British Standard

BRITISH STANDARD

BS 5955-8:2001

Plastics pipework (thermoplastic materials)

Part 8: Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold services and heating systems in buildings

ICS 83.140.30; 91.140.10; 91.140.60

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee, PRI/88, Plastic piping systems, to Subcommittee PRI/88/2, Thermoplastic piping systems and components for pressure applications, upon which the following bodies were represented:

British Adhesives and Sealants Association

British Plastics Federation

British Plumbing Fittings Manufacturers' Association

Chartered Institute of Water and Environment

Health and Safety Executive

Institute of Materials

Institution of Civil Engineers

Institution of Gas Engineers

National Association of Plumbing and Heating

Standards Association of Australia

Water UK

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Contents

Foreword

This British Standard has been prepared under the direction of the Plastics Standards Committee. Its preparation was entrusted by Technical Committee PRI/88, Plastics piping systems and components, to Subcommittee PRI/88/2, Plastics piping systems and components for pressure applications. It supersedes the 1990 edition, which is now withdrawn.

It specifies methods and gives requirements for the installation of polybutylene (PB) and crosslinked polyethylene (PE-X) pipes and associated fittings compatible with the scope of BS 7291:2001. It is intended for the use of engineers, architects, surveyors, contractors, installers and inspection authorities for purposes of use of hot and cold water, including heating systems in buildings. To further assist end-users, requirements have also been given for jointing systems which may be used with these components, together with recommended methods of storage, handling and transport.

NOTE In the preparation of this standard, the opportunity has been taken to present it in the form of a practice specification in accordance with the guidance given in PD 6612:1997. This format allows the requirements of the specification to be supported by recommendations. To comply with this specification, the user has to comply with all its requirements. The user may depart from recommendations, but this would be on his own responsibility and he would be expected to have good reasons for doing so.

Attention is drawn to BS 1710 for a specification on identification and marking of service pipework to discriminate between different applications and/or pipework for other purposes. This is not intended to imply that the requirements given in BS 1710 for the marking of pipework are either necessary or desirable for installations in situations used only for domestic purposes.

Annex A and Annex B are informative.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Installations covered by this part of BS 5955 fall within the scope of the Water Supply (Water Fittings) Regulations [1] and/or relevant byelaws, and persons using this standard should therefore be conversant with the applicable Water Regulations.

Guidance on water regulations matters can be obtained from local water undertakers or from the Water Regulations Advisory Scheme.

Summary of pages
This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

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1 Scope

This part of this British Standard specifies the practices to be followed in the application and installation of thermoplastics pipes and associated fittings which fall within the scope of BS 7291:2001 and are used for the distribution of hot and cold water, including drinking water, and heating systems within buildings.

Guidance is also given on acceptable methods of jointing polybutylene (PB) and crosslinked polyethylene (PE-X) pipes and associated fittings, together with recommendations on their storage, handling and transportation.

Whilst it is recognized that in the majority of installations there will be combination of plastics and metallic components, guidance is only given for those parts of the installation where thermoplastics pipes and/or associated fittings are utilized, except where a transition occurs between plastics and metallic components.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 5449, *Specification for forced circulation hot water central heating systems for domestic premises.*

BS 5970, *Code of practice for thermal insulation of pipework and equipment (in the temperature range –100 °C to +870 °C).*

BS 6920-1:2000, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water — Part 1: Specification.*

BS 7291-1:2001, *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Part 1: General requirements.*

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

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

BS 7671, *Requirements for electrical installations — IEE Wiring Regulations.*

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

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

BS EN 1254-3, *Copper and copper alloys — Plumbing fittings — Part 3: Fittings with compression ends for use with plastics pipes.*

3 Terms and definitions

For the purposes of this part of BS 5955, the terms and definitions given in BS 7291-1:2001 and the following apply.

3.1
boiler
appliance designed for heating water either for heating systems or hot water supply

3.2
circulator
appliance designed for the supply of hot water in conjunction with a separate storage vessel, operated by gravity circulation

3.3
component
part of an installation which can be either plastics or metallic

3.4
installation
complete assembly for the provision of hot and cold water and/or heating systems

3.5
pipework system
parts of an installation which comprise thermoplastics pipes and associated fittings

4 Classification

The pipework system shall be classified in accordance with the classifications for thermoplastics pipes and associated fittings specified in BS 7291-1:2001, i.e. class W, H or S.

5 Design considerations

5.1 Service conditions

The installed pipework system shall be capable of operation at the service conditions appropriate to the applications in accordance with BS 7291-1:2001, Table 2.

5.2 Materials

All components used shall be suitable for the maximum system temperatures and pressures as specified in BS 7291-1:2001 for their intended application. Components of PB and PE-X shall conform to the requirements appropriate to their class as given in the relevant British Standard(s), i.e.:

PB	BS 7291-2
PE-X	BS 7291-3

5.3 Water quality

5.3.1 *Effect of materials on the quality of water*

When used under the conditions for which they are designated, non-metallic products in contact with or likely to come into contact with water fit for human consumption shall conform to the requirements of BS 6920-1:2000.

NOTE 1 Non-metallic products for installation and use in the United Kingdom which are verified and listed under the UK Water Regulations Advisory Scheme are deemed to satisfy the requirements of this sub-clause. Details of the Scheme are available from WRc Evaluation and Testing Centre Ltd, Fern Close, Pen-y-Fan Industrial Estate, Oakdale, Gwent. NP1 4EH.

NOTE 2 A list of approved chemicals and materials and details of the approvals scheme is available from the Secretary of the Committee at the Department of the Environment, Drinking Water Directorate, Floor 2/E5, Ashdown House, 123 Victoria Street, London. SW1E 6DE.

NOTE 3 There is no corresponding British Standard and associated test methods generally applicable to metallic products, i.e. complete fittings or parts of fittings which may come into contact with potable water. Attention is drawn to the UK Water Regulations Advisory Scheme (see note 1) and to the relevant requirements for fittings conforming to BS EN 1254-2 and/or BS EN 1254-3 or equivalent.

5.3.2 *Effect of materials on heating systems*

If the material from which the plastics components are constructed can affect the reactivity of recirculated water, or vice versa, this shall be taken into account when determining the type and variety of materials used in the design of the system and the need for and selection of system additives (see **5.3.3**).

COMMENTARY AND RECOMMENDATIONS ON **5.3.2**. *Recirculated water can be affected by leaching of constituents from the components and/or by permeation of gas or vapour through the walls of the components. The effects can be deleterious to other systems components, but may be reduced by use of appropriate additives. If the system environment is other than air and the system contents other than water, it could be necessary to consider the possibility of reactions and effects additional to those catered for in BS 7291-1:2001 and the applicable material related part(s) of that standard.*

5.3.3 *System additives*

Where a corrosion inhibitor or other water treatment is recommended for a heating system by the plastic components' manufacturer, this shall be applied in accordance with the manufacturer's instructions.

NOTE Attention is drawn to **5.3.1**.

COMMENTARY AND RECOMMENDATIONS ON **5.3.3**. *The use of a system additive may be required to prevent deterioration of steel components (e.g. radiators), and to keep the water condition reasonable for circulation efficiency. The correct level of additive concentration, and method of checking concentration level and system water condition, will normally be advised by the corrosion inhibitor manufacturer.*

Corrosion inhibitor additives should only be used in thermoplastic piping systems where the inhibitor manufacturer verifies that the product will not adversely affect the long term performance of the piping system and where such additives are produced under a BS EN ISO 9000 Quality Management and Quality Assurance Standard. Where system additives are used, these should be applied in accordance with BS 7593.

5.4 Pipe sizing

The sizes of pipes and fittings used in an installation shall be such as to provide an adequate flow and/or delivery of water for the application of the installation.

Water velocities for heating systems shall conform to BS 5449.

COMMENTARY AND RECOMMENDATIONS ON **5.4**. *It is customary when sizing metal piping for domestic hot water systems to use frictional loss data related to cold water temperature. The density of cold water is more than hot water effectively providing a safety factor for some scale build-up.*

Plastic components have smooth, glossy internal surfaces, which discourage the accumulation of limescale in hard water areas and pitting and corrosion in soft water areas. The bore diameter will therefore be maintained almost indefinitely.

For the purpose of calculating design flow rates, refer to BS 5449. Head loss for piping can be calculated by using the pipe manufacturers published data, or by using suitable graphs, which allow for the correct internal pipe diameter to be applied. As thermoplastic piping has excellent noise attenuation and is not susceptible to corrosion, hot and cold water flow velocities up to 3 m/s are acceptable for the distribution pipework and velocities of up to 5 m/s are acceptable for short final appliance connections.

6 Installation work on site

6.1 Pipework

6.1.1 *Positioning*

The positioning and supporting of pipes shall allow for free movement, for expansion and be such as to avoid airlocks.

Pipes running through brickwork, masonry and solid floors shall be sleeved to allow movement of the pipe without damage to the building fabric or pipe. The overall length of the sleeve shall be such that it projects at least 2 mm beyond the finished thickness of the wall or partition.

COMMENTARY AND RECOMMENDATIONS ON **6.1.1**. *Holes should be used through joists in preference to notches to avoid a reduction in the structural strength of the joists and inadvertent damage to the pipework.*

In general, with the exception of underfloor heating systems, pipework should not be embedded in concrete or masonry unless it is installed without joints as part of a heating system, or run within a conduit, which allows for future pipe replacement.

Where it is required to run jointed pipework in concrete or masonry, it should be provided with properly designed ducts or chases fitted with removable covers or covered by decorative material which allows reasonable ease of access in accordance with the Water Regulations and/or byelaws.

To minimize the risk of accidental damage to pipework and, with the exception of pipework run within a conduit, pipework concealed within a wall or floor should be at a depth of not less than 25 mm.

Where pipework is installed in contact with concrete or masonry, any metallic components should be corrosion resistant, e.g. conforming to BS EN 1982.

The storage, handling and transport of the plastics components or assemblies thereof before and during installation should be conducted in accordance with Annex A.

Generally, plastics are poor conductors of heat. A naked flame should not be used in close proximity to the plastics components either for thawing the contents of the plastics pipework or for effecting soldered joints on metallic components.

Plastics components should not be allowed to come into contact with soldering flux or with jointing compounds based on linseed oil or other solvents likely to have a deleterious effect on the pipe or fitting.

6.1.2 ***Pipe supports***

Pipe supports shall be designed to provide a permanent fixing. Where fittings such as valves and manual controls are used, these shall be firmly anchored so as to minimize any turning moment imparted to the pipe by operation of e.g. handwheels, levers.

COMMENTARY AND RECOMMENDATIONS ON **6.1.2**. *Pipe fixings and supports should be fitted in accordance with Table 1.*

It is recommended that pipe clips made from plastics materials are used, preferably encompassing the pipe by more than 80 % of its circumference.

Each support should take its due proportion of the pipe weight and should allow free movement for expansion and contraction, particularly at the end of long runs where a change of direction takes place. The linear expansion of plastics is approximately ten times that of copper. Installers should therefore be aware that the pipe will expand with heat and may become visually unacceptable in installations where the pipe is exposed. It is recommended that long pipe runs are installed out of sight, e.g. under floors or in ducts fitted with removable covers. However, where this is not possible, long pipe runs should be adequately supported in such a way that bends occur between anchoring points.

Table 1 — Recommended spacing of support centres for PB and PE-X pipes

Nominal size mm	Horizontal runs m	Vertical runs m
16	0.3	0.5
18 to 25	0.5	0.8
28	0.8	1.0
32	0.8	1.0
35	0.8	1.1
40	0.9	1.2
50	1.0	1.3
63	1.1	1.4
75	1.2	1.6
90	1.3	1.7
110	1.6	2.1

6.2 Jointing

All joints shall be made in accordance with the instructions of the fittings' manufacturer.

COMMENTARY AND RECOMMENDATIONS ON **6.2**. *Joints may be divided into three categories as follows:*

a) *Mechanical joints, which can be compression, pushfit, and/or flat faced unions, flanges and/or screwed unions. Where plastics fittings are concerned, mechanical fittings often rely on sealing by compression of an olive or elastomeric, sealing ring, except for screwed fittings, when the seal is effected using polytetrafluoroethylene (PTFE) tape. Push fit fittings also incorporate a pipe retention device or grip ring;*

b) *Socket fusion joints of the electrofusion type in which the pipes are socket fusion joints, in which pipes are jointed to pipes and/or fittings by the application of heat under controlled conditions to the respective surfaces. Advice should be sought from the applicable pipe or fittings' manufacturer;*

c) *Electrofusion, in which the joint with the pipe is made by simultaneously melting together the outer part of the pipe and the inner part of the fitting by means of heat induced by current flowing in an appropriate resistor inserted in the fitting body.*

*The joints described are capable of withstanding endthrust. However, proper consideration should be given to the anchorage of all pipelines as detailed in **6.1.2**. It should be noted that not all plastics pipes are capable of being jointed by all methods.*

Proprietary plastic pipe cutters should be used for cutting plastic pipes and the pipe manufacturer's recommendations should be sought when using these. Pipes should be cut at right angles. Burrs and ridges should be removed before assembly.

6.3 Pipe bending

The minimum cold bend radii for PB and PE-X shall be as specified by the pipe manufacturer. Where no specification exists, the minimum bend centerline radii for small diameter pipes shall be based on the outside diameter (OD) of the pipe. For 10 mm to 28 mm PB pipes, the minimum bend radii shall be pipe OD × 8 for supported bends. For 32 mm to 63 mm PB pipes, the minimum bend radii shall be pipe OD × 15. For PE-X pipes in the size range 10 mm to 35 mm, the minimum bend radii shall be pipe OD × 12 for supported bends.

COMMENTARY AND RECOMMENDATIONS ON **6.3**. *PB and PE-X pipes have some degree of flexibility and may be cold bent to accommodate contours and curvatures; it is necessary to support the cold bend in order to maintain its configuration. Where bend clips are available, these should be used to hold the bend.*

Hot bending of thermoplastics pipe for hot water applications is not recommended for use on site.

6.4 Boiler or circulator connection

Plastics pipework shall not be connected directly to a boiler or circulator. A transition piece i.e. metal to plastics, shall be used for this purpose and shall be located not less than 350 mm from the connection to the boiler or circulator. Plastics pipes and fittings (PB and PE-X only) can be connected to heat producing appliances, such as boilers, gas circulators and hot water storage cylinders, providing they operate within the limits of the classified service conditions given in BS 7291-1:2001, Table 2, where the malfunction temperature does not exceed 95 °C. Plastics pipework shall not be connected directly to a boiler or circulator where the malfunction temperature exceeds 95 °C.

COMMENTARY AND RECOMMENDATIONS ON **6.4**. *For boilers (gas and oil fired, or electric) with full thermostatic, high limit control and pumped circulation, the method of connection should be as follows.*

a) 1) *For boilers which do not have a cast iron heat exchanger, direct plastics pipework connections are acceptable, providing the connections are not less than 350 mm from the burner or a greater distance where specified in the burner manufacturer's installation instructions, and not inside the boiler casing.*

   2) *For boilers with a cast iron heat exchanger, metal piping should be used to maintain a distance of not less than 350 mm between the boiler casing and the plastics pipe or fitting, or a greater distance where specified in boiler manufacturer's installation instructions.*

   3) *For back boilers, metal pipework should be used within the fire opening extending out of the chimney brickwork, in addition to 1) and 2).*

b) *For solid fuel boilers, metal piping should be used to maintain a suitable distance between radiant heat sources and a plastics pipe or fitting. The distances should be in accordance with the pipework manufacturer's recommendations. Plastics piping systems are not recommended for gravity circulation installations (i.e. non-pumped pipework).*

6.5 Electrical work

All electrical work connected with the system shall be in accordance with BS 7671.

COMMENTARY AND RECOMMENDATIONS ON **6.5**. *In general, where plastics pipework is used throughout a system, there is normally no requirement to provide supplementary earth bonding to short lengths of metal pipe at terminal water connections, metal radiators or metal taps.*

Attention is drawn to BS 7671.

6.6 Painting

COMMENTARY AND RECOMMENDATIONS ON **6.6**. *When required, plastics can be painted using normal household paints and normal methods of application. Should there be any doubt as to the suitability of the paint to be used, the advice of the plastics component's manufacturer should be sought. Cellulose paint should never be used.*

6.7 Frost protection

Pipework shall be run only where precautions against frost have been taken.

COMMENTARY AND RECOMMENDATIONS ON **6.7**. *Advice of the plastics component's manufacturer should be followed.*

6.8 Insulation

COMMENTARY AND RECOMMENDATIONS ON **6.8**. *Plastics materials are poor conductors of heat and therefore thermal insulation may be reduced. Where thermal insulation is used, it should conform to the recommendations of BS 5970 and the tests specified in* ***6.9*** *should be made before the insulation work is completed and whilst the joints are exposed.*

6.9 Pressure testing

COMMENTARY AND RECOMMENDATIONS ON **6.9**. *It is recommended that the system be pressure tested in accordance with BS 5449 prior to filling.*

7 Commissioning

7.1 Filling

The completed installation shall be filled and then thoroughly flushed out. The installation shall then be refilled and proper precautions taken to avoid air locks. Any defective workmanship or materials shall be rectified. When all work is completed, the system shall be run for such time as to allow all parts of the system to heat up to normal operating temperature and then be allowed to cool to a cold condition for a period of 3 h. When the work is completed, the system shall be commissioned in accordance with BS 5449.

7.2 Handing over

Upon satisfactory completion of the commissioning procedures, the installer shall demonstrate to the user the method of operation, limitations, maintenance requirements, and the safety precautions to be observed. The installer shall also hand over any tools for operating, cleaning and maintenance of the installation.

On acceptance, the installer shall provide the user with operating and maintenance instructions and any other documents or information appropriate to the installation.

Annex A (informative)
Guidance on storage, handling and transport

A.1 General

Care should be taken in handling and storage to prevent damage to plastics components. Plastics components, although strong, are lightweight and, as such, they are easily handled with a tendency for them to be mishandled much more than their metal counterparts.

A.2 Storage

Straight lengths should be stored on a flat surface free from sharp protrusions and be uniformly supported along their entire length.

Coils should be stored either on edge, or stacked flat one upon another to a maximum height of 2 m. In either case the storage area should be free from materials liable to abrade or puncture the pipes.

All fittings and accessories should be stored in their original containers, or as recommended by the manufacturer.

Storage in direct sunlight should be avoided as extended exposure to UV light can lead to deterioration.

A.3 Handling

The loading and unloading of pipes should be carried out with care to avoid damage.

Where mechanical handling is employed, the techniques used should ensure that no damage to pipes can occur. Metal slings, hooks and chains should not come into contact with the pipe.

Because plastics are softer than metals they are generally more prone to damage by abrasion and by objects with a cutting edge. Care should therefore be exercised in handling pipe to avoid damage to the wall surfaces. Particular care should be taken in handling pipe in cold weather; it should be recognized that plastics become less robust at the lower temperatures encountered during winter installation.

Pipes should not be dragged along rough ground or dropped on a hard surface.

A.4 Transport

Vehicles with a flat bed should be used for transporting pipe. The bed should be free from nails or other projections. Straight lengths should be uniformly supported along their length. Pipes should be loaded on vehicles in such a way that there is no overhang or bending.

Annex B (informative)
Guidance on jointing techniques

NOTE This annex is intended to give guidance on various types of jointing systems used with plastics pipes, and also jointing procedures. Such procedures will generally give acceptable results, but wherever the fitting manufacturer's instructions are available, these should always be followed.

B.1 Preparation of pipe

Proprietary plastic pipe cutters should be used for cutting plastics pipe and the pipe manufacturer's recommendations should be sought when using these. Pipes should be cut at right angles. Burrs and ridges should 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 recut to remove these.

A small chamfer should be made around the outside of the pipe, for socket fusion only, to aid assembly.

B.2 Mechanical joints

B.2.1 *Compression joints*

B.2.1.1 *Principle*

Compression joints may rely on the compression of an elastomeric component, such as a joint ring conforming to BS EN 681-1, or the compression of an olive to effect a seal. Where an elastomeric ring is used the fitting is secured to the pipe by the use of a locking or grip ring. Proprietary metallic compression fittings may also be used as recommended by the manufacturer of the thermoplastic pipe.

B.2.1.2 *Jointing procedure*

Only compression fittings approved by the plastics component manufacturer(s) should be used. Joints should be made in accordance with the recommendations of the fittings manufacturer. Where these are not stated, the following procedure is recommended.

a) Mark the fitting insertion depth on the pipe. Cut the pipe to length in accordance with **B.1**.

b) Pass the nut and olive locking or grip ring over the pipe end ensuring that they are the correct way round. Where plastic pipes are to be jointed, it is important to insert the correct size liner firmly into the end of the pipe.

c) Insert the prepared end onto the fitting body as far as the internal stop.

d) Tighten the nut in accordance with the fitting manufacturer's instructions.

B.2.2 ***Push-fit joints***

B.2.2.1 *Principle*

The push-fit joint relies on compression of an elastomeric ring conforming to BS EN 681-1, to effect a seal. The fitting is held onto the pipe by a locking or grip device.

B.2.2.2 *Jointing*

Joints should be made in accordance with the instructions of the fittings' manufacturer. Where these are not stated, the following procedure is recommended.

a) Cut the pipe to length in accordance with **B.1**.

b) Insert the correct size of support liner firmly into the end of the pipe.

c) Assemble the joint by pushing the pipe into the fitting as far as the internal stop. The joint is now ready for use and can be subjected to full operating temperatures and pressures immediately.

B.3 Thermal fusion joints

B.3.1 ***Socket fusion and butt fusion joints***

B.3.1.1 *Principle*

Joints of the socket fusion types rely on the application of heat under controlled conditions to the respective surfaces of thermoplastics pipes and/or fittings which are to be joined together.

B.3.1.2 *Jointing*

The correct jointing procedure should be obtained from the appropriate pipe or fittings manufacturer prior to commencing the installation.

B.3.2 ***Electrofusion joints***

B.3.2.1 *Principle*

The joint with the pipe is made by simultaneously melting together the outer part of the pipe and the inner part of the fitting of the same material by means of heat induced by current flowing in an appropriate resistor inserted in the fitting body.

B.3.2.2 *Jointing*

The correct jointing procedure and advice on the equipment required should be obtained from the fittings manufacturer.

Bibliography

Standards publications

BS 1710, *Specification for identification of pipelines and services.*

BS 7593, *Code of practice for treatment of water in domestic hot water central heating systems.*

BS EN 1982, *Copper and copper alloys — Ingots and castings.*

Other publications

[1] The Water Supply (Water Fittings) Regulations 1999. Regulations for Electrical Installations. London: The Stationary Office.

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