

Specification for

Unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water

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The preparation of this British Standard was entrusted by the Plastics Standards Committee (PLM/-) to Technical Committee PLM/9, upon which the following bodies were represented:

- British Gas Corporation
- British Plastics Federation
- British Valve Manufacturers' Association Ltd.
- Copper Tube Fittings Manufacturers' Association
- Department of the Environment (Housing and Construction Industries)
- Department of the Environment (Property Services Agency)
- Department of Transport (Highways)
- Electricity Supply Industry in England and Wales
- Engineering Equipment and Materials Users' Association
- Institution of Civil Engineers
- Institution of Production Engineers
- Institution of Public Health Engineers
- Institution of Water Engineers and Scientists
- National Association of Plumbing, Heating and Mechanical Services Contractors
- Plastics and Rubber Institute
- Plastics Land Drainage Manufacturers' Association
- Royal Institute of Public Health and Hygiene
- Water Authorities Association
- Water Companies Association
- Water Research Centre

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Institute of Plumbing
- Ministry of Agriculture, Fisheries and Food
- National Brassfoundry Association
- Standards Association of Australia

This British Standard, having been prepared under the direction of the Plastics Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 December 1986

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Foreword

This revision of BS 3505 has been prepared under the direction of the Plastics Standards Committee and supersedes the 1968 edition, which is withdrawn.

The main differences between this revision and the 1968 edition are as follows.

- a) The size range has been rationalized with the removal of nominal sizes 2½, 7, 9 and 22. (Although the pipe dimensions are expressed in metric units, this standard continues to designate the nominal size of pipes in inch equivalent figures to avoid confusion with pipe sizes having dimensions in accordance with metric series values in ISO 161/1.) The class B classification has also been removed.
- b) Requirements for the effects of materials on water quality have been modified.
- c) The method for the determination of long-term hydrostatic strength has been modified, so that the maximum period over which test results are to be obtained at 20 °C has been extended from not more than 1 000 h to not less than 10 000 h.
- d) A requirement for resistance to hydrostatic pressure at 60 °C has been added.
- e) A requirement for fracture toughness has been added, together with an associated method of test (see appendices C and D).
- f) The method for assessment of impact resistance has been modified to establish a maximum true impact rate (TIR) at a specified confidence level.
- g) Some restrictions have been placed on the colour of pipes, depending upon their size and intended installation and taking the following into account.

The National Joint Utilities Group has agreed that all buried thermoplastics utilities services up to 75 mm in external diameter should be colour coded for identification purposes. Among the conclusions given in the Group's Publication No. 4 "The identification of small buried mains and services" is that the colour selected for potable water pipes be blue. For this purpose, it is desirable to avoid the shade allocated for use by compressed air lines in accordance with BS 1710. If grey, the colour should be dark enough to avoid those shades used for telecommunications ducting.

- h) The requirements of this standard have been made verifiable, so that third party certification may be applied. Guidance provided on the periodic maintenance of equipment or on quality control testing is therefore given in the form of notes and in an advisory appendix (see appendix E).

The recommended maximum working stress of the material continues to be based on three values according to nominal size, as follows: a maximum stress of 9.8 MPa has been used for calculating the minimum wall thickness of pipes of nominal size up to ¾, one of 11.0 MPa for nominal sizes 1 to 6 inclusive and one of 12.3 MPa for pipes of nominal size 8 and above.

Attention is drawn to CP 312-2, which gives guidance on the use of pipes manufactured in accordance with this standard.

Attention is also drawn to BS 4346-2, which specifies joints and fittings for use with unplasticized PVC pressure pipes.

It has been assumed in the preparation of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced personnel.

Purchasers ordering to this standard are advised to specify in their purchasing contract that the supplier operate a quality system in compliance with BS 5750-2 to assure themselves that products claimed to comply with BS 3505 consistently achieve the required level of quality.

Certification. Attention is drawn to the certification facilities described on the inside back cover.

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. In particular, attention is drawn to water industry requirements for materials in contact with potable water.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for unplasticized polyvinyl chloride (PVC-U) pipes up to and including nominal size 24, for conveying cold potable water at pressures up to and including 9, 12 or 15 bar¹⁾ at 20 °C, depending on the size.

Methods of test, associated guidance and information on quality control testing are given in appendices.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Material

2.1 Base material

The material from which the pipe is produced shall be polyvinyl chloride with additives as necessary for the manufacture of pipe in accordance with this standard and to satisfy colour requirements, if applicable (see foreword and 6.1.2).

2.2 Reworked material

If reworked material is added or used, it shall be clean and in accordance with 2.1; it shall be derived from pipe produced in accordance with this standard, reground under the supervision of the same manufacturer and used only in the production of pipe sizes up to and including nominal size 6.

3 Pressure classification of pipes

Pipes are classified by maximum sustained working pressure, as follows:

- a) 9 bar (class C);
- b) 12 bar (class D);
- c) 15 bar (class E).

NOTE The working pressures given above are the calculated maximum sustained working pressures for the conveyance of cold water at a temperature of 20 °C. For use at higher temperatures or under conditions of pulsating pressures, reference should be made to CP 312-2.

4 Dimensions and tolerances

4.1 Nominal size

The nominal size of the pipe shall be one of the sizes given in Table 1.

4.2 Outside diameter

When determined in accordance with BS 2782: Method 1101A, the outside diameter of the pipe shall comply with the limits specified in Table 1 for the relevant nominal size of the pipe.

4.3 Wall thickness

When determined in accordance with BS 2782: Method 1101A, the wall thickness of the pipe shall comply with the limits specified in Table 1 appropriate to the nominal size and class of pipe. The average wall thickness of the pipe shall be determined by taking the arithmetic mean of at least the following number of measurements of wall thickness around the pipe, including both the minimum and maximum values:

- a) up to and including 6 mm wall thickness: four measurements;
- b) greater than 6 mm wall thickness: six measurements.

4.4 Tolerance on length

The ends of pipes shall be cut cleanly and squarely. If the length of a pipe is specified, the effective length shall be not less than that specified, when determined at 23 ± 2 °C.

NOTE The preferred effective lengths of pipe are 6 m or 9 m. For plain-ended pipes, the effective length corresponds to the overall length. For pipes with an integrally formed ring seal joint in accordance with BS 4346-2, the effective length does not include the length required for the joint.

5 Performance requirements

5.1 General

The requirements given in 5.2 and 5.3 shall be met, subject to 5.4, which shall apply whenever a change in process technique or introduction of a new or modified compound has occurred.

The relevant tests shall be applied to pipe taken from a production run from which the product has complied with all the other requirements of this standard.

5.2 Hydrostatic properties

NOTE Attention is drawn to advice given in appendix E concerning samples of pipes of different design stress categories, formulations, pressure classifications and sizes.

5.2.1 Long-term hydrostatic strength at 20 °C. When test pieces in accordance with 5.2.2 are tested at 20 ± 1 °C in accordance with BS 4728, and the results are analysed in accordance with appendix A, the extrapolated values for circumferential wall stress for the periods of time given in Table 2 shall comply with the limits specified in Table 2 according to the applicable design stress category.

¹⁾ 1 bar = 10^5 N/m² = 0.1 MPa

Table 1 — Pipe dimensions for 9 bar (class C), 12 bar (class D) and 15 bar (class E) pipes

Nominal size	Mean outside diameter		Individual outside diameter		Wall thickness								
	min.	max.	min.	max.	9 bar (class C)			12 bar (class D)			15 bar (class E)		
					Average value ^a		Individual value	Average value ^a		Individual value	Average value ^a		Individual value
					max.	min.	max.	max.	min.	max.	max.	min.	max.
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3/8	17.0	17.3	17.0	17.3	—	—	—	—	—	—	1.9	1.5	1.9
1/2	21.2	21.5	21.2	21.5	—	—	—	—	—	—	2.1	1.7	2.1
3/4	26.6	26.9	26.6	26.9	—	—	—	—	—	—	2.5	1.9	2.5
1	33.4	33.7	33.3	33.8	—	—	—	—	—	—	2.7	2.2	2.7
1 1/4	42.1	42.4	42.0	42.5	—	—	—	2.7	2.2	2.7	3.2	2.7	3.2
1 1/2	48.1	48.4	48.0	48.5	—	—	—	3.0	2.5	3.0	3.7	3.1	3.7
2	60.2	60.5	60.0	60.7	3.0	2.5	3.0	3.7	3.1	3.7	4.5	3.9	4.5
3	88.7	89.1	88.4	89.4	4.1	3.5	4.1	5.3	4.6	5.3	6.5	5.7	6.6
4	114.1	114.5	113.7	114.9	5.2	4.5	5.2	6.8	6.0	6.9	8.3	7.3	8.4
5	140.0	140.4	139.4	141.0	6.3	5.5	6.4	8.3	7.3	8.4	10.1	9.0	10.4
6	168.0	168.5	167.4	169.1	7.5	6.6	7.6	9.9	8.8	10.2	12.1	10.8	12.5
8	218.8	219.4	218.0	220.2	8.8	7.8	9.0	11.6	10.3	11.9	14.1	12.6	14.5
10	272.6	273.4	271.6	274.4	10.9	9.7	11.2	14.3	12.8	14.8	17.5	15.7	18.1
12	323.4	324.3	322.2	325.5	12.9	11.5	13.3	17.0	15.2	17.5	20.8	18.7	21.6
14	355.0	356.0	353.7	357.3	14.1	12.6	14.5	18.6	16.7	19.2	22.8	20.5	23.6
16	405.9	406.9	404.3	408.5	16.2	14.5	16.7	21.1	19.0	21.9	26.0	23.4	27.0
18	456.7	457.7	454.9	459.5	18.2	16.3	18.8	23.8	21.4	24.6	—	—	—
20	507.5	508.5	505.4	510.6	20.2	18.1	20.9	—	—	—	—	—	—
24	609.1	610.1	606.5	612.7	24.1	21.7	25.0	—	—	—	—	—	—

^a See 4.3.