Before painting, ensure the surface of the pipe is clean, dry and free from grease and silicone compounds. If repainting is required, chemical paint strippers and hot air guns should not be used.

Chemical resistance

Plastics pipes have good chemical resistance. However, in the event of spillage of chemicals, the pipework should be washed with clean water. Building materials such as standard concrete, mortar, plaster, do not affect the pipes. Timber treatments for woodworm or rot are normally water-based: ideally spraying is carried out prior to pipe installation but if not, pipes and fittings should be covered during treatment. Care should be taken that solvent-based cleaning products, tapes, paints, adhesives or sealing compounds do not come into contact with pipes.

Commissioning

Commissioning includes filling & flushing, any required disinfection, pressure testing and if the water quality regarding suspended matter content, corrosion damage, scaling and organic and inorganic constituents must be controlled, water conditioning.

Pressure testing of plastic pipe work is carried out according to BS EN 806-4:2010, test Procedures B or C and in line with the Water Supply (Water Fittings) Regulations, Byelaws in Scotland.

Guidance on Filling & flushing and water conditioning for drinking water systems can be found in BS 806-2:2005 and BS 806-4:2010 as well as in HSG274 Part 2:2014, BS 8558:2015, and BS PD 855468:2015.

For closed loop heating systems, the guidance given in BSRIA BG 29 - *Pre-commissioning Cleaning of Pipework Systems* and BG 50 - *Water Treatment for Closed Heating and Cooling Systems* can be followed.

Care shall be exercised in the correct selection of any additives used to ensure they are compatible with the installed pipe system and do not result in any long-term damage.

As for all piping systems, shock treatment of disinfectant or continuous dosing of disinfectant should only be used to manage existing contamination and should never be used as a precautionary measure to prevent contamination. Manufacturers advice should be sought before commencing any of these treatments.

Corrosion Inhibitors can be used to prevent corrosion of steel radiators and other vulnerable components. Most proprietary anti-corrosion compounds and central heating anti-freeze admixtures used at the normal recommended concentrations do not affect the majority of plastic pipe systems.

Note: The use of central heating inhibitors which are safeguarding heating systems against the formation of sludge, scale build–up and corrosion is best practice and allows the use of plastic pipes without oxygen barrier. Plastic pipes with oxygen barrier for heating systems are commonly available.

Summary

In summary, the main advice points from manufacturers are:

- Use connectors (and pipe inserts) compatible with the pipe
- Consult pipe sizing guides to guarantee sufficient flow
- Do not exceed the specified temperatures and pressures for the application
- Design the system to allow for movement and expansion caused by thermal cycling
- Do not put mechanical strain on a piping system
- Carefully follow manufacturer's guidance when connecting to a boiler
- Protect from direct sunlight
- Do not bury pipe and fittings directly in concrete (except for underfloor heating pipe)

Installation

- Protect pipework during installation from damage such as scratching, chemical attack by unsuitable substances (e.g. solder flux) or heat (e.g. blow torches)
- Consideration of necessary clearances from any heat generating equipment (e,g. lamps, refrigerators, chimneys, etc.) shall be given
- Do not use components that are obviously damaged

- Protect the pipework during service from freezing, direct mechanical abuse or attack by rodents
- Comply with electrical continuity requirements
- Do not bend pipework excessively, twist joints or apply side load
- Correctly support the pipe (consult manufacturer instructions on clipping)

Testing and commissioning

- Ensure unvented hot water cylinders are functioning correctly
- Always pressure test systems before commissioning
- Always disinfect hot and cold water domestic systems before commissioning

Annex A

Continuously Circulated Hot water Systems

Overview

These systems (known as recirculating, secondary hot circulation, return or ring main systems) carry pumped hot potable water to outlets where the temperature is between 60°C to 70°C and is replenished by an incoming water supply to replace the water drawn to outlets.

These systems are very different from intermittent systems for hot water distribution which are only hot when water is being drawn. Only products approved by the manufacturer for continuously operating systems should be used. The manufacturer and their technical information must always be consulted for specific limitations.

A clear understanding of the quality of the water to be used in a recirculating system is essential to correct design. The long-term performance of a continuously operating system will be affected by the temperature and pressure duty cycle and the aggressiveness of the water e.g. from free chlorine and pH. Disinfection routines may also have an effect and must also be agreed by the manufacturer.

The following aspects must be considered for recirculating hot water systems *in addition* to all other advice in this guide.

UK service conditions

Temperature: Systems shall have a design recirculating temperature of between 60°C and 70°C. The maximum temperature during fault conditions (for very short periods of time) should not exceed 95°C.

The difference in temperature between the flow and return connections on the water heater should not exceed 5°C. Insufficient temperature at the outlets shall not be solved by raising the temperature in the recirculating hot water system above 70°C.

Pressure: System pressures shall not exceed those specified by the manufacturer. Refer to BS EN 806-2:2005, table 2 for specific information on classification of service conditions.

Flow rates

Pipes within a recirculating hot water system need to be sized for both delivery of water in terms of volume and maximum velocity 2.0m/s.

Manufacturers' technical information shall be used during the design of a recirculating hot water system.

For care applications reference should be made to NHS Model engineering specifications D 08.

References:

Approved Document L1A: *Conservation of fuel and power in new dwellings.*

BS 7291-1:2010+A1:2023 *Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings. Part 1: General requirements.*

BS 7291-2:2010+A1:2023 *Thermoplastics pipe and fitting* systems for hot and cold water for domestic purposes and heating installations in buildings. Part 2: Specification for polybutylene (PB) pipe and associated fittings.

BS 7291-3:2010+A1:2023 *Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings. Part 3: Specification for crosslinked polyethylene (PE-X) pipes and associated fittings.*

BS EN 1057 *Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications.*

Domestic Building Services Compliance Guide, DCLG, 2013 (incorporating 2018 amendments).
Water Supply (Water Fittings) Regulations 1999 No. 1148.

WRAS Commissioning Plumbing Systems Advisory Leaflet. No. 9-05-01, WRAS, December 2008.

See also list of design codes on page 5.

A list of members who manufacture and supply plastic pipes for hot and cold water supply and central heating systems is provided on the BPF Pipes Group website, https://www.bpfpipesgroup.com/product-applications/building-services/