BRITISH STANDARD

BS EN 806-4:2010

Specifications for installations inside buildings conveying water for human consumption

Part 4: Installation

ICS 91.140.60

National foreword

This British Standard is the UK implementation of EN 806-4:2010. This part of BS EN 806 partially supersedes BS 6700:2006+A1:2009. On publication of parts 1 to 5 of BS EN 806, BS 6700:2006+A1:2009 will be withdrawn.

NOTE EN 806 parts 1 to 5 have been agreed by CEN to be a 'package' with a common Date of Withdrawal for conflicting National Standards (Resolution CEN/BT/20/1993 and CEN/TC 164 Resolution 199 refer).

The UK participation in its preparation was entrusted to Technical Committee B/504/2, Water Supply - Internal systems and components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Specifications for installations inside buildings conveying water for human consumption - Part 4: Installation

Spécifications techniques relatives aux installations d'eau destinée à la consommation humaine à l'intérieur des bâtiments - Partie 4 : Installation

Technische Regeln für Trinkwasser-Installationen - Teil 4: Installation

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Foreword

This document (EN 806-4:2010) has been prepared by Technical Committee CEN/TC 164 “Water Supply”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2010, and conflicting national standards shall be withdrawn at the latest by September 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document is intended for the use of engineers, architects, surveyors, contractors, installers, water suppliers, consumers and regulatory authorities.

This standard has been written in the form of a practice specification. It is the fourth part of a European Standard consisting of five parts as follows:

— *Part 1: General*

— *Part 2: Design*

— *Part 3: Pipe sizing — Simplified method*

— *Part 4: Installation*

— *Part 5: Operation and maintenance*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies requirements and gives recommendations for the installation of potable water installations within buildings and for pipework outside buildings but within the premises in accordance with EN 806-1. This European Standard is applicable to new installations, alterations and repairs.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 200, *Sanitary tapware — Single taps and combination taps for water supply systems of type 1 and type 2 — General technical specification*

EN 545:2006, *Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

EN 681-1, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 751-1, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds*

EN 751-2, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 2: Non-hardening jointing compounds*

EN 751-3, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 3: Unsintered PTFE tapes*

EN 805, *Water supply — Requirements for systems and components outside buildings*

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

EN 806-2, *Specification for installations inside buildings conveying water for human consumption — Part 2: Design*

EN 817, *Sanitary tapware — Mechanical mixing valves (PN 10) — General technical specifications*

EN 1044, *Brazing — Filler metals*

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

EN 1092 (all parts), *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated*

EN 1111, *Sanitary tapware — Thermostatic mixing valves (PN 10) — General technical specification*

EN 1254-1, *Copper and copper alloys — Plumbing fittings — Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes*

EN 1254-2, *Copper and copper alloys — Plumbing fittings — Part 2: Fittings with compression ends for use with copper tubes*

EN 1254-4, *Copper and copper alloys — Plumbing fittings — Part 4: Fittings combining other end connections with capillary or compression ends*

EN 1254-5, *Copper and copper alloys — Plumbing fittings — Part 5: Fittings with short ends for capillary brazing to copper tubes*

EN 1514-1, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 1: Non-metallic flat gaskets with or without inserts*

EN 1717:2000, *Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow*

EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10226 (all parts), *Pipe threads where pressure tight joints are made on the threads*

EN 10240, *Internal and/or external protective coatings for steel tubes — Specification for hot dip galvanized coatings applied in automatic plants*

EN 10242, *Threaded pipe fitting in malleable cast iron*

EN 10255, *Non-Alloy steel tubes suitable for welding and threading — Technical delivery conditions*

EN 10312, *Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption — Technical delivery conditions*

EN 13443-1, *Water conditioning equipment inside buildings — Mechanical filters — Part 1: Particle rating 80 µm to 150 µm — Requirements for performances, safety and testing*

EN 15161, *Water conditioning equipment inside buildings — Installation, operation, maintenance and repair*

EN 29454-1:1993, *Soft soldering fluxes — Classification and requirements — Part 1: Classification, labelling and packaging (ISO 9454-1:1990)*

EN 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 4016, *Hexagon head bolts — Product grade C (ISO 4016:1999)*

EN ISO 4034:2000, *Hexagon nuts — Product grade C (ISO 4034:1999)*

EN ISO 7091, *Plain washers — Normal series — Product grade C (ISO 7091:2000)*

EN ISO 9453, *Soft solder alloys — Chemical compositions and forms (ISO 9453:2006)*

EN ISO 15874-3, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 3: Fittings (ISO 15874-3:2003)*

EN ISO 15875-3, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 3: Fittings (ISO 15875-3:2003)*

EN ISO 15876-3, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 3: Fittings (ISO 15876-3:2003)*

EN ISO 15877-3, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 3: Fittings (ISO 15877-3:2009)*

EN ISO 21003-3, *Multilayer piping systems for hot and cold water installations inside buildings — Part 3: Fittings (ISO 21003-3:2008)*

IEC 60449, *Voltage bands for electrical installations of buildings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 806-1:2000 and EN 1717:2000 apply.

4 Work on site

4.1 General

This Clause gives requirements and recommendations on how installation work should be carried out in order to ensure the system fulfils its requirements for long-term safe and economic use and maintain environmental sustainability.

All products shall comply with the relevant product standards and, while awaiting the adoption of verifiable European criteria, with the national regulations.

4.2 Handling of materials

Pipes, fittings and other components shall be protected, handled and stored carefully to avoid damage and to prevent contamination by dirt, building materials, vermin and other extraneous matter.

Manufacturers' advice shall be followed concerning how their products should be loaded, transported, unloaded and stored.

4.3 Bending pipes

Bending of a straight pipe shall be carried out by using purpose designed equipment.

When forming bends, care shall be taken to avoid rippling and throating and restricting the diameter of pipes when forming bends.

Bent pipes shall be inspected for damage before use.

Hot dipped zinc coated steel pipes over DN 50 shall not be bent (see EN 10240 and EN 10255).

4.4 Jointing of pipes

4.4.1 General

All joints shall be made in accordance with the relevant standards and the manufacturer's instructions. Care shall be taken to establish satisfactory jointing techniques for all water service pipework. Pipes shall be cut at right angles to their axes. Burrs and ridges shall be removed before assembling a joint. If gouges, splits or damage to the pipe end are apparent, the end of the pipe should be re-cut to remove them. Materials used to make the joint should be prevented from entering the waterways. All pipes and fittings shall be internally clean and free from particles of sand, soil, metal filings and chips, etc.

All pipe joints shall be permanently watertight. Pipe joints shall be clad, plastered over or otherwise covered only after having been pressure tested (see 6.1), unless national regulations require accessibility of certain joints, then compliance with those national regulations shall be achieved.

During installation all inlets and outlets of finished or partly finished pipework, to which draw off fittings or other components have not yet been connected, shall be tightly closed with stoppers, caps or blind flanges. Closed stop valves shall not count as tight closures.

When the installation is complete, flushing shall be carried out (see 6.2) to remove dust, debris and flux residues. Disinfection should also be undertaken when necessary (see 6.3).

All components shall be prepared in accordance with the relevant European Standards. Where threaded joints are used on metallic components, the sealing materials shall comply with EN 751-1, EN 751-2 and EN 751-3. Where threaded joints are used on plastic components, the sealing materials shall comply with EN 751-3.

For pipes in buildings and buried pipes within the premises, all joints shall be of endload bearing type.

4.4.2 Pipe materials and jointing methods

A listing of different jointing methods for different pipe materials and connection joints is listed in the following tables:

— Table 1: Jointing methods for metallic pipes;

— Table 2: Jointing methods for plastics pipes (PE-X, PE, PVC-U);

— Table 3: Jointing methods for plastics pipes (PVC-C, PP, PB);

— Table 4: Jointing methods for multilayer pipes.

Table 1 — Jointing methods for metallic pipes

Available jointing methods for metallic piping systems	Material for pipes			
	Ductile Iron	Stainless Steel	Hot dip galvanised steel (HDGS)	Copper
	Materials for fittings			
	Ductile Iron	Stainless steel and brass	Hot dip galvanised malleable cast iron	Copper and copper alloys
Soldering	-	-	-	X
Brazing	-	X[d]	X[d]	X[c]
Welding	-	X[d]	-	X[c]
Threaded joint [a]	X[b]	X[b]	X	X[b]
Compression fittings	-	X	X	X
Press-fit fittings	-	X	-	X
Sockets with elastomeric sealing ring and spigot ends	X	-	-	-
Push fit joint	X	X	X	X
Flanges	X	X	X	X
Demountable unions	X[b]	X[b]	X[b]	X[b]

NOTE For written description of jointing methods, see Annex A.

a Thread in accordance with either EN 10226-1 or EN 10226-2

b Thread on transition fittings

c See national regulations and standards.

d Corrosion risks have to be considered, see also national regulations and standards.

X Existing

- Not existing

Table 2 — Jointing methods for plastics pipes (PE-X, PE, PVC-U)

Available jointing methods for plastics piping systems	Material for pipes									
	PE-X		PE (cold water only)						PVC-U	
	Material for fitting									
	Plastic fittings	Metallic fittings	Ductile Iron	Malleable Cast Iron	Copper alloys	POM	PP	PE	Ductile Iron	PVC-U
Welding (electro fusion, butt… fusion…)	-	-	-	-	-	-	-	X	-	-
Solvent cemented joints	-	-	-	-	-	-	-	-	-	X
Threaded joint [a]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	-	X[b]
Compression fittings	X	X	X	X	X	X	X	-	X	X
Crimped / Press-fit fittings	X	X	-	-	-	-	-	-	-	-
Sockets with elastomeric sealing ring and spigot ends	-	-	X	X	-	X	-	X	X	X
Push fit joint	X	X	-	-	X	-	-	-	-	-
Flanges	X	X	X	X	X	-	X	X	X	X
Demountable unions	X	X	-	X	X	-	-	X	X	X
NOTE For written description of jointing methods, see Annex A.										
a Thread in accordance with either EN 10226-1 or EN 10226-2 b Thread on transition fittings X Existing - Not existing										

Table 3 — Jointing methods for plastics pipes (PVC-C, PP, PB)

Available jointing methods for plastics piping systems	Materials for pipes								
	PVC-C			PP			PB		
	Material for fittings								
	Stainless Steel	Copper Alloys	PVC-C	Plastic fittings other than PP	Metallic fittings, except CU and CU alloys	PP	Plastic fittings other than PB	Metallic fittings	PB
Welding	-	-	-	-	-	X	-	-	X
Solvent cemented joints	-	-	X	-	-	-	-	-	-
Threaded joint [a]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]	X[b]
Compression fittings	X	X	-	X	X	X	X	X	X
Crimped / press-fit fittings	-	-	-	-	-	-	X	X	-
Sockets with elastomeric sealing ring and spigot ends	-	-	-	-	-	-	-	-	-
Push fit joint	-	-	-	X	X	-	X	X	X
Flanges	X	X	X	X	X	X	X	X	X
Demountable unions	X	X	X	X	X	X	X	X	X
NOTE For written description of jointing methods, see Annex A.									
a Thread in accordance with either EN 10226-1 or 10226-2 b Thread on transition fittings X Existing - Not existing									

Table 4 — Jointing methods for multilayer pipes

Available jointing method	Material for fittings	
	Plastic fittings	Metallic fittings
Welding	X	-
Threaded joint [a]	X[b]	X[b]
Compression fittings	X	X
Crimped / press-fit fittings	X	X
Push fit joint	X	X
Flanges	X	X
Demountable unions	X	X

a Thread in accordance with EN 10226-1 and 10226-2

b Thread on transition fittings

X Existing

- Not existing

NOTE Multilayer pipes are not mentioned in EN 806-2.

4.4.3 Boilers and instantaneous water heaters connection

Boilers and instantaneous water heaters shall not be connected directly to plastics pipework where the safety devices allow short term (< 10 s) maximum temperatures higher than 95 °C and a water pressure higher than the maximum design pressure (MDP) (< 10 %).

4.5 Joining pipes to cisterns

4.5.1 General

Where appropriate, cisterns shall be fully supported across the base to avoid deformation when filled and to avoid undue stress on the pipe connections. Holes shall be correctly positioned for the connection of pipes to cisterns. Holes shall not be cut with flame cutters. Where practicable, all outlets from a cistern should be taken from the bottom of the cistern to prevent the retention of sediment. All debris, fillings, borings and blanks shall be removed from the inside of the cistern.

4.5.2 Steel pipes to steel, fibre cement or glass reinforced plastics cisterns

The threaded end of the pipe shall be secured in the hole in the cistern either by backnuts and washers both inside and outside (soft washers being used additionally with glass reinforced plastics and fibre-cement cisterns or where there are irregular surfaces) or by using bolted or welded flanged connections.

4.5.3 Copper or plastics pipe to steel, fibre cement or glass reinforced plastics cisterns

A copper alloy connector, having a shoulder to bear on the inside, of the cistern and secured by a backnut to the outside shall be used. Corrosion resistant support washers shall be used both on the inside and the outside of the cistern, additional soft washers shall be used as in 4.5.2.

Because of the risk of galvanic corrosion of the cistern connection of copper pipework to galvanized steel cisterns shall be avoided (see Clause 5).

4.5.4 Concrete cisterns

Connections to concrete cisterns shall be made preferably by the use of short thread flanged connections having an anchor flange (fixing point) either cast or welded on. Alternative suitable methods of connection can be used. Care shall be taken to ensure that the connections are properly aligned both in the horizontal and vertical planes when being cast into the concrete, which shall be compacted around the anchor flange to ensure a watertight joint.

4.5.5 Thermo-plastics cisterns

The following detailed items shall be followed in accordance with the manufacturer's instructions.

Pipes shall be carefully connected to plastics cisterns and supported to avoid distortion of the cistern.

Scribing tools shall not be used to scratch or mark the position of a hole to be cut in a plastics cistern.

Holes for pipes shall be cut in plastics cisterns with a tank cutting bit or hole saw. They shall be truly circular, having clean edges and be free from notches. The cistern wall shall be supported during the cutting operation by a wooden or other suitable strut.

A supporting back plate shall be used on the outside of the cistern where the float-operated valve is fitted, to spread the thrust of the lever arm over a greater area of the side wall. Corrosion resistant support washers shall be used both on the inside and the outside of the cistern with additional soft washers.

4.6 Underground pipe laying

Requirements for underground pipe laying within the curtilage of the building shall be in accordance with those specified in EN 805.

Where ground contamination is encountered or suspected suitable impermeable pipework shall be used or the pipe shall be sleeved. No pipe susceptible to deterioration by contact with any substance shall be laid or installed in a place where such deterioration is likely to occur.

Every underground pipe entering a building shall do so with due regard to frost protection and accessibility.

Where a pipe enters a building it shall be accommodated in a suitable sleeve that prevents the passage of water, gas or vermin, i.e. the ends of the sleeve shall be sealed.

4.7 Pipework in buildings

4.7.1 Allowances for thermal movement and prevention of noise

In installations that do not have limited straight runs and many bends and offsets, allowance for expansion and contraction of the pipes shall be made by:

— forming expansion loops;

— introducing changes of direction to avoid long straight runs;

— fitting proprietary expansion joints.

In installations with limited straight runs and many bends and offsets, thermal movement is accommodated automatically.

Where applicable, pipes should be fitted clear of joints, beams, floor boards and other pipes. Where this is not possible, pads of insulating material should be fitted between the pipe and the structure to minimise noise.

At all times, installations shall be such as to minimize noise and in accordance with national regulations.

4.7.2 Pipe fixings

4.7.2.1 General

Pipe support should be designed to provide a permanent fixing. Where fittings such as valves and manual controls are used, these should be firmly anchored to minimise any movement imparted to the pipe by operations of hand wheels or levers for example.

Support spacing should be given in accordance with the manufacturer's installation instructions or local and national regulations. Where clamps are used the function of the piping system shall not be affected.

Pipe brackets are designed to secure pipes directly to the structure and shall not be used to fix components. The parts of the structure to which brackets are fastened shall have adequate strength, or be strengthened.

4.7.2.2 Spacings for pipe fixings

The spacings for fixings for internally located piping should be in accordance with the recommendations of the producers and, if missing, with Annex B and Annex C.

4.7.2.3 Fixings for copper and stainless steel pipe

Where required, clips or brackets made of suitable materials that fulfil the requirements for fire and noise protection shall be used. Galvanised clips shall not be used for fixing copper and stainless steel pipes unless insulated.

For spacings, see Annex C.

4.7.2.4 Fixings for hot dipped galvanised steel pipe

Where required, hot dipped galvanised steel piping shall be secured by suitable plastic or steel clips or brackets that fulfil the requirements for fire and noise protection. Copper clips or brackets shall not be used for fixing steel piping.

4.7.2.5 Fixings for plastics and multilayer pipes

Plastics piping shall be secured by suitable metal or plastic clips or brackets. Allowance shall be made for free axial movement within the clips and brackets, except for anchor points (see Annex B).

Annex B shows the calculation method of and means of compensation of thermal effects for metals, PE, PVC-U, PVC-C, PE-X, PP and PB.

4.7.2.6 Fixings for insulated piping

Piping that is or is to be insulated shall be secured with clips or brackets that allow sufficient space between the pipe and the surface (batten or wall) to which the pipe is fixed for the insulation to be properly installed.

4.7.3 Concealed (hidden) piping

4.7.3.1 General

If national regulations require accessibility of certain joints, then compliance with those national regulations shall be met.

4.7.3.2 Pipes laid within protective pipes and/or insulation

This piping shall be housed in properly constructed builders work floor ducts or wall chases and where possible access for maintenance and inspection shall be provided.

Where pipes in protective pipes and/or insulations are embedded within the fabric of the building (e.g. concrete floors and walls) it is important to ensure that deformation or displacement does not occur and that no liquid concrete can enter the annular gap.

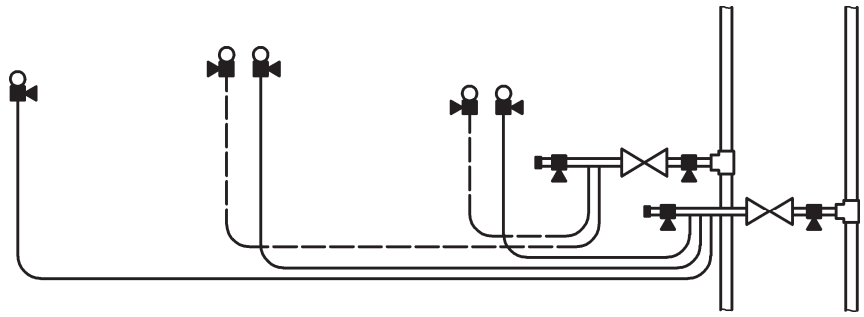
Protective pipes in floors shall be cut off at a minimum distance above the finished floor level of 30 mm to avoid liquid ingress.

Protective pipes carrying plastics pipes should be laid with bending radius not less than eight times the outside diameter of the water carrying pipe.

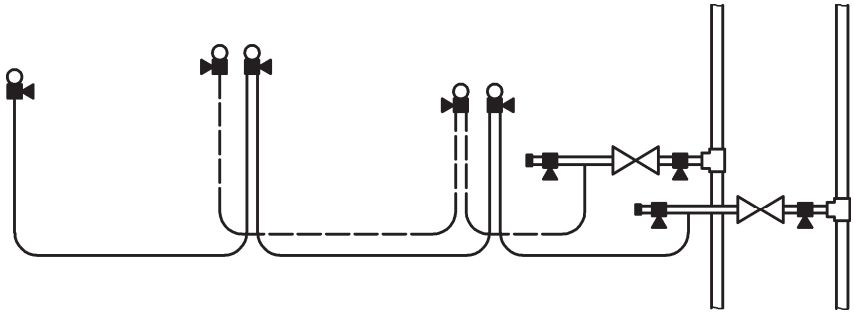
When plastics pipes are installed in protective pipes thermal expansion is automatically accommodated but it is advisable to fix the pipe and the protective pipe where they emerge from the wall or floor.

4.7.3.3 Plastics pipes and protective pipes hanging or looping free

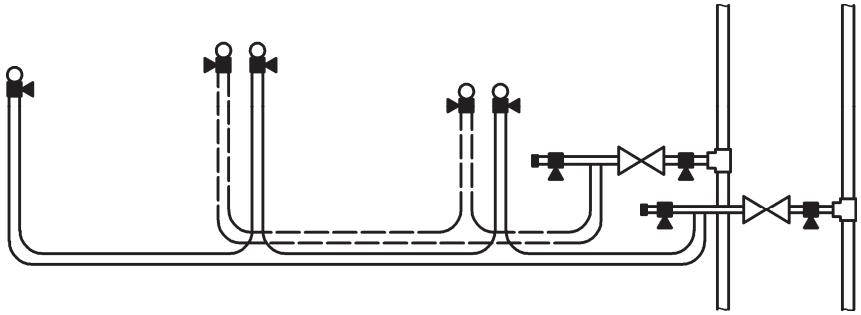
Pipes carrying hot water will expand with heat. When these pipes are hanging or looping free within wall or floor constructions, the ends of the pipes shall be fixed where they emerge from the structure as shown in Figure 1.



a) Individual junctions



b) Single distribution lines



c) Closed loop distribution system

Figure 1 — Pipes hanging or looping free

4.7.4 Piping passing through structures

Structural elements shall not be notched or bored in such a way that the integrity of the structure is compromised.

4.7.5 Clearance of structural members

Piping laid through notches, holes, cut-outs or chases shall not be subjected to external forces and shall be free to expand or contract. Piping passing through walls and floors shall be sleeved.

4.7.6 Penetration of fire walls and floors

Pipework penetration of compartment walls, floors and fire barriers shall not adversely affect their integrity and shall be installed in accordance with national or local regulations.

4.7.7 Drainage and prevention of air locks

Pipes shall be laid so as to prevent the formation of air locks; drainage fittings shall be provided at the lowest points of the system. Where pipes are likely to suffer frost damage they can be drained or protected by other methods, e.g. electrical trace heating.

4.7.8 Pipe positioning

Where pipes for hot and cold potable water are arranged one above another, the hot water pipe shall be located above the cold water pipe.

4.8 Valves and taps

All installed sanitary taps shall conform to the relevant product standards, e.g. EN 200, EN 817, EN 1111 and shall be provided with protection against backflow and back siphonage in accordance with EN 1717.

Valves and hose taps shall be installed in accordance with EN 806-2, EN 1717 and national regulations.

Taps not fixed directly to an appliance shall be fixed to a suitable pipe fitting and the fitting, or the pipe immediately adjacent to the tap, shall be firmly secured to a suitable support, to prevent strain on the pipe and its joints when the tap is operated.

Locate taps and pipes in such a way as to reduce stagnation.

4.9 Identifying and recording piping locations

4.9.1 Location of pipes and valves

Valves shall be accessible for service and maintenance.

Supply pipes and valves shall be marked to indicate the service they carry except in the case of single family dwellings.

Pipes carrying and taps providing reclaimed water shall be marked in accordance with EN 806-2 to differentiate them from potable water pipes and plumbing systems.

Where necessary, durable markers with stamped or set-in indexes shall be added to indicate the pipe service, size, and position below the surface.

4.9.2 Identification of above ground piping

All systems shall be marked and, where aesthetically acceptable, water piping shall be colour banded and coded in accordance with national regulations where these exist.

In any building other than a single dwelling, every supply pipe and every pipe for supplying water solely for fire fighting purposes shall be clearly and indelibly marked to distinguish them from each other and from every other pipe in the building.

4.9.3 Record of installation

During the installation of a water supply system, records of all pipe runs, cisterns, valves, outlets, etc. shall be kept. On completion of the works, records shall be prepared in a durable format of the 'as fixed' installation. These records shall be handed over to the building owner.

4.9.4 Identification of valves installed above ground

Every valve in the hot and cold water installation installed above ground should be provided with a durable identification label with a description of the service concerned and the function of the valve at the valve itself or fixed to a permanent structure near the valve. Alternatively, the label shall be marked with a reference number for the valve, instead of or in addition to the marking described in this sub-clause, and a durable diagram of the service showing the valve reference numbers shall be fixed in a readily visible position to a permanent part of the building or structure.

4.10 Water conditioning devices

General installation requirements for water conditioning devices, in addition to those written in this standard, are defined in EN 15161 and specific requirements to be complied with are included in the relevant product standard.

5 Dissimilar metals

5.1 General

The use of different metals in a drinking water installation shall be in accordance with the relevant standards.

Under certain circumstances copper can cause corrosion of other metals used in an installation since it is a noble metal. Copper, copper alloys and stainless steel are commonly used together with no significant consequent galvanic corrosion effects since their electrochemical potential differences are small.

For example, it is possible to combine copper tubes with tubes made of stainless steel. In case of combination of galvanized steel with other materials, information in 5.3 shall be taken into account.

5.2 Combination of pipes and fittings/valves made of different metals

Combination of pipes and fittings made of different materials can have an effect to the corrosion likelihood of single components. Remarks to that are given in Table 5.

Table 5 — Combination of pipes and fittings

Fitting (or valve)	Pipe		
	Stainless steel	**Hot dipped galvanized steel**	**Copper**
Stainless steel	+	See producer's recommendations.	+
Hot dipped galvanized steel	-	+	-
Copper	+	See producer's recommendations.	+
Copper alloy	+	+	+
+ possible - not possible			

NOTE 1 The EN 12502 series (see [1] to [5]) addresses the corrosion likelihood of various metallic materials used in water distribution systems.

NOTE 2 Where galvanized steel is mentioned in the text, it means hot dipped galvanized steel.

5.3 Flow-direction-rule

In circumstances where galvanized steel is used in the same installation with copper, the galvanized steel products shall be installed up-stream of copper, i.e. water flows from galvanized steel products to copper and direct contact between galvanized steel products and copper shall be avoided, e.g. by using a brass or gun metal fitting. Similarly, copper and galvanized steel products shall not be used in the same drinking water circulation system (see also EN 12502-3 [3]).

The normal use of valves made of copper alloys in a water distribution system is not critical in this context because of their relatively low surface area.

6 Commissioning

6.1 Filling and hydrostatic pressure testing of the installations inside buildings conveying water for human consumption

6.1.1 General

The installation inside buildings shall be pressure tested. This can be done either with water or, where national regulations give permission, low pressure oil free and clean air or inert gases may be used.

Be aware of the possible danger from high gas or air pressure in the system.

The hot or cold water installation shall only be filled with drinking water without particles ≥ 150 μm (e.g. using mechanical filters in accordance with EN 13443-1).

For hydrostatic pressure testing, pressure gauges and the recording apparatus shall have an accuracy of 0,02 MPa (0,2 bar) and shall be fitted at the lowest point in the system. The pressure gauge has a range of 0 MPa to 1,6 MPa (0 bar to 16 bar). When required, the system test pressure may be increased to comply with regulations**.**

A complete record of the details of the test (complete test procedure diagram) shall be made and preserved.

The maximum allowable pressure climb velocity v due to bringing the system under pressure is calculated by formula (1):

$$v = \frac{4 \times \mathrm{PN}}{60} \left[\mathrm{bar} \cdot \mathrm{s}^{-1}\right] \quad (1)$$

6.1.2 Steel pipes, stainless steel pipes and copper pipes (linear elastic material)

For the purpose of leakage testing, the finished pipe work shall be vented and filled slowly with drinking water without particles ≥ 150 μm (e.g. using mechanical filters in accordance with EN 13443-1) and subjected to a test pressure equal to 1,1 times the maximum design pressure (MDP).

Where there are considerable differences (> 10 K) between the ambient temperature and the water temperature, a period of 30 min shall be allowed to permit temperature equilibrium after the system test pressure has been applied. The pressure shall be maintained for a minimum of 10 min. There shall be no pressure drop or visual evidence of leakage (see 6.1.3.1, test procedure A).

6.1.3 Plastics pipes (elastic or visco-elastic material)

6.1.3.1 General

As a result of their material properties, plastics pipes expand for a limited period when pressurised. This influences the test result. For elastic materials (PVC-U, PVC-C, multilayer material etc.) and visco-elastic materials (PE, PP, PEX, PB, etc.) a change in the temperature of the pipe system can result in a pressure change.

When the equilibrium temperature of the plastic pipe system is higher than 25 °C, a derating factor (f_T) has to be applied in function of the used material. The manufacturer of the pipe system can deliver the derating factor (f_T) diagram function of the service temperature (T).

The test pressure is then calculated by using formulas (2) and (3):

$$TP = 1{,}1 \times MDP, \text{ for } T \leq 25\ °C \quad (2)$$

$$TP = 1{,}1 \times f_T \times MDP, \text{ for } T > 25\ °C \quad (3)$$

where

T is the temperature;

TP is the test pressure;

MDP is the maximum design pressure;

f_T is the temperature derating factor for the used elastic or visco-elastic pipe system material.

The water shall, as far as possible, be kept at a constant temperature throughout the test. The finished pipework shall be vented and slowly filled with drinking water without particles ≥ 150 µm (e.g. using mechanical filters in accordance with EN 13443-1). For pressure testing of plastic pipes a distinction shall be made as shown in Table 6.

Table 6 — Type of hydrostatic testing procedures as a function of the pipe system material

Type of material	Hydrostatic test procedure
Linear elastic materials (i. e. metals)	Test procedure A in accordance with 6.1.3.2
Elastic materials (PVC-U, PVC-C, etc.) and multi layer materials	
Visco-elastic materials (i. e. PP, PE, PEX, PA, PB, etc.) with DN/OD ≤ 63	
Visco-elastic materials with DN/OD > 63 (i.e. PP, PE, PEX, PA, PB, etc.)	Test procedure B or C in accordance with 6.1.3.3 and 6.1.3.4 respectively
Combined system with DN/OD ≤ 63 (metals and plastics)	Test procedure A in accordance with 6.1.3.2
Combined systems with DN/OD > 63 (metals and plastics)	Test procedure B or C in accordance with 6.1.3.3 and 6.1.3.4 respectively

NOTE When not stated otherwise, the installer may choose the test procedure B or C.

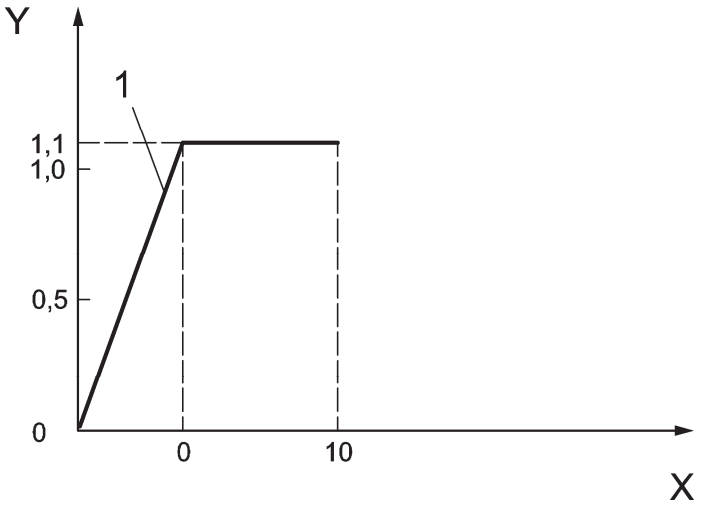
6.1.3.2 Test procedure A

Arrange for the system to be vented.

Fill the system with water, ensuring that all air is removed and seal all air vents and outlet valves.

Apply the selected test pressure TP equal to 1,1 times the maximum design pressure MDP by pumping, in accordance with Figure 2, for a period of 10 min.

The test pressure must stay constant during these 10 min (Δp = 0). If there is a pressure loss, the system shall be maintained at the test pressure until the obvious leaks within the system are identified.



Key
1 Pumping
X Time, in min
Y Test pressure divided by MDP

Figure 2 — Test procedure A: Hydrostatic pressure testing of metal piping systems, testing for water tightness

6.1.3.3 Test procedure B

Arrange for the system to be vented.

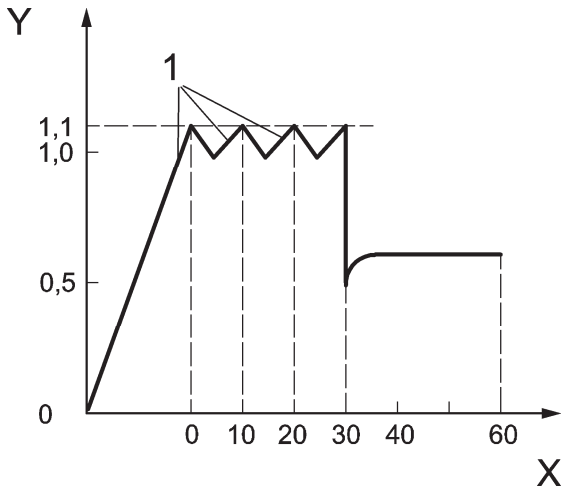
Fill the system with water, ensuring that all air is removed and seal all air vents and outlet valves.

Apply the selected test pressure TP equal to 1,1 times the maximum design pressure MDP by pumping, in accordance with Figure 3, for a period of 30 min. An inspection should be carried out to identify any obvious leaks within the system under test.

Reduce the pressure by bleeding water from the system to 0,5 times test pressure, in accordance with Figure 3.

Close the bleed valve. The system will be regarded as leak-tight if the pressure maintains a value equal to or greater than 0,5 times the operating pressure for a period of 30 min after the pressure reduction. Check visually for leaks. If during that period there is a pressure drop, there will be a leak within the system. Maintain the pressure and identify the leak.

If the equilibrium temperature of the system is above 25 °C, the derating factor f_T of the material shall be taken into account.



Key
1 Pumping
X Time, in min
Y Test pressure divided by MDP

Figure 3 — Test procedure B: Hydrostatic pressure testing of plastics piping systems, testing for water tightness

6.1.3.4 Test procedure C

Arrange for the system to be vented.

Fill the system with water, ensuring that all air is removed and seal all air vents and outlets valves.

Apply the selected hydrostatic test pressure, TP equal to 1,1 times the maximum design pressure MDP by pumping, in accordance with Figure 4, for a period of 30 min.

Note the pressure after a period of 30 min. An inspection should be carried out to identify any obvious leaks within the system.

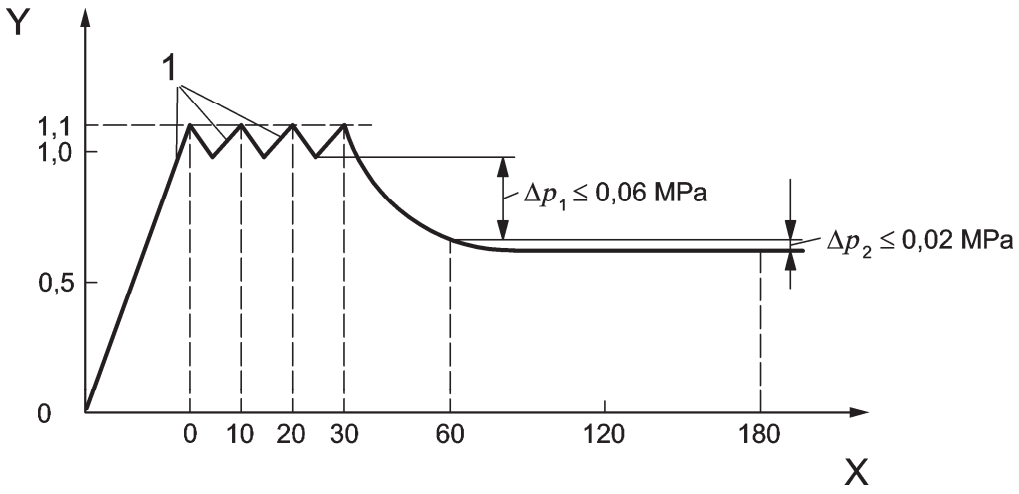
Note the pressure after a further 30 min. If the pressure drop is less than 0,06 MPa (0,6 bar), the system can be considered to have no obvious leakage. Continue the test without further pumping.

Check visually for leaks during the next 2 h. If the pressure drops by more than 0,02 MPa (0,2 bar) over that period, this will indicate a leak within the system. Maintain the pressure and identify the leak.

For sections of any installation (supply pipes and distributing pipes), use test procedure C.

Installations comprising both plastics and metal pipes shall be pressure tested in accordance with 6.1.3.2 or 6.1.3.3.

If the equilibrium temperature of the system is above 25 °C, the derating factor f_T of the material shall be taken into account.



Key

1	Pumping
X	Time, in min
Y	Test pressure divided by MDP
$\Delta p1$	Maximum pressure drop between 30 min and 60 min of test procedure
$\Delta p2$	Maximum pressure drop between 60 min and 180 min of test procedure

Figure 4 — Test procedure C: Hydrostatic pressure testing of plastic piping systems, testing for water tightness

6.2 Flushing the pipework

6.2.1 General procedure

The drinking water installation shall be flushed with drinking water as soon as possible after installation and pressure testing and immediately before commissioning. Cold and hot water pipes shall be flushed separately. The water used for the flushing procedure shall be drinking water. It shall be taken into account that particles in the water can damage the installation (corrosion, disfunctioning). To prevent this, a mechanical filter in accordance with EN 13443-1 (no particles ≥ 150 µm) shall be used.

Where a system is not brought into use immediately after commissioning, it shall be flushed at regular intervals (up to 7 days).

6.2.2 Flushing with water

Precautions shall be taken to protect sensitive valves and equipment (e.g. WC flushing valves, thermostatic mixers, etc.) against foreign particles arising from the installation of the system.

Filters installed upstream of valves or installation, which cannot be replaced, shall be backwashed or renewed after flushing.

Aerators, flow strainers, flow controllers, shower heads or hand showers, already installed with valves should be removed to increase flow.

In case of concealed thermostatic valves and other sensitive valves, the manufacturer's instructions shall be followed.

All servicing valves in the section to be flushed shall be fully opened.

Depending on the size of the installation and on the layout of the pipework, the system may be flushed in sections. Flushing shall commence at the lowest storey of any building and proceed upward storey by storey.

The minimum velocity for flushing the installation shall be at least 2 m/s.

The water in the system shall be changed at least 20 times during flushing.

At any particular floor level, the draw-off-points shall be fully opened starting with the point most remote from the riser.

After flushing the furthest, downstream draw-off-point, the draw-off points shall be closed, in order, commencing with the draw-off point at the upstream end of any circuit.

A complete record of the flushing procedure shall be made and retained and handed over to the building owner.

NOTE It may be necessary to flush with warm water to adequately remove flux residues.

6.2.3 Flushing procedure with water/air mixture

The following is an alternative to 6.2.2.

The pipe system may be flushed using a drinking water/air mixture, intermittently under pressure, the minimum velocity in any pipe being 0,5 m/s. This requires a certain number of taps (see Table 7) to be open. A reservoir and pump are to be used for flushing if the minimum flow rate is not achieved when the pipework section tested is completely filled.

Table 7 — Recommended minimum flow rate and minimum numbers of draw-off points to be opened for flushing, related to the largest nominal diameter of the pipework in the flushing section (for a minimum velocity of 0,5 m/s)

Largest nominal diameter of the pipework in the flushing section DN	25	32	40	50	65	80	100
Minimum flow rate with the pipework section completely filled, in l/min	15	25	38	59	100	151	236
Minimum number of the draw-off points DN 15 or equivalent cross section fully opened	1	2	3	4	6	9	14

The compressed air (supplied from cylinders or from compressors) shall be available in sufficient quantity and quality harmless to health (e.g. oil-free), with an air pressure equal at least to the static pressure of the water.

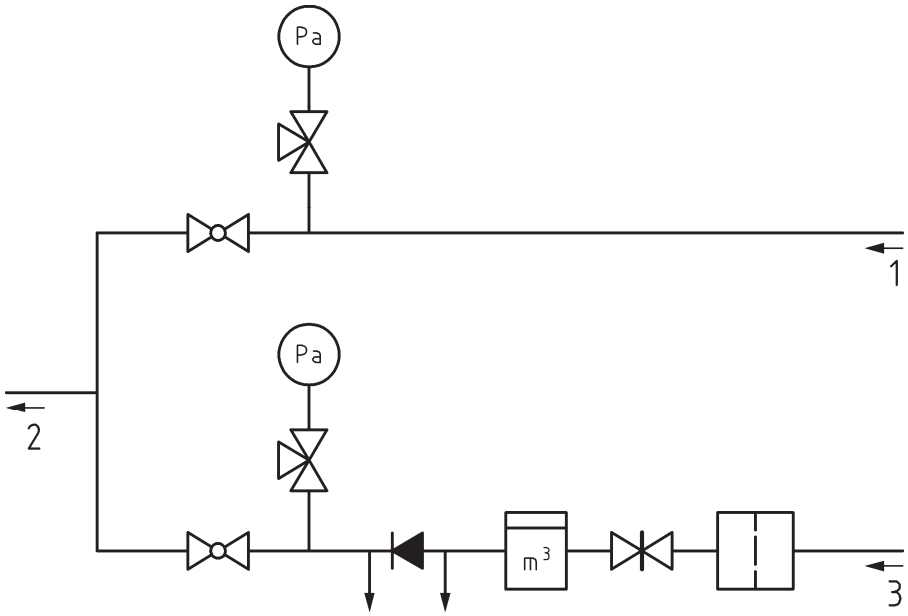
Depending on the size of the installation and the layout of the pipework, the system shall be flushed in sections. No section shall exceed 100 m of pipe run.

Starting with the servicing valve at the inlet to the flushing section, the order sequence of the flushing procedure should be from the closest to the most remote riser. Starting at the lowest level of the riser, the flushing should be carried out storey by storey.

After flushing with the last tap opened, taps shall be closed in reverse sequence. The flushing effect shall be reinforced by periodic opening and closing of the air and water supply at regular intervals, pressure surges produced by rapid opening and closing valves (e.g. ball valves) having proved particularly effective.

For manual operation of taps, an "open" interval of 5 s and a "closed" interval of less than 2 s is recommended.

A higher pressure surge frequency may be generated by automatic flushing (e.g. by using a special flushing appliance in accordance with the manufacturer's instructions). Figure 5 shows an example of an arrangement for intermittent flushing of the pipework.



Key
1 Compressed air
2 Air/water mixture
3 Water

Figure 5 — Flushing arrangement with water air mixture

6.3 Disinfection

6.3.1 General

For single dwellings, and minor extensions or alterations in any premises, disinfection is not usually necessary, flushing is sufficient. Any disinfection shall be done in accordance with national or local regulations.

After flushing, drinking water installations may be disinfected where it is specified by the responsible person or authority. Depending on the size of the installation, it may be necessary to divide the system into sections.

During the whole disinfection procedure it must be ensured that there is no draw-off of any water. A sufficient alternative water supply shall be provided in buildings which are in use.

Where any supply pipe within the installation is to be disinfected and there is a possibility that the disinfection substance can come into contact with the point of delivery, the water supplier shall be informed. Complete isolation from the incoming service pipe may be required.

Where water that has been used to disinfect an installation is to be discharged into a drain or a sewer, the responsible authority shall be informed and their approval given before the discharge takes place. Where necessary, a neutralising agent may be required.

The sequence of disinfection shall be: service pipes; supply pipes; cisterns; distributing pipes, as applicable.

Contractors and building users, especially working outside office hours, such as cleaners and security guards, shall be informed by notices displayed at all draw-off points. It shall also be ensured that no other chemicals, such as sanitary appliance cleaning materials, are added to the water containing disinfection substances until the disinfectant solution is flushed out of the system.

6.3.2 Selection of disinfectants

The choice of disinfectant used will depend on:

— local or national requirements, availability and justified traditional practices within a member state,

— factor such as shelf-life and ease of handling (likelihood of accidents to personnel or the environment),

— water quality considerations (e.g. pH values and, in the case of calcium hypochlorite, the hardness of the water),

— the materials used within the installation.

Any chemical used for disinfection of drinking water installations shall comply with the requirements for chemicals used in water treatment as given in European Standards, or national standards where European Standards are not applicable.

The application and use of disinfectants shall be in accordance with the relevant EU Directives and any local or national regulations.

Transportation, storage, handling and use of all these disinfectants may be hazardous and health and safety requirements shall be rigorously adhered to.

6.3.3 Methods for using disinfectants

The system shall be filled with the disinfectant solution at the initial concentration and for the contact time specified by the manufacturer of the disinfectant. If the residual of the disinfectant at the end of the contact time is less than the manufacturer's recommendation, the disinfection procedure shall be repeated as necessary until the residual concentration is achieved after the appropriate contact time. After successful disinfection, the system shall be immediately drained and thoroughly flushed with drinking water. Flushing shall continue in accordance with the disinfectant manufacturers' instructions/recommendations or until there is no evidence of the disinfectant being present, or is below a level, which is allowed by national regulations. Persons undertaking the disinfection shall be suitably qualified.

After flushing, sample(s) for bacteriological analysis shall be taken and analysed. Where a bacteriological analysis of the samples indicates that adequate disinfection has not been achieved, the installation shall be flushed out, re-disinfected and further samples shall be taken.

A complete record of the details of the whole procedure and test results shall be made and handed over to the building owner.

6.3.4 Disinfection of storage cisterns and distributing pipes

All visible dirt or debris shall be removed from the system.

The storage cistern and distributing pipes shall be filled with water and the servicing valve on the supply to the cistern closed. The capacity of the cistern shall be determined and a calculated quantity of disinfection chemical of known strength shall be added to the cistern until the initial concentration of disinfection solution in the water in the cistern is achieved. The disinfectant solution is drawn around the system by successively opening each draw-off fitting, working away from the cistern, and closing it when the disinfectant solution at the initial concentration is discharged. The cistern shall be refilled and disinfectant solution added as above as necessary during this operation, maintaining the solution at the initial concentration at all times. The contact time commences when the entire system is filled with disinfectant solution at the initial concentration, including the cistern to overflow level.

It is essential that any paint or coating shall be thoroughly cured before disinfection takes place and care shall be taken not to exceed the recommended initial concentration of disinfectant solution.

6.3.5 Localised repairs

Where required by 6.3.1, junctions or other fittings inserted into an existing pipeline, or other localised repairs, shall be disinfected by immersion in a disinfectant solution before installation.

Annex A
(normative)

Pipe system material specifications, jointing procedures and pipe installation for different types of materials

A.1 General

Not all the jointing methods described in the Tables 1 to 4 are (completely) described in this annex. All jointing methods shall be made in accordance with the manufacturer's instructions or local regulations.

A.2 Connections between different materials

A.2.1 Above-ground pipework

When different materials are used within a single installation the method of jointing shall be designed for both materials for the safety and integrity of the system.

A.2.2 Below-ground pipework

Joints in buried pipework should be kept to a minimum. Joints between pipes of different materials shall also be kept to a minimum.

For making service connections, a saddle shall be fixed round the larger pipe and a ferrule screwed into the saddle. In the case of fibre-cement pipes, in all events the installer shall observe the manufacturer's instructions.

For joints in buried pipes, see national regulations.

A.3 Ductile iron

A.3.1 General

Ductile iron pipes and fittings shall be according to EN 545.

Protective coatings are required. Linings are required in drinking water installations.

A.3.2 Types of joints

a) Sockets with elastomeric sealing ring and spigot ends and push fit joints

The push fit or spigot and socket joint includes a specially shaped synthetic rubber ring gasket fitted into the socket of a pipe before the spigot of the next pipe is pushed in. A special lubricant must be used on the inside of the gasket and on the outside of the pipe spigot before jointing.

Pipes and fittings with flexible joints shall comply with EN 545:2006, 4.2.2.1, for their spigot external diameter and their tolerances. This offers the possibility of interconnection between components equipped with different types of flexible joints.

b) Flanged joints

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with EN 1092-2. This ensures interconnections between all flanged components (pipes, fittings, valves, etc.) of the same PN and DN and adequate joint performance.

c) Demountable unions

Demountable unions are another form of rubber ring joint used for connecting together lengths of pipe that are straight-barrelled, i.e. no socket is used and no spigot beads are necessary. Slight angular deviations at joints are possible with these couplings.

A.3.3 Jointing procedures

Flanges shall be carefully aligned before the bolts are inserted and the flanges bolted together. The alignment shall be precise to avoid fracture of the pipe or flange. An elastomeric gasket with corresponding DN and PN class on the flange is inserted between the flanges, in such a way that it lies inside the bolt circle but does not intrude into the pipe bore.

The faces of flanges shall be perfectly clean before assembly and the bolts shall be tightened in a sequence to ensure an even pressure is maintained all around. No grease, bitumen paint, oil, dirt, grit or water shall be permitted on the flange or elastomer ring faces. The contact between the flange and the elastomeric gasket face should be between clean dry metal and clean dry elastomer.

Bolts and nuts shall comply as a minimum with the requirements of EN ISO 4016 and EN ISO 4034:2000, grade 4.6. When applicable, washers shall comply with EN ISO 7091. Gaskets and sealing rings shall be in accordance with EN 681-1.

Assembly shall be made in accordance with the manufacturer's instructions.

A.4 Stainless steel piping

A.4.1 General

Only stainless steel pipes produced with material in accordance with EN 10088-2 and welded stainless steel pipes produced and tested in accordance with EN 10312 shall be used.

Cold cutting techniques may be used on stainless steel. Pipes shall be cut to length with fine-toothed saws or pipe cutters or equivalent. Oil-cooled saws and cutting torches shall not be used. Before being joined, the ends of the pipes shall be deburred internally and externally.

Stainless steel pipe for water supply systems with a nominal diameter ≤ 28 mm may be bent cold in accordance with the manufacturer's recommendation.

A.4.2 Types of joints

a) Brazing of stainless steel

Manufacturer's recommendations for fluxing and applying the brazing alloy shall be followed. The flux shall be flushed away after making the joint.

Since most of the brazing alloys are sensitive to knife-line corrosion in the presence of chlorides, their use is limited to special installations.

NOTE The type of knife-line corrosion attack that occurs in the systems under consideration is characterised by a loss of the bond between stainless steel and certain silver based braze filler metals as a result of selective corrosion at the interface. This effect mainly occurs with joints brazed under oxidising conditions using fluxes.

The incubation period for the occurrence of knife-line corrosion can be very long, even up to several years of service. In an advanced state, pitting corrosion can be initiated at the locations of knife-line corrosion.

b) Welding of stainless steel

Only if permitted by national or local regulations, stainless steel pipes joined by welding may be used.

Welding of stainless steel requires special equipment and well trained and skilled personnel. For details and corrosion likelihood, see EN 12502-4 [4].

c) Threaded joints

Threaded joints are used for connections to other systems or valves.

d) Compression fittings

Type A fittings, non-manipulative, with compression ends. A joint made by the compression of a ring or sleeve onto the outside wall of a tube and utilising a metal to metal seal. Fittings with compression ends, soft seal, this joint is similar, but uses a soft sealing ring rather than a metal sealing ring.

e) Fittings with press end (press-fit fitting)

Joint made by the compression of a press-fit fitting onto a tube that employs a sealing element.

f) Push-fit fitting

Push-fit fittings shall be in accordance with national regulations.

g) Flanges

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with EN 1092-1. This ensures interconnections between all flanged components (pipes, fittings, valves, etc.) of the same PN and DN and adequate joint performance.

h) Demountable unions

See A.4.2 d).

A.4.3 Preparation of tube

Type A fittings (in accordance with EN 1254-2)

a) Ensure the tube is of the correct specification.

b) For slip fittings only, pre-mark the tube to indicate an appropriate insertion depth; otherwise pass the compression nut and compression ring over the tube.

c) Insert the tube into the fitting socket and push as far as any internal stop or insertion mark.

d) Tighten the compression nut onto the fitting by hand as far as possible and then by use of a spanner in accordance with the manufacturer's recommendations. Tightening beyond the manufacturer's recommendations may lead to problems in service.

A.4.4 Corrosion

For guidance on the assessment of corrosion likelihood in water distribution and storage systems, see EN 12502-4 [4].

A.5 Hot dip galvanised steel piping

A.5.1 General

Only hot dip galvanised steel pipes in accordance with EN 10240, coating quality A.1 shall be used.

A.5.2 Types of joints

a) Brazing

Only if permitted by national or local regulations, hot dip galvanised steel pipes joined by brazing may be used. Brazing of hot dip galvanised steel pipes requires special equipment and well-trained and skilled personnel.

NOTE Hard zinc layers with reduced corrosion resistance could be formed beside the line of brazing.

b) Threaded joints

Thread cutting emulsions shall meet the requirements specified in the relevant national regulations. Such emulsions are water soluble, free from petroleum products. Where adjustable dies are used to cut tapered pipe threads the dies shall be set to the specified nominal thread size. Pipes and fittings shall be screwed together over their useful thread length with allowance being made for the tolerance specified in EN 10226 series. Thread sealant shall comply with the requirements specified in EN 751-1, EN 752-2 and EN 751-3.

Hot dip galvanised malleable iron fittings in accordance with EN 10242 shall be used with hot dip galvanised steel tubes suitable for threading.

Jointing threads shall comply with EN 10226 series. Fastening threads complying with EN ISO 228-1 are suitable for joints, where the seal is made by a gasket, outside the thread.

The sealing compound must be approved for drinking water applications.

Galvanic coatings do not provide sufficient protection against corrosion, therefore are not suitable for water-bearing parts. Cadmium plated fittings are prohibited.

c) Compression fittings

Non-manipulative fittings with compression ends. A joint made by the compression of a ring or sleeve onto the outside wall of a tube.

d) Flanges

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with EN 1092-1. This ensures interconnections between all flanged components (pipes, fittings, valves, etc.) of the same PN and DN and adequate joint performance.

The faces of the flanges shall be perfectly clean before assembly and the bolts shall be tightened in a sequence to ensure an even pressure is maintained all around. No grease, bitumen paint, oil, dirt, grit, or water should be permitted on the flange or rubber ring faces. The contact between the flange and the rubber face shall be clean dry metal and clean dry rubber. Flanges may be of the screw on type or the brazed on type.

Bolts and nuts shall comply as a minimum with the requirements of EN ISO 4016 and EN ISO 4034:2000, grade 4.6. When applicable, washers shall comply with EN ISO 7091. Gaskets and sealing rings shall be in accordance with EN 681-1. The dimensions of gaskets shall be in accordance with EN 1514-1.

e) Dismantleable unions

See A.5.2 c).

A.5.3 Welded joints

Welded joints shall not be used.

A.5.4 Corrosion

For guidance on the assessment of corrosion likelihood in water distribution and storage systems, see EN 12502-3 [3].

A.6 Copper piping

A.6.1 General

Copper tubes shall be in accordance with EN 1057.

A.6.2 Categories of joints

a) Soldered or brazed joint with fittings in accordance with EN 1254-1, EN 1254-4 or EN 1254-5

A joint made when molten lead-free solder or brazing alloy is drawn by capillary action into the small annular space between the inside diameter of the fitting and the outside diameter of the tube.

NOTE Instead of the word brazing in some countries the term hard soldering is also used. Soft soldering is another term for soldering with lower temperatures than brazing.

b) Soldered joint without fittings

Copper tubes of the same diameter may be joined without the use of fittings and without change of direction. This is achieved by careful expansion of one of the tube ends using appropriate tools to create a capillary gap between the expanded and unexpanded tube. The joint is completed by using lead-free solder or brazing alloy.

c) Welded joint

Welding is permitted for tube joints with and without welding fittings. A minimum tube wall thickness of 1,5 mm is required for welded joints.

d) Threaded joints

Copper tubes in accordance with EN 1057 are not suitable for threading. Where threaded joints are required for connections to other systems or valves use fittings in accordance with EN 1254-4.

e) Compression fittings in accordance with EN 1254-2

— **Type A,** a joint made by the compression ring or sleeve onto the outside wall of a tube.

— **Type B,** compression fittings require the end of the tube to be flared, cupped or belled with special forming tools. The formed end of the tube is compressed against a shaped end of the corresponding

section of the fitting or a loose ring or sleeve when the cap nut is tightened. This type of fitting is not suitable for hard temper tube (R290 in accordance with EN 1057).

f) Press-fit joints in accordance with national regulations

Joint made by pressing a fitting containing an elastomeric sealing element onto the tube, by use of a special press tool.

For the use of press fittings with R220 and R250 copper pipes in accordance with EN 1057, national regulations apply.

g) Push-fit fitting

The fittings shall be in accordance with national regulations.

h) Flange joint

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with EN 1092-3. This ensures interconnections between all flanged components (pipes, fittings, valves, etc.) of the same PN and DN and adequate joint performance.

The following flange joints can be used:

— Flange connection with gunmetal brazed-on flange;

— Flange connection with copper brazed-on flared flange and loose flange;

— Flange connection with flat gunmetal flange and loose flange.

i) Demountable unions

These fittings shall be in accordance with EN 1254-4.

A.6.3 Jointing procedures

A.6.3.1 Jointing procedure for capillary fittings

All brazing or soft solder alloys shall be free of lead, antimony and cadmium and meet requirements of European Standards, e.g. EN 1044, EN ISO 9453.

Drinking water installations should be soldered. Brazing is only allowed by local or national regulations.

Brazing, local annealing for creating sockets and hot bending is not permitted in sizes ≤ 28 mm × 1,5 mm.

Soldering and brazing of tubes and fittings ≥ 35 mm calls for particular skill in handling and heating.

NOTE Local annealing for socketing of bigger sizes than 28 mm x 1,5 mm can cause corrosion problems.

Soldering

The lead-free solders specified in Table A.1 in accordance with EN ISO 9453 are suitable for use.

Table A.1 — Solders

Solders	Melting range °C
S-Sn 97 Ag 3	221 to 230
S-Sn 97 Cu 3	230 to 250
S-Sn 99 Cu 1	230 to 240

Fluxes shall be applied (e.g. with a brush) only on the cleaned external surfaces of the tube ends to be inserted into the fitting. This prevents flux being pushed into the tube when bringing together the tube and fitting. External flux residues shall be removed by wiping.

Solder fluxes in accordance with EN 29454-1:1993, types 2.1.2, 3.1.1 and 3.1.2, shall be used for soldering. The flux shall be water soluble and approved for drinking water applications.

For slip fittings pre-mark the tube to indicate an appropriate insertion depth.

Insert the tube into the fitting socket and push as far as any internal stop or insertion mark.

These steps should be performed successively and without undue delay to prevent dirt ingress, oxidation or corrosion.

Apply heat evenly to the assembled joint.

Allow the joint to cool with out any disturbance and wipe away any flux residues.

Brazing

A procedure similar to soldering is used but the fluxes, brazing alloys and temperatures required will be different, demanding higher skill factors.

Brazing should be carried out by using capillary fittings or by expanding one tube end to fit the other and provide the appropriate annular gap. Butt-jointing of the parts to be connected is not permitted.

Examples of permitted brazing alloys are given in Table A.2.

Table A.2 – Examples of permitted brazing alloys in accordance with EN 1044

Brazing alloy designation	Brazing alloy melting range °C	Working temperature °C	Flux
AG 106	630 to 730	710	FH10
AG 203	660 to 735	730	
AG 104	640 to 680	670	
CP 105	645 to 825	740	Flux not necessary
CP 203	710 to 890	760	

A.6.3.2 Jointing procedures for welding

Welding may be carried out using:

a) Oxyacetylene welding;

b) Shielded arc welding.

Suitable welding alloys like SG-CuAG or SG-CuSn shall be used and suitable fluxes like FH 21 or FH 30 may be used but fluxes are not essential.

A.6.3.3 Jointing procedures for compression fittings

Assembly shall be in accordance with the manufacturer's instructions and applicable local regulations.

— **Type A** fittings (in accordance with EN 1254-2)

These compression ring assemblies should not be used with soft tubes (R 220 annealed in accordance with EN 1057) unless a supporting sleeve is used in accordance with EN 1254-2. No preparation of the ends of the tube is required other than they are cut square and deburred or chamfered as specified.

— **Type B** fittings (in accordance with EN 1254-2)

These compression assemblies are only to be used with soft tubes (R220) and half-hard tubes (R250) in accordance with EN 1057.

— **End load bearing couplings**

End load bearing couplings are only to be used with R290 and R250 copper tubes in accordance with EN 1057 for in-line joints.

A.6.3.4 Jointing procedures for press-fit fittings

Press-fit fittings are suitable for all tube tempers (R220, R250, R290) in accordance with EN 1057. The joint shall be made by using a tool intended for the purpose.

A.6.3.5 Push-fit

Refer to the manufacturer's instructions for the socket depth of each size of fitting and pre-mark the tube or pipe to indicate the approximate insertion depth.

— A depth gauge can be used to mark the tube to indicate when the tube is fully inserted into the fitting.

— Soft copper tubes may require the insertion of a manufacturer's supporting sleeve (insert stiffener) before installation.

— Insert the tube into the fitting to rest against the gripping device.

— Push the tube firmly, with a slight twisting action, until it makes firm contact with the tube abutment or, in the case of fittings without an abutment, refer to the manufacturer's instructions.

— Pull on the tube to check that the fitting is secure.

— Push-fit fittings should be installed at a minimum distance apart in accordance with the manufacturer's instructions. These instructions will accommodate requirements for disconnection, if appropriate.

A.6.3.6 Flanges

See EN 1092 series.

A.6.3.7 Demountable unions

— The tube ends shall be cut square to the tube axis. Any burrs (inside and outside) shall be removed.

— Re-round the tube ends of soft tubes (R220) with appropriate re-rounding tools (ring and punch).

— For cleaning fittings and pipe ends use only suitable materials like non-metallic abrasive pads. Do not use metallic materials like fine steel wool.

— Remove any residues from the cleaning process.

A.6.4 Bending

Bending should be made using purpose designed equipment in accordance with the manufacturer's instructions.

A.6.5 Drift expanding

When making a drift expansion of a tube end for jointing without a fitting, use tools specific for this purpose, such as a drifting tool inserted with a hammer or a segmented expansion tool.

A.6.6 Corrosion

For guidance on the assessment of corrosion likelihood in water distribution and storage systems, see EN 12502-2 [2].

A.7 Plastic piping

A.7.1 Types of joints

a) Welding — butt or fusion fittings

Where which pipes are joined to pipes and/or fittings by the application of heat under controlled conditions to the respective surfaces.

b) Solvent cemented joints

Procedure where solvent cement is applied to the spigot end and to the socket.

c) Threaded joints

Threaded joints are used for connections to other systems or valves.

d) Compression fittings

Type A, compression ring joints with soft seal. A joint made by the compression ring or sleeve onto the outside wall of a tube.

e) Crimped joints

Joint made by compression of a fitting containing an elastomeric sealing element onto the tube, by use of a press tool.

f) Push-fit fitting

The fittings shall be in accordance with EN ISO 15874-3, EN ISO 15875-3, EN ISO 15876-3, EN ISO 15877-3, EN ISO 21003-3 and national regulations.

g) Flange joints

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with the EN 1092 series. This ensures interconnections between all flanged components (pipes, fittings, valves) of the same PN and DN and adequate joint performance. If the loose flange is made of another material, then it is recommended to use the corresponding part of the EN 1092 series.

For the flange connections of plastic pipes it is common to use fittings with collar and a loose flange.

h) Demountable unions

See A.7.1 d).

All plastic pipes are not capable of being joined by all methods. Care should be taken that proprietary pipes and fittings are compatible.

A.7.2 Preparation of pipe

Pipes shall be cut to length with a fine tooth saw unless otherwise recommended by the manufacturer. Proprietary pipe cutters are available for cutting some plastics pipes and the pipe or fitting manufacturer's instructions should be sought when using these. Pipes shall be cut at right angles to their axes. Burrs and ridges shall be removed before assembling a joint. If gouges, splits or damage to the pipe end are apparent, then the end of the pipe should be re-cut to remove these. Where recommended by the manufacturer, pipe end support sleeves should be used.

A.7.3 Fused joints

A.7.3.1 General

This procedure is applicable to fusible components only.

It is essential that electrically powered devices used to produce heat conform to their manufacturer's specifications in order to avoid hazards.

Thermal fusion joints achieve sealing by melting together pipes and/or fittings by means of a heating tool or by heat induced by current in an appropriate resistor inserted in the fitting bulk. Elements to be jointed should be of types/grades that are fusible.

A.7.3.2 Jointing procedure

Joints shall be made in accordance with the manufacturer's instructions and generally in accordance with the following procedures.

a) Socket fusion fitting

The recommended procedure is as follows:

Cut the pipe to length in accordance with A.7.2. After cutting the pipe and before fusing ensure that the surfaces of all parts to be fused and of the heating tools are clean.

Heat simultaneously the pipe and fitting ends to be joined, in accordance with the manufacturer's instructions.

Insert pipe into fitting without twisting taking care not to exceed insertion length. Any misalignment should be corrected immediately after insertion.

Hold pipe and fitting together until the plastics materials cools (see manufacturer's advice).

After at least 1 h the joint is ready to be subjected to test conditions.

b) Electrofusion fitting

The recommended procedure is as follows:

Cut the pipe to length in accordance with A.7.2. After cutting the pipe and before fusing ensure that the surfaces of all parts to be fused and heated are scraped and degreased. Insert pipe into fitting taking care to align and fix them correctly.

Connect resistor ends to the power supply and start fusion. The fusion times and the power supply set-up should be sought from the system supplier.

Respect the cooling time for fusion joint in accordance to the manufacturer's advice.

After at least 1 h the joint is ready to be subjected to test conditions.

During the fusion process, the fitting is part of an electrical system as defined in EN 60335-1 and IEC 60449.

c) Butt fusion joint

Cut the pipe to length in accordance with A.7.2. After cutting the pipe, fix it to the fusion machine and adjust pipes and or fittings to minimise misalignment, then plane the fusion surfaces to allow max contact to the surface of the heating element. Also ensure that the surfaces of all parts to be fused and of the heating tools are clean and are at the right temperature.

Start the fusion procedure (fusion parameters in function of the used plastics material, the nominal diameter and the pressure class):

- heating phase (time, pressure);
- turn over time;
- pressure increasing (time, fusion pressure and dwell pressure);
- fusion phase (time, pressure);
- cooling phase (time, pressure).

Keep pipe and/or fitting inside the machine until the materials are cooled down (see manufacturer's advice).

A.7.4 Solvent cement fittings

A.7.4.1 General

This procedure is applicable to PVC-U and PVC-C components. Joints shall be made in accordance with the instructions of the fitting manufacturer and generally in line with the following:

Only solvent cements and cleaners in accordance with national regulations recommended by the PVC-U/PVC-C pipe and fitting manufacturers shall be used.

Solvent cements and cleaners shall be used only in areas of adequate ventilation. Labels incorporate statutory hazard warning signs and these labels should be read prior to using these cements and cleaners.

It is advisable to use small containers and to close them immediately after use in order to minimise evaporation.

The solvent cement shelf life has to be taken into consideration.

Solvent cements should not be diluted.

A.7.4.2 Jointing procedure

Joints shall be made in accordance with the instructions of the PVC-U/PVC-C pipes/fittings manufacturer and generally in accordance with the following procedure:

— Cut the pipe to length in accordance with A.7.2;

— Trim and chamfer the pipe;

— Abrade the parts to be assembled;

— Clean and/or degrease the two parts;

— Apply the cement on the two parts;

— Push the spigot and socket together; any misalignment should be corrected immediately after insertion;

— Remove excess cement with a clean cloth or with absorbent paper;

— Allow the fitting to rest the minimum required time given by the system supplier before applying the pressure; the joint is then ready for use and can be subject to test conditions.

A.7.5 Compression fittings

A.7.5.1 General

In which the joint is made by the compression of a ring or sleeve on the outside wall of the pipe with or without additional sealing elements and with internal support are of two main types that require different jointing procedures as follows:

— for joints which rely on the compression of an olive or an elastomeric component, such as a joint ring or compression of a sleeve, to effect a seal;

— for joints where an elastomeric ring is used and the fitting is secured to the pipe either by push-fit for compression of a locking ring onto the pipe by means of a screwed nut or similar;

— for joints where a visco-elastic ring is used and the fitting is secured to the pipe by radial shrinking of the previously expanded pipe and ring.

A.7.5.2 Jointing procedure

Joints shall be made in accordance with the fittings manufacturer's instructions and generally in accordance with the following procedure:

- Cut the pipe to length in accordance with A.7.2.
- Fit any necessary support liner firmly into the end of the pipe (not necessary for assembled fittings). Where fittings are not assembled, pass the nut, locking ring and, where applicable, the sealing ring and spacer, over the pipe end ensure that they are the correct way round.
- Insert the prepared pipe end into the fitting body as far as the internal stop and/or any insertion mark on the pipe end.
- Tighten the nut in accordance with the fittings manufacturer's instructions without using excessive force.

The joint is now ready for use and can be subjected to test conditions immediately.

A.7.6 Push-fit fittings

Joints shall be made in accordance with the fittings manufacturer's instructions and generally in accordance with the following procedure:

- Cut the pipe to length in accordance with A.7.2.
- Lubricate the pipe and fitting if appropriate. It is important to use an approved lubricant recommended by the fittings manufacturer to avoid the use of toxic substances and/or prevent deterioration of the ring and the joint assembly.
- Insert any necessary support liner firmly into the end of the pipe.
- Assemble the joint by pushing the pipe into the fitting as far as the internal stop and/or any insertion mark on the pipe.

The joint is now ready for use and can be subjected to test conditions immediately.

A.7.7 Flanged fittings

A.7.7.1 General

A fitting in which the pipe connection consists of two mating flanges which are mechanically pressed together and sealed by the compression of an elastomeric gasket or sealing ring between them.

A.7.7.2 Jointing procedure

Joints shall be made in accordance with the fittings manufacturer's instructions and generally in accordance with the following procedure:

- Cut the pipe to length in accordance with A.7.2.
- Pass the flange adaptor, and where applicable, the sealing ring or gasket (over the tube).
- Assemble the flange.
- Tighten the bolts on the flanged joint using a torque wrench in order to control the torque to the manufacturer's recommendations.

The joint is now ready for use and can be subjected to test conditions immediately.

a) Flat seat union fittings

A fitting in which the pipe connection consists of two components (at least one of which normally incorporates a flat sealing surface) which are mechanically pressed together and sealed by the compression of an elastomeric gasket or sealing ring between them. These fittings are of two main types that require different procedures for jointing respectively to metallic components or to plastic components.

b) Jointing plastics pipes to metallic components

The joint shall be made in accordance with the fittings manufacturer's instructions and generally in line with the following: solvent cement or fuse the pipe into the socket of a plastics fitting in accordance with A.7.3 or A.7.4 as appropriate.

When the joint has attained its strength, connect the plastics fitting to the metallic fitting, ensuring that the gasket/sealing ring is positioned between the mating faces. Do not use mastic, hemp or other jointing compounds to effect a seal.

Tighten the nut sufficiently to give a pressure tight seal. The degree of tightness should not normally exceed a further half turn beyond finger tightness.

The joint is now ready for use and can be subjected to test conditions immediately.

Annex B
(informative)

Calculation and compensation for thermal effects of pipes

B.1 Thermal expansion of metal pipes

Metal pipes are subjected to thermal expansion, which requires consideration to prevent any damage.

Thermal expansion or contraction of a metal pipe can be calculated according to the formula (B.1):

$$\Delta L = \Delta T \times \alpha \times L \qquad \text{(B.1)}$$

where

ΔL is the thermal length variation, in mm;
ΔT is the temperature difference, in K;
L is the length of the pipe, in m;
α is the coefficient of thermal expansion in accordance with Table B.1, in mm/(m · K).

Table B.1 — Coefficients of thermal expansion for metal pipes

Pipe material	α **mm/(m · K)**
Copper	**0,017**
Stainless steel	**0,017**
Galvanised steel	**0,0116**

The calculated value shall be rounded up to the next 5 mm step.

The flexible arm should be sufficiently long to prevent damage. The brackets should allow clearance to the wall after expansion (see Figures B.2 and B.3). This is also applicable in cases where pipes are supported along their length.

Table B.2 gives average values for the minimum length of a flexible arm to compensate for thermal expansion.

Table B.2 — Mean values for the length of flexible arms for metal pipe systems

OD mm	Thermal expansion ΔL			
	5 mm	10 mm	15 mm	20 mm
	Compensation with the minimum length L_B for a flexible arm			
12	475	670	820	950
15	503	750	920	1 060
18	580	820	1 000	1 060
22	640	910	1 110	1 280
28	725	1 025	1 250	1 450
35	810	1 145	1 400	1 620
42	890	1 250	1 540	1 780
54	1 010	1 420	1 740	2 010
64	1 095	1 549	1 897	2 191
76,1	1 195	1 689	2 069	2 389
88,9	1 291	1 826	2 236	2 582
108	1 423	2 012	2 465	2 846
133	1 579	2 233	2 735	3 158
159	1 727	2 442	2 991	3 453
219	2 026	2 866	3 510	4 053
267	2 237	3 164	3 875	4 475

B.2 Thermal expansion of plastics pipes

Plastics pipes are subjected to thermal expansion that requires consideration to prevent any damage.

Thermal expansion or contraction of a plastics pipe can be calculated using formula B.1 and coefficients of thermal expansion given in Table B.3.

Table B.3 — Coefficients of thermal expansion for plastics pipes

Pipe material	α mm/(m · K)
PE	0,20
PVC-U	0,08
PVC-C	0,07
PE-X	0,15
PP	0,15
PB	0,13
Multilayer with metallic layer	0,02
Multilayer without metallic layer	a)

a) For some constructions of multilayer pipes different values of α shall be used. The manufacturer of the multilayer piping system shall declare which value of α shall be used.

B.3 Positioning of anchor points

The positioning of anchor points can be used to give direction to and to limit to the amount of thermal expansion. Examples are given in Figures B.1, B.2 and B.3.

This is also valid for mains in a basement.

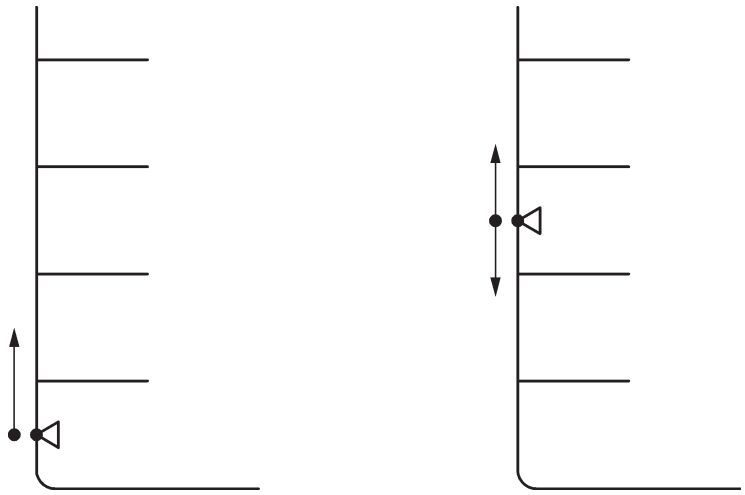


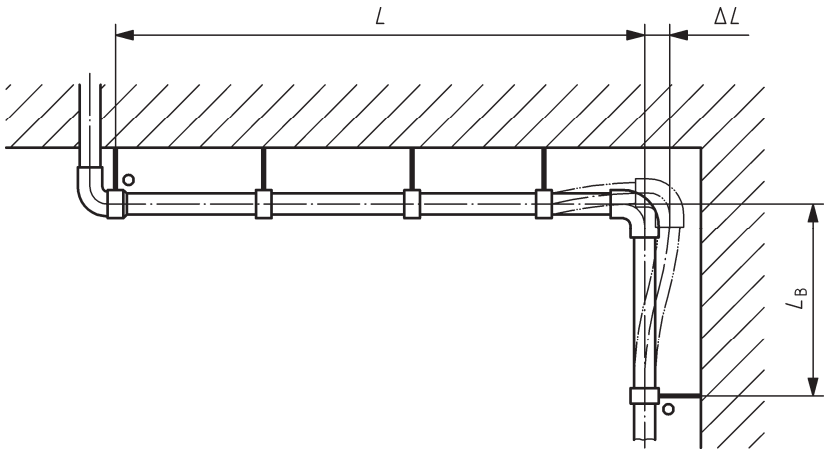
Figure B.1 — Positioning of anchor points (installation with branches)

B.4 Installation of pipes allowing expansion by means of a flexible arm

The flexible arm should be sufficiently long to prevent damage.

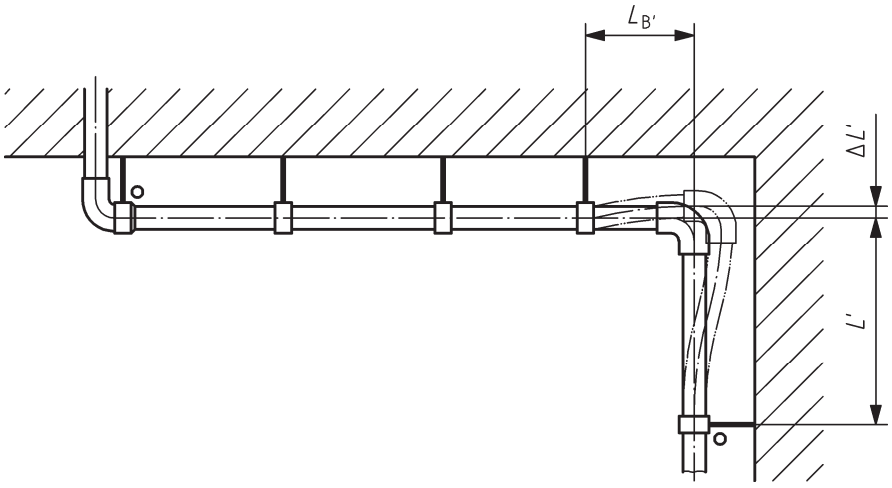
The brackets should allow clearance to the wall after expansion. This is also applicable in cases where pipes are supported along their length.

A typical installation is shown in Figures B.2 and B.3.



Key
ΔL Length difference
L Length of pipe section
L_B Length of flexible arm
o Anchor point

Figure B.2 — Compensation of expansion ΔL by flexible arm



Key
$\Delta L'$ Length difference
L' Length of pipe section
L_B' Length of flexible arm
o Anchor point

Figure B.3 — Compensation of expansion ΔL` by flexible arm

The length of the flexible arm, L_B can be calculated from the formula (B.2):

$$L_B = C \times \sqrt{d_e \times \Delta L} \quad \text{(B.2)}$$

where

L_B is the length of the flexible arm, in mm;
C is the material constant in accordance with Table B.4
d_e is the outside diameter, in mm;
ΔL is the thermal length variation as determined by formula B.1, in mm.

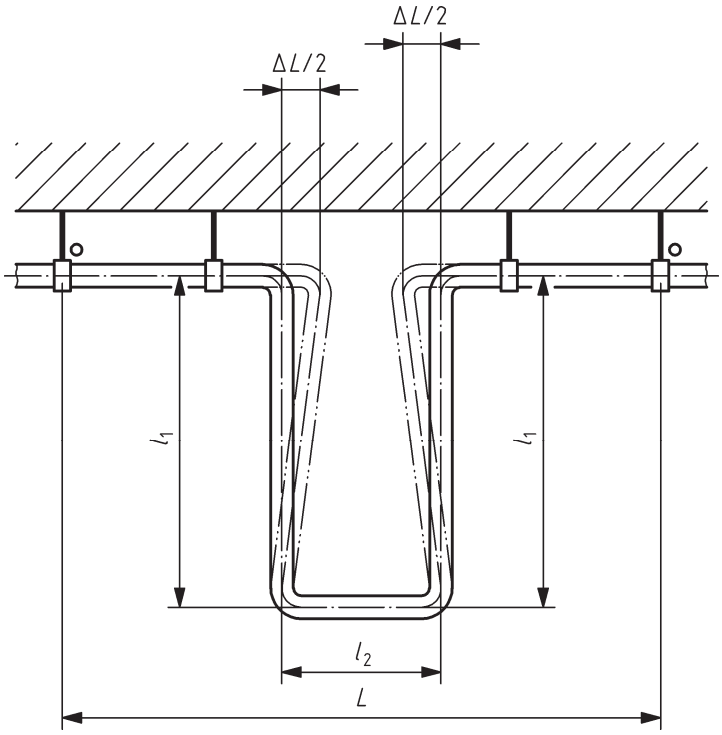
Table B.4 — Values of material constant C

Material	C
PE	27
PVC-U	34
PVC-C	34
PE-X	12
PP	20
PB	10
Multilayer [a]	30

[a] For some constructions of multilayer pipes there are different values of C. The manufacturer of the multilayer piping system declares which value of C has to be used.

B.5 Installation of pipes allowing expansion by means of an expansion loop

A typical installation is shown in Figure B.4.



Key
See explanations to formula (B.3).
L Distance between fixed brackets
l_1 Length of loop
l_2 Width of loop
ΔL Linear thermal expansion
o Anchor point

Figure B.4 — Compensation of the thermal expansion by expansion loop

The length of the flexible arm, L_B can be calculated from the following formula:

$$L_B = C \times \sqrt{d_e \times \frac{2 \times \Delta L}{2}} = 2 \times l_1 + l_2 \qquad \text{(B.3)}$$

where

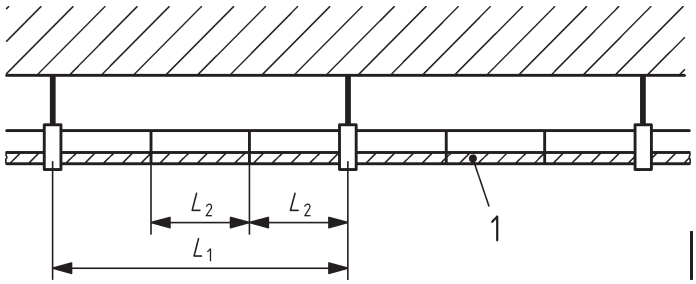
L_B is the length of the flexible arm, in mm;
C is the material constant;
d_e is the outside diameter, in mm;
ΔL is the linear thermal expansion, in mm;
l_1 is the length of loop, in mm;
l_2 is the width of loop, in mm.

It is preferable to design the loop so that $l_2 = 0{,}5\ l_1$.

The expansion loop is also calculated using formula B.3. In this case the flexible arm $L_B = l_1 + l_1 + l_2$.

B.6 Installation of pipes allowing expansion and with continuous support and guide brackets

A typical installation is shown in Figure B.5.



Key
1 Continuous support
L_1 Distance between supporting guide bracket or between supporting guide bracket and anchor point
L_2 Distance between bindings
Maximum distances between guide brackets and bindings are given in Tables B.5 and B.6.

Figure B.5 — Continuous support with guide brackets allowing expansion

Table B.5 — Distance L_1 (approximate values)

Pipe outside diameter mm	L_1 mm	
	Cold water	Hot water
≤ 20	1 500	1 000
> 20 to ≤ 40>	1 500	1 200
> 40 to ≤ 75	1 500	1 500
> 75 to ≤ 110	2 000	2 000

Table B.6 — Distance L_2 (approximate values)

Pipe outside diameter mm	L_2 mm	
	Cold water	Hot water
≤ 20	500	200
> 20 to ≤ 25	500	300
> 25 to ≤ 32	750	400
> 32 to ≤ 40	750	600
> 40 to ≤ 75	750	750
> 75 to ≤ 110	1 000	1 000

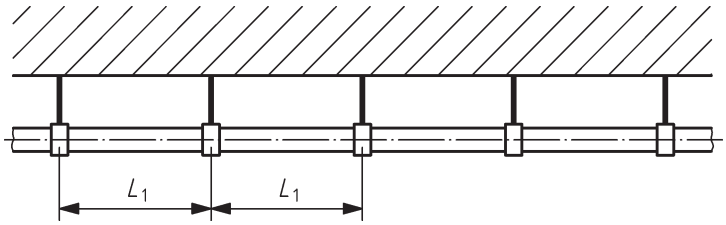
B.7 Installation of pipes allowing expansion and with guide brackets

Maximum distance between guide brackets are shown in Table B.7.

Table B.7 — Distance L_1 (approximate values)

Pipe outside diameter mm	L_1 mm	
	Cold water	Hot water
≤ 16	750	400
> 16 to ≤ 20	800	500
> 20 to ≤ 25	850	600
> 25 to ≤ 32	1 000	650
> 32 to ≤ 40	1 100	800
> 40 to ≤ 50	1 250	1 000
> 50 to ≤ 63	1 400	1 200
> 63 to ≤ 75	1 500	1 300
> 75 to ≤ 90	1 650	1 450
> 90 to ≤ 110	1 900	1 600

For vertical pipes L_1 should be multiplied by 1,3.



Key
L_1 Distance between guide brackets or between guide bracket and anchor point

Figure B.6 — Guide brackets allowing expansion

B.8 Installation of pipes on continuous horizontal supports

Pipes may be laid down on continuous horizontal support (i.e. cable path), where the elongation is compensated by "snaking" of the pipe. The course of the pipe should be designed to give enough space for elongation or contraction of the pipe. To avoid vertical movement of the pipe, the pipe should be secured.

B.9 Installation of pipes not allowing expansion

Installation of pipes between anchor points is sometimes required for special situations, in this case the force due to thermal expansion and contraction are transmitted through the supports to the buildings structure. Examples are given in Figures B.7, B.8, B.9 and B.10.

B.10 Positioning of anchor points

The anchor points are positioned so that the thermal variations cannot take place (for PE-X, PB, PP and PE). The maximum allowable distance between anchor points should be below or equal to 6 m.

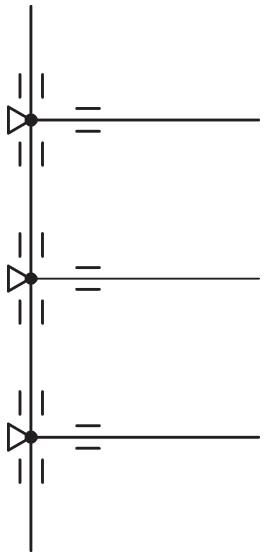
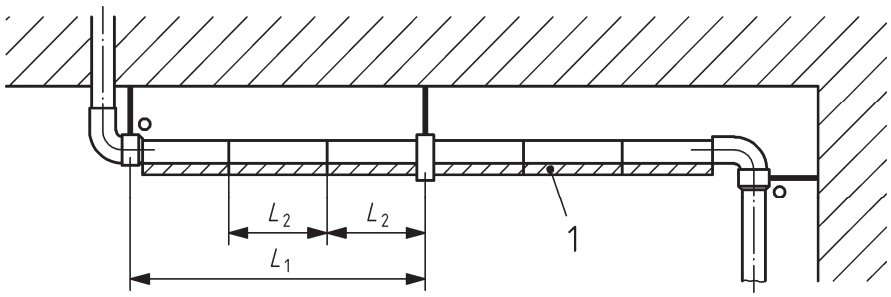


Figure B.7 — Positioning of anchor points at branches

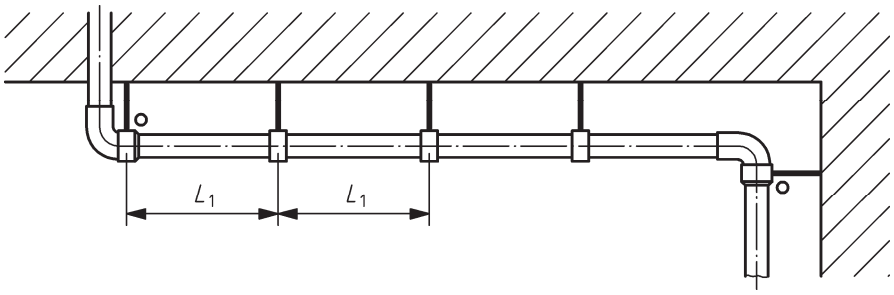
B.11 Installation between anchor points where continuous pipe stiffening is provided (PE-X, PB, PP and PE)

Maximum distances between different fixings as shown in Figure B.8 should conform to Tables B.5 and B.6.



Key
1 Continuous support
L_1 Distance between guide brackets or between guide bracket and anchor point (see Table B.5)
L_2 Distance between bindings (see Table B.6)
o Anchor point

Figure B.8 — Continuous support not allowing expansion



Key
L_1 Distance between guide brackets or between guide bracket and anchor point
o Anchor point

Figure B.9 — Installation between anchor points with guide brackets

Table B.8 — Distance L_1 (approximate values)

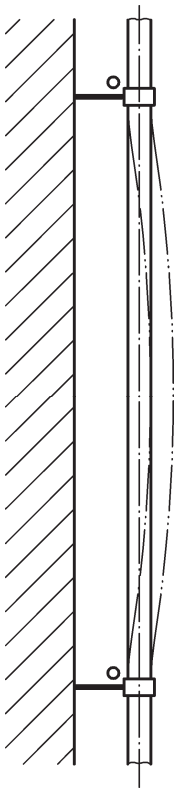
Pipe outside diameter mm	L_1 mm	
	Cold water	Hot water
≤ 16	600	250
> 16 to ≤ 20	700	300
> 20 to ≤ 25	800	350
> 25 to ≤ 32	900	400
> 32 to ≤ 40	1 100	500
> 40 to ≤ 50	1 250	600
> 50 to ≤ 63	1 400	750
> 63 to ≤ 75	1 500	900
> 75 to ≤ 90	1 650	1 100
> 90 to ≤ 110	1 850	1 300

Maximum distance between anchor points and guide brackets as shown in Figure B.9 should conform to Table B.8.

B.12 Installation of pipes supported only at the anchor points (for PE-X, PB, PP and PE)

In this case, the forces due to thermal expansion and contraction only partially are transmitted through the anchor points to the building structure.

This may be used where the movement caused by thermal expansion as shown in Figure B.10, can be tolerated and/or is visually acceptable.



Key
o Anchor point

Figure B.10 — Pipes supported only by anchor points

NOTE Under certain conditions, depending on the construction, Clauses B.10, B.11, and B.12 can also be valid for multilayer piping systems. Detailed information should be given by the manufacturer of the multilayer piping system.

Annex C
(informative)

Recommended maximum spacings of fixings for metal pipes

Recommended maximum spacings of fixings for metal pipes are given in Table C.1.

Table C.1 — Maximum spacing of fixings for metal pipes

Type of piping	**Nominal size of pipe**		**Spacing on horizontal run** [a] m	**Spacing on vertical run** [a] m
Copper (EN 1057) and stainless steel tubes (EN ISO 1127, EN 10312)	DN/OD Copper	DN/OD Stainless steel		
	10	10	1,000	1,500
	12	12	1,200	1,800
	15	15	1,200	1,800
	22	20	1,800	2,400
	28	25	1,800	2,400
	35	32	2,400	3,000
	42	40	2,400	3,000
	54	50	2,700	3,600
	67	—	3,000	3,600
	76	80	3,000	3,600
	108	100	3,000	3,600
	133	—	3,600	4,200
Ductile iron tubes in accordance with EN 545		DN		
		50	1,800	1,800
		80	2,700	2,700
		100	2,700	2,700
		150	3,600	3,600

[a] Due to different wall thickness and different tempers, the spacing of fixings for copper tubes may very reflecting the locally used dimensions.

Bibliography

[1] EN 12502-1, *Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems – Part 1: General*

[2] EN 12502-2, *Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems – Part 2: Influencing factors for copper and copper alloys*

[3] EN 12502-3, *Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems – Part 3: Influencing factors for hot dip galvanised ferrous materials*

[4] EN 12502-4, *Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems – Part 4: Influencing factors for stainless steels*

[5] EN 12502-5, *Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems – Part 5: Influencing factors for cast iron, unalloyed and low alloyed steels*

[6] EN ISO 1127, *Stainless steel tubes – Dimensions, tolerances and conventional masses per unit length (ISO 1127:1992)*

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