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Water Industry Specification

# SPECIFICATION FOR UNPLASTICISED PVC PRESSURE FITTINGS AND ASSEMBLIES FOR COLD POTABLE WATER (UNDERGROUND USE)

## FOREWORD

This specification has been prepared by the Water Research Centre (WRc) under the direction of the Sewers and Water Mains Committee in consultation with the Water Industry and the British Plastics Federation and provides UK requirements relating to metric PVC-U fittings with a view to harmonisation within the single Europe.

This document is the specification for unplasticised polyvinyl chloride (PVC-U) fittings which may be injection moulded or made from pipe conforming to WIS No. 4-31-06 to provide solvent jointed assemblies. Where possible, the requirements of ISO/DIS 4422, the draft International Standard for PVC-U pipes and fittings for cold potable water (underground use) has been followed. The colour of fittings may be blue or grey.

The size range has been rationalised to 6 sizes from nominal size 63 to 315 and includes such fittings as tees, elbows, flanges, etc. A similar range is specified for assemblies which are normally used with pipes conforming to WIS No. 4-31-06 and incorporating integral joints. Most currently manufactured fittings up to and including size 160 are rated at 16 bar with larger fittings up to size 315 being rated at 10 bar. This may be in excess of the requirements of this specification but purchasers should ensure that marked pressure ratings are suitable for the intended purpose.

Attention is drawn to the uPVC Pipe Manual, which gives guidance on the use and installation of PVC-U pressure pipelines.

Purchasers are reminded that this specification requires that the manufacturer shall operate a quality system relating to the manufacture of pipe and fittings to this specification in compliance with BS 5750: Part 2 (EN 29002) which ensures that products claimed to comply with this specification consistently meet the required level of quality. Enquiries regarding the availability of third party certification should be addressed to an appropriate NACCB or equivalent accredited third party certification body or to WRc.

Compliance with this specification does not itself confer immunity from legal obligations.

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

Reference to a British Standard, Water Industry Specification or any other specification applies equally to any equivalent specification.

This specification includes the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

It has been assumed in the drafting of this specification that the execution of its provision is entrusted to appropriate qualified and experienced people.

Information contained in this specification is given in good faith but neither the Foundation for Water Research nor the Water Research Centre can accept any responsibility for actions taken as a result.

## CONTENTS



FWR
FOUNDATION
*for water research*

*Allen House, The Listons, Liston Road, Marlow, Buckinghamshire SL7 1FD*
*Telephone: (0628) 891589 Facsimile: (06284) 72711*

WRc

Technical enquiries to WRc, PO Box 85, Frankland Road, Blagrove, Swindon, Wilts., SN5 8YR. Tel: (0793) 511711 Fax: (0793) 511712 Telex: 449541

## 1. SCOPE

This specification specifies the requirements for injection moulded fittings and solvent jointed assemblies made from unplasticised polyvinyl chloride (PVC-U) for use in the conveyance of cold potable water below ground.

**NOTE** The titles of the publications referred to in this document are listed under clause 10 – REFERENCES.

## 2. FIELD OF APPLICATION

This specification applies to fittings and solvent jointed assemblies in nominal sizes 63 to 315 for use at working pressures of 8 and 12.5 bar made of PVC-U, pigmented blue or grey and to be used for cold potable water below ground.

**NOTE** The working pressures or nominal pressures (PN) given above are the maximum recommended working pressures for fittings complying with this specification 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 the uPVC manual: Pressure applications.

## 3. QUALITY ASSURANCE

Manufacturers shall operate a quality system relating to this specification in compliance with BS 5750: Part 2 (EN 29002).

## 4. DEFINITIONS

### 4.1 Fittings

A fitting is an injection moulded fittings manufactured from PVC-U with dimensions conforming to the requirements of 6.1.

### 4.2 Assemblies

An "assembly" is a component made from a fitting designed for solvent cement jointing and complying with this specification, i.e. WIS No. 4-31-07 together with pipe complying with WIS No. 4-31-06 and assembled using a solvent cement complying with BS 4346: Part 3. Alternatively, an assembly is a component made from a fitting incorporating an elastomeric sealing ring and complying with this specification, i.e. WIS No. 4-31-07, together with pipe complying with WIS No. 4-31-06 and assembled by push-fit.

**NOTE** 1 Assemblies incorporating elastomeric sealing rings are not strong in tension and should be suitably restrained when submitted to pressure tests (see clause 7 and Appendix A).

**NOTE** 2 Some of the tests specified in BS 4346: Part 3 require solvent cement assemblies of the sizes specified in BS 3505 to be evaluated. With impending metrication and the size range contained in WIS No. 4-31-06 and WIS No. 4-31-07, the requirements of BS 4346: Part 3 may have to be modified.

## 5. MATERIAL

### 5.1 Composition

The material from which fittings are made shall consist of polyvinyl chloride, together with only those additives that are needed for the manufacture and performance of pipe and fittings to this specification.

### 5.2 Pigmentation

The colour of fittings shall be blue within the range 20 E53 to 20 E56 of BS 4901 or of a shade of grey darker than colour 00 A09 of BS 4800.

### 5.3 Rework Material

Under normal conditions, rework material shall not be used in the manufacture of injection moulded fittings of nominal size greater than size 160.

If rework material is used, it shall be subject to strict control procedures in its use, be clean and in accordance with 5.1 and 5.2 derived from injection moulded fittings produced in accordance with this specification. It shall be reground under the strict supervision of and used by the same manufacturer in the production of such fittings.

No other rework material shall be used.

## 6. GEOMETRIC CHARACTERISTICS

### 6.1 Dimensions of injection moulded fittings

The dimensions of laying lengths of fittings with plain sockets shall be in accordance with ISO 264.

The inside socket diameters of fittings with plain sockets, their tolerances and their socket length shall be in accordance with ISO 727.

The dimensions of laying lengths of fittings with elastomeric sealing ring type joints shall be in accordance with ISO 6455.

The socket length of fittings with elastomeric sealing ring type joints shall be in accordance with ISO 2045.

### 6.2 Dimensions of flanges

The basic dimensions for flanges shall be in accordance with ISO 2536.

The dimensions of flange adaptors with plain sockets shall be in accordance with ISO 3460. The dimensions of flanged spigots and flanged sockets with elastomeric sealing ring type joints shall be in accordance with ISO 6455.

### 6.3 Dimensions of assemblies

**6.3.1** The dimension of the spigot end (a) of a spigoted assembly, measured from the face of the socket of the fitting to the end of the spigot shall be in accordance with Table 1 (see Figure 1).

**Table 1 – Dimensions of spigoted assemblies (a) – minimum**

| Nominal size | Spigot end (a) (mm) |
|---|---|
| 63 | 130 |
| 90 | 147 |
| 110 | 160 |
| 160 | 187 |
| 200 | 212 |
| 250 | 239 |
| 315 | 256 |

**NOTE** Where pipes are jointed with couplers using elastomeric sealing rings, the length of the spigot ends may be reduced to those specified in ISO 6455.

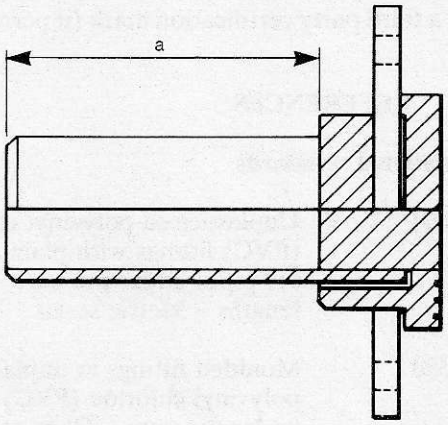


**Figure 1 – Illustration of dimension of spigot end (a)**

**6.3.2** The dimensions of flanges of flanged fittings shall be in accordance with ISO 2045.

**6.3.3** The dimensions of flanges of flanged fittings shall be in accordance with ISO 2536.

## 7. TYPE TEST REQUIREMENTS

### 7.1 Fittings

**7.1.1** *Long Term pressure test: material assessment*

The material test shall be carried out on injection moulded pipe test pieces whose nominal outside diameter shall be not less than 50mm. These test pieces shall have a wall thickness calculated from an admissible stress of 10.0MPa and shall contain weld lines. The free length of pipe between connecting end caps shall not be less than 150mm.

Sufficient number of injection moulded pipe test pieces of the same nominal diameter shall be produced in order to carry out the test in accordance with Appendix A of WIS No. 4-31-06: Issue 1. The value of the mean stress data at 50 years shall not be less than 26.0MPa and that of the 97.5% extrapolated lower confidence limit of the stress at 100 000 hours shall not be less than 23.0MPa.

**7.1.2** *1 000 hour pressure test at 20°C*

For type testing, fittings shall be tested as an assembly (see 4.2). When tested in accordance with Appendix A at a temperature of 20 (+2-1)°C, the fitting as an assembly shall withstand a pressure of 2.0 x the nominal pressure (PN) of the assembly for not less than 1 000 hours without leakage. Reinforcement of the mouth of the fitting is permitted.

Fittings normally provided as part of solvent jointed assemblies shall be tested as those assemblies. Such assemblies shall not be tested before 14 days after assembly.

Fittings incorporating elastomeric sealing components shall be tested as jointed assemblies with pipe. Such assemblies are not strong in tension and should be suitably restrained when submitted to pressure testing.

### 7.2 Assemblies

**7.2.1** *1 000 hour pressure test at 20°C*

When tested in accordance with Appendix A at a temperature of 20 (+2–1)°C, the assembly shall withstand a pressure of 2.0 x nominal pressure (PN) of that assembly for not less than 1 000 hours without leakage. Reinforcement of the mouth of the fitting is permitted.

Solvent jointed assemblies shall not be tested before 14 days after assembly.

Assemblies incorporating elastomeric sealing rings are not strong in tension and should be suitably restrained when submitted to pressure testing.

**7.2.2** *Negative pressure test requirements for elastomeric ring sealed assemblies*

When each joint of the assembly is individually tested by the method described in Appendix C of WIS No. 4-31-06, the joint, whilst deformed, shall withstand a pressure of 25 ±3kN/m$^2$ (0.25 ±0.3 bar) below atmospheric pressure for 1 hour without leakage.

### 7.3 Effect on water quality – Fittings and assemblies

**7.3.1**

When used under the conditions for which they are designated, non-metallic products in contact with or likely to come into contact with potable water shall comply with the requirements of BS 6920: Part 1: 1988.

**NOTE 1** Non-metallic products for installation and use in the United Kingdom which are verified and listed under the UK Water Fittings Byelaws Scheme are deemed to satisfy the requirements of this clause. Details of the Scheme are obtained from the Water Research Centre Byelaws Advisory Service, 660 Ajax Avenue, Slough SL1 4BG.

**7.3.2**

Non-metallic products approved by the Department of the Environment Committee on Chemicals and Materials of Construction for use in Public Water Supply and Swimming Pools are considered free from adverse health effects for the purposes of compliance with this clause.

**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, Water Division, Romney House, 43 Marsham Street, London SW1P 3PY.

## 8. QUALITY CONTROL REQUIREMENTS

### 8.1 Fittings

**8.1.1** ***1 hour pressure test at 20°C***

When tested in accordance with Appendix A at a temperature of 20 (+2–1)°C, fittings shall withstand a pressure of 4.2 x the nominal pressure (PN) of the fitting for not less than 1 hour without leakage.

**8.1.2** ***Flattening test***

Fittings shall be tested in accordance with and meet the requirements of ISO/DIS 9853.

**8.1.3** ***Oven test***

Fittings shall be tested in accordance with and meet the requirements of ISO 580.

In addition to the requirements of ISO 580, the fitting, on removal from the hot air oven, shall be cut using a razor sharp blade, from the mouth of the socket or spigot of the fitting over its full length and the exposed surfaces examined.

The number of cuts on each fitting tested shall be:

For fittings of nominal size up to and including 160 – not less than 4 cuts equally spaced around the periphery of the mouth of the socket or spigot of the fitting;

For fittings of nominal size greater than 160 – not less than 8 cuts equally spaced around the periphery of the mouth of the socket or spigot of the fitting;

For branch fittings such as tees, the cuts shall be made through the mouth of the socket or spigot of the branch of the fitting.

After testing, the test piece shall show no delaminations or cracks that penetrate to a depths greater than 20% of the wall thickness at that point.

### 8.2 Solvent cement assemblies

**8.2.1**

When tested in accordance with Appendix A, at a temperature of 20 (+2–1)°C, a solvent cement assembly shall withstand a pressure of 1.5 x the nominal pressure (PN) of the assembly for not less than 1 hour and shall not leak.

## 9. MARKING

All fittings and assemblies shall be clearly marked or labelled to show the following information:

(a) reference to this Water Industry Specification, i.e. WIS No. 4-31-07; (The use of this mark is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of this specification and the claim is his sole responsibility).
(b) manufacturer's name or trade mark;
(c) nominal size of the pipe to which the fitting corresponds;
(d) fitting material;
(e) nominal pressure;
(f) batch identification;
(g) a third party certification mark (if permissible).

## 10. REFERENCES

**International standards**

| | |
|---|---|
| ISO 264 | Unplasticised polyvinyl chloride (PVC) fittings with plain sockets for pipes under pressure – Laying lengths – Metric series. |
| ISO 580 | Moulded fittings in unplasticised polyvinyl chloride (PVC) for use under pressure – Oven test. |
| ISO 727 | Unplasticised polyvinyl chloride (PVC) fittings with plain sockets for pipes under pressure – Dimensions of sockets – Metric series. |
| ISO 1167 | Plastic pipes for the transport of fluids – Determination of the resistance to internal pressure. |
| ISO 2045 | Single sockets for unplasticised polyvinyl chloride (PVC) pressure pipes with elastic sealing rings type joints. Minimum depth of engagement. |
| ISO 2536 | Unplasticised polyvinyl chloride (PVC) pressure pipes and fit- |

| | |
|---|---|
| | tings, metric series. Dimensions of flanges. |
| ISO 3460 | Unplasticised polyvinyl chloride (PVC) pressure pipes – metric series – Dimensions of adapter for backing flange. |
| ISO/DIS 4422 | Pipes and fittings in unplasticised polyvinyl chloride (PVC-U) for water supply – Specification. |
| ISO 6455 | Unplasticised polyvinyl chloride (PVC) fittings with elastic sealing ring type joints for pipes under pressure – Dimensions of laying length – Metric series. |
| ISO/DIS 9853 | Unplasticised polyvinyl chloride (PVC) fittings. Flattening test. |

**British standards**

| | |
|---|---|
| BS 1610 | Materials testing machines and force verification equipment. Part 1: Specification for the grading of forces applied by materials testing machines. |
| BS 4346 | Joints and fittings for use with unplasticised PVC pressure pipes. Part 3: Solvent cements. |
| BS 4800 | Specification for paint colours for building purposes. |
| BS 4901 | Specification for plastic colours for building purposes. |
| BS 5750 | Quality systems Part 2 (EN 29002) Specification for production and installation. |
| BS 6920 | Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water. Part 1: Specification Part 2: Methods of test. |

**Water Industry Specification**

| | |
|---|---|
| No. 4-31-06 | Specification for blue unplasticised PVC pressure pipes and integral joints for cold potable water (underground use). |
| WAA/WRc | uPVC Manual: Pressure applications. |

**European Standard**

| | |
|---|---|
| EN 29002 | Quality Systems – Model for quality assurance in production and installation. |

## APPENDIX A

### Method for pressure testing fittings and assemblies

### A.1 TEST PIECES

#### A1.1 Fittings

The test pieces shall consist of complete fittings. The ends of the fitting shall be sealed using end load resistant caps or plugs. Typical equipment is illustrated in Figure 2 and Figure 3.

**Figure 2. Typical end caps for pressure testing fittings with spigot ends**

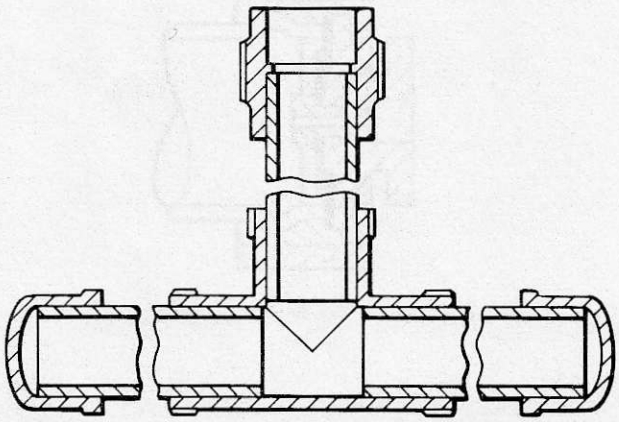

**Figure 2(a) End caps using solvent cement joints**

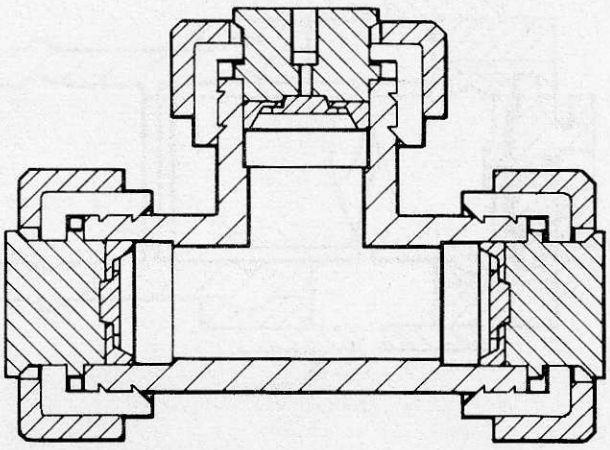

**Figure 2(b) Mechanical joints using compression by means of ribbed half segments**

When using the type of end cap illustrated in Figure 2(a), a period of at least 10 days shall be allowed to ensure satisfactory setting of the joint.

The end caps shall be equipped to enable the test piece to be connected to the pressure apparatus described in ISO 1167 as well as to enable the test piece to be vented.

### A1.2 Assemblies

The test piece shall consist of a complete assembly. The ends of the assembly shall be sealed using caps or plugs. Flanged ends shall be sealed using blank flanges. Spigot ends shall be sealed using end load resistant plugs or end caps (Figure 2(b) shows a typical arrangement) and integral joints incorporating elastomeric sealing rings may be sealed using the type of end cap illustrated in Figure 3.

**Figure 3(a)**

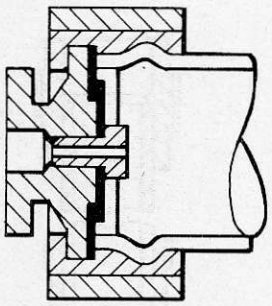

**Figure 3(b)**

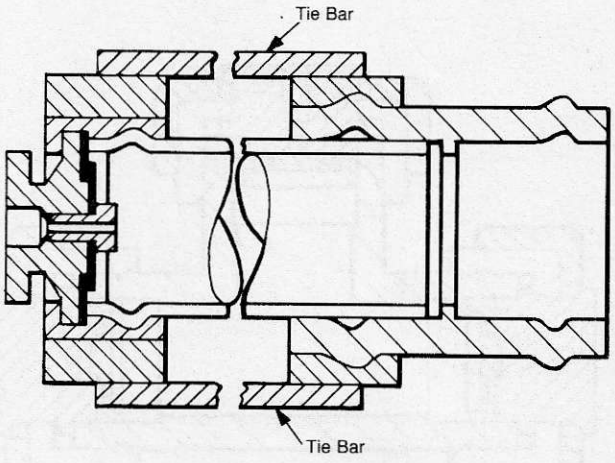


**Figure 3. Typical end cap for integral joint incorporating an elastomeric sealing ring**

The end caps or plugs shall be equipped to enable the test piece to be connected to the pressure apparatus described in ISO 1167 as well as to enable the test piece to be vented.

Assemblies incorporating elastomeric sealing rings are not strong in tension and should be suitably retrained when submitted to pressure testing.

Assemblies which have been made using solvent cement joints should not normally be tested for at least 10 days. However, when the test pressure is low (see 8.2.1) this period may be reduced and the advice of the solvent cement manufacturer should be sought.

### A.2 PROCEDURE

The test procedure shall be as specified in ISO 1167 at the specified temperature and pressure. The time to failure shall be recorded. If the test piece has not failed within the specified time, the test may be discontinued and the test recorded as a "Pass".

### A.3 REPORT

The report shall include the following:

(a) full identification of the test pieces
(b) the type of end fittings used
(c) if solvent cement used, the setting period
(d) the test temperature with degree of accuracy
(e) the test pressure with degree of accuracy
(f) the number of assemblies tested
(g) the time to failure (if failure occurs before the specified period time has elapsed) or the time after which the test has discontinued.