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EAST AFRICAN STANDARD

**Code of Practice for Plastics pipework (thermoplastics material) —
Part 2: Unplasticized PVC pipework for the conveyance of liquids
under pressure**

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

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Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

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Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

CP 312-2:1973, *Code of Practice for Plastics pipework (thermoplastics material) — Part 2: Unplasticized PVC pipework for the conveyance of liquids under pressure*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

Draft for comments only — Not to be cited as East African Standard

BRITISH STANDARD

**CP 312-2:
1973**

*Incorporating
Amendment No. 1*

Code of Practice for

**Plastics pipework
(thermoplastics
material) —**

**Part 2: Unplasticized PVC pipework for
the conveyance of liquids under
pressure**

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This part of the Code of Practice has been prepared by a Committee convened by the Codes of Practice Committee for Building. Having been endorsed by the Council for Codes of Practice, it was published under the authority of the Executive Board on 30 November, 1973

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^a Deceased February 1971.

Amendments issued since publication

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Contents

	Page
Code drafting committee	Inside front cover
Foreword	iii
<hr/>	
1 General	
1.1 Scope	1
2 Working pressure and effects of temperature	1
3 Limitations	2
4 Flow properties	2
5 Jointing procedures	2
5.1 General	2
5.2 Solvent cement joints	3
5.3 Pushfit (insertion) joints	4
5.4 Mechanical joints	4
5.5 Service connections	5
6 Bending	5
6.1 Cold bending	5
6.2 Hot bending	5
7 Storage, handling and transport	5
7.1 Storage	5
7.2 Handling	6
7.3 Transport	6
8 Inspection	6
9 Installation	6
9.1 General	6
9.2 Installation of buried pipes	6
9.3 Above ground installations	7
9.4 Support spacings	7
10 Test pressures and testing	8
10.1 Hydrostatic test pressures	8
10.2 Hydrostatic testing	8
11 Repairs	8
<hr/>	
Figure 1a — Typical section through pushfit insertion joint supplied on pipe (i.e. integral)	9
Figure 1b — Typical section through pushfit insertion joint provided in a loose coupling having spigot end stop (or central register)	9
Figure 2 — Part section and end view of a wedge ring joint	9
Figure 3 — Section through a screwed adaptor joint	10
Figure 4 — Section through a typical composite metal and PVC backed union with mechanical compression joint	10
Figure 5 — Typical section through a moulded stub flange solvent welded on to a PVC pipe end	10
Figure 6 — Typical section through a moulded "O"-ring stub flange solvent welded on to a PVC pipe end	11
Figure 7 — Typical section through a moulded full-faced flange solvent welded on to a PVC pipe end	11
Figure 8 — Support for PVC pipe	12
Figure 9 — Surge pressure envelope for Class B pipe	13
Figure 10 — Surge pressure envelope for Class C pipe	14
Figure 11 — Surge pressure envelope for Class D pipe	15

	Page
Figure 12 — Surge pressure envelope for Class E pipe	15
Table 1 — Recommended spacing of support centres for horizontal UPVC pipes	8
Publication referred to	16

Foreword

The preparation of this Code of Practice has been authorized in order to present the details of comparative physical, chemical, and mechanical properties of the various plastics pipes, to guide the selection for different applications, and to define sound practice in the installation of such pipes.

Part 1 deals with the selection of the most suitable pipework material. Part 2 provides recommended practice in the installation of unplasticized polyvinyl chloride (UPVC) pipework for the conveyance of liquids under pressure and Part 3 provides similar information for polyethylene pipework.

NOTE The name “polyethylene” is now preferred to “polythene” and is used in this Code of Practice except where the latter is included in the title of a published British Standard which has not yet been revised to take account of this preference.

It is proposed to issue further parts dealing with other materials and applications as follows:

- Part 4: *Unplasticized PVC soil pipes;*
- Part 5: *Plastics waste pipes;*
- Part 6: *Plastics drain pipes.*

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.

Summary of pages

This document Comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, 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 General

1.1 Scope

1.1.1 This part of the code gives guidance on the proper application and installation of UPVC (unplasticized polyvinyl chloride) pipe for the conveyance of liquids under pressure. The choice of materials for particular applications is covered in Part 1 of this code.

1.1.2 This code does not purport to cover reinforced pipe or UPVC used as a lining material bonded to polyester glass.

1.1.3 The use of plastics pipes in services supplied from the mains of water undertakings is governed by the byelaws of the undertakings and these shall be strictly observed. Requirements that pipes shall be located and protected so as to avoid damage by frost are satisfied if the recommendations of CP 99 are observed.

NOTE The titles of the British Standards referred to in this Code of Practice are listed on the inside back cover.

2 Working pressure and effects of temperature

2.1 The normal maximum working pressure for the various classes of UPVC pipe for carrying liquids are given in BS 3505 and BS 3506 and these pressures are applicable where the working temperature is at 20 °C or below. The normal maximum working pressures given in these standards have been calculated from known data on the basis of a life of at least 50 years of operation continuously with water at the given pressures. Where pipes are required to operate only for a limited duration of total life, it may be permissible to allow somewhat higher maximum working pressures to be used but the manufacturer's advice should be sought in such cases.

2.2 Where piping is required to convey liquids at a temperature above 20 °C but not greater than 60 °C, the allowable maximum working pressure has to be reduced, or alternatively a shorter life expectancy has to be allocated. In conditions where the ambient temperature does not exceed 20 °C, a reduction of 1.5 % in allowable working pressure per 1 °C rise in fluid temperature above 20 °C should be applied. Where the ambient temperature is between 20 °C and 60 °C a reduction of 2 % in allowable working pressure per 1 °C rise in ambient temperature is recommended.

2.3 Where a pipe may be subject to external influences such as mechanical abuse, it may be desirable to adopt a thicker wall of pipe than is required to meet the pressure requirement, that is to say to adopt a higher class of pipe. Similarly, higher classes of pipe may be used to advantage for carrying hazardous liquids or liquids with a limited degree of attack on UPVC (see Table 2a of CP 312-1:1973).

2.4 "Surge" is the term used to define the fluctuations in pressure of liquids in pipelines, caused by start up or close down of pumps, or by the rapid opening or closing of valves, i.e. by the sudden change in velocity of the pipe's contents. Such conditions normally manifest themselves in the phenomenon known as "water-hammer", and are influenced by the rate of change of velocity, the modulus and dimensions of the pipe, and the density of the liquid being conveyed. From the data obtained it is evident that any changes in surge pressure should be restricted in amplitude if a brittle failure mechanism is to be avoided, or alternatively, the maximum permissible stress of the pipe should be reduced by half.

The nomograms given in Figure 9 to Figure 12 inclusive apply the recommended restriction in amplitude. On the left hand side of the nomograms the scale indicates the range from zero to the "maximum sustained working pressure" (M.S.W.P.) for each class of pipe specified in BS 3505/6, whilst to the right centre, values representing half the M.S.W.P. to zero are marked. A maximum/minimum surge pressure envelope is then constructed, from which the limits of surge variation may be selected. Examples of the use of nomograms for selecting limits for surge pressure are given in Figure 9 and Figure 10.

This recommendation, therefore, limits total surge pressure variation from the minimum to the maximum, to 50 % of the maximum sustained working pressure of the pipe class. This variation can range, in the case of a Class B (6 bar) pipe, from, for example, 0 to 3 bar to 3 bar to 6 bar, as shown in Figure 9.

In addition, there is evidence that Class B pipe is unsuitable for use if the surge pressure variation includes negative pressures. Therefore, unless design calculations give an assurance that negative pressures cannot occur, Class C (9 bar) pipe should be regarded as the minimum acceptable.

Such surges should not decrease the expected life of the pipe provided that the surge pressure regime does not exceed 1 per 10 minutes. A surge pressure regime is defined as the series of pressure pulsations created by, for example, each valve shut off.

For static state conditions, where no surge is generated, it is permissible to use the pipe up to the maximum sustained working pressure, no derating being necessary. Such static state conditions would include pump “flutter”, and normal diurnal pressure changes.

NOTE To avoid confusion between this Code of Practice and CP 2010, in which surge pressures are dealt with for other pipeline materials, using different design approaches, the following equivalent pressure terminology should be noted. The “maximum sustained working pressure” (M.S.W.P.) in this document is equivalent to the terms “maximum allowable sustained pressure”, “internal design pressure” or “pipeline internal design pressure” used in different parts of CP 2010. It is equal to the sum of the operating pressure (referred to in different parts of CP 2010 as the “maximum operating pressure”, the maximum sustained operating pressure’ or the “maximum static pressure”) and the maximum positive surge pressure.’

3 Limitations

3.1 UPVC pipe should not be used under pressure at temperatures exceeding 60 °C. Reductions in pressure ratings at all temperatures above 20 °C (see Section 2) should be applied.

3.2 UPVC is a poor conductor of heat; a naked flame should not be used for thawing the contents of UPVC pipework. The pipe should be protected against radiant heat that could raise its surface temperature above 60 °C.

3.3 UPVC has good all round chemical resistance but reference should be made to the chemical resistance Table in Part 1 of this code before deciding on its use for any particular purpose.

3.4 UPVC is a poor conductor of electricity and no attempt should, therefore, be made to use pipework constructed therefrom as a means of earthing electrical equipment; similarly the contents of such pipes cannot be thawed by electrical techniques using the pipe as the conductor.

3.5 Because of the high electrical resistivity of UPVC pipes, caution is required in the use of the pipes where static electricity may be an important consideration.

3.6 The on-site fabrication of fittings and bends is not recommended.

3.7 UPVC is a material which is “notch sensitive”, i.e. the cutting of screw threads produces a condition in which the impact strength of the pipe at the joint is considerably reduced, and therefore such cutting should only be used under special conditions. Attention is drawn to **5.4.2**

4 Flow properties

4.1 UPVC has a smooth, glossy surface which discourages the formation of scale; the bore will therefore be maintained almost indefinitely.

4.2 For the purposes of calculation of flow rates through UPVC pipes, the Colebrooke-White equation may be used, in which the value of the hydraulic roughness factor K is 0.003 mm.

When using the Hazen-Williams equation a coefficient, C , of 150 is indicated as an upper limit. Due regard should however be given to the effect of pipe diameter and water velocity and to the friction losses caused by fittings. The character of the water (or liquid) to be conveyed should also be taken into account.

Particular waters may, at certain times, give rise to slime and silt deposits which, whilst not necessarily damaging to the smooth surface of the pipe material, may in themselves increase the friction losses in pipelines.

4.3 Detailed frictional loss data and flow charts are available from plastics pipe manufacturers, and reference may also be made to Hydraulic Research Paper No. 2, Charts for the hydraulic design of channels and pipes, 2nd edition, 1963, HMSO.

4.4 Because the outside diameter of UPVC pipe of a nominal size is specified, the bore of the pipe will vary according to its pressure class (see BS 3505 and BS 3506) and therefore this should be taken into account when calculating flow characteristics.

5 Jointing procedures

5.1 General

5.1.1 UPVC pipe to comply with BS 3505 and BS 3506 is made by continuous extrusion but is normally supplied in standard lengths. Some pipes are supplied plain ended for jointing with separate couplings, whilst others are supplied with integral sockets already formed on one end of each pipe.

5.1.2 Joints and fittings for use with UPVC pipe are specified in BS 4346. Such joints are designed to be at least equal in service performance to the pipes themselves; they are accordingly capable of withstanding the prescribed test pressure applicable to the class of pipe concerned.

5.1.3 Separate couplings and fittings complying with BS 4346 conform also to the normal toxicity requirements of BS 3505 and are, accordingly, suitable for use with potable water.

5.1.4 Joints may be divided into three categories as follows.

- 1) Solvent cement joints, in which a solvent cement is applied to both the pipe end (spigot) and to the socket.
- 2) “Pushfit” insertion joints, in which an elastomeric sealing component is automatically compressed to form an effective seal when the spigot end is inserted into the socket.

3) Mechanical joints in which the compression of a sealing ring is completed by some external tightening device.

5.1.5 All three categories of joint may be incorporated in sockets provided on the pipe itself, in which case they may be referred to as integral joints. Alternatively two joints may be incorporated in a double socket for jointing plain ended pipes; in this case they are usually referred to as couplings or couplers.

5.1.6 It will be seen that pipe joints in categories 2) and 3), which depend upon the compression of an elastomeric sealing component to effect a water tight pressure seal, offer little resistance to end thrust forces such as may be set up at bends, junctions, valves, etc., and therefore the pipeline has to be suitably anchored when these joints are used. However, proper consideration should be given to the anchorage of all pipelines.

5.1.7 Where there is a need to dismantle pipelines from time to time, joints in category 3) are to be preferred.

5.1.8 Sliding couplers having no central stop or register, are made expressly for repair work so that they may be slipped back over spigot ends and then returned to the required jointing position.

These repair couplers may also be used to provide "door" pipes which can be removed and replaced at will where, for example, it is desired to provide for the inspection of the internal condition of the pipeline.

5.1.9 Whilst UPVC fittings and couplings complying with BS 4346 have similar corrosion resistance properties to those of the pipes themselves, it may be necessary in certain industrial applications to be satisfied that any special corrosion resistance requirements will also be met by the elastomeric sealing rings and components other than UPVC. In such cases the advice of the manufacturers should be sought, as special sealing rings suitable for the application concerned may be available.

5.1.10 The requirements of byelaws and statutory regulations should always be ascertained before a final decision is made as to the class of pipe and type of joint to be used.

5.2 Solvent cement joints

5.2.1 For successful solvent cement joints, the dimensions of sockets and spigots must comply, respectively, with BS 4346-1 and with BS 3505 or BS 3506.

5.2.2 Solvent cements are the subject of BS 4346-3¹⁾

5.2.3 *Means of jointing.* Joints should be made up in accordance with the instructions of the manufacturer of the pipe and/or cement. Where these are not stated, the procedure detailed below should be followed.

1) The cement should be thoroughly stirred before use.

2) The pipe should be cut clean and at right angles to the axis.

3) Swarf and other materials should be cleaned from the pipe end.

4) A small chamfer at an angle of 15° to 20° to the horizontal with a length of 0.75 mm should be made round the outside of the pipe.

5) The pipe for a length at least equal to the socket depth, and the socket, should both be wiped clean of grease and dirt.

6) The pipe end and the socket should be abraded with clean medium grade glass paper so that the mating surfaces are uniformly roughened.

7) The pipe end and the socket should then be cleaned with tetrahydrofuran applied with a clean rag or absorbent paper soaked in the solvent.

8) The cement should be applied evenly in one coat to the mating surfaces, stroking the cement along and not round the surfaces²⁾ Care should be taken to avoid the application of an excessive amount of cement, which could lead to a weakening of the pipe wall by solvent action.

9) The joint should be immediately pushed together without twisting until the full depth of the socket is achieved and held for 20 to 30 seconds. The surplus cement should be removed from the mouth of the socket.

5.2.4 After completing the solvent cementing operation, it is necessary to hold the two lengths of pipe (or pipe and fitting) on either side of the joint undisturbed for a sufficient length of time to allow initial bonding to take place. The surplus cement should then be removed. A further period of time is necessary for sufficient mechanical strength to be developed before any movement or handling of the pipeline is attempted.

¹⁾ In course of preparation.

²⁾ For sizes up to nominal size 3 the joint may be made by one operative. Larger sizes should be made by two operatives applying cement simultaneously to spigot and socket.

5.2.5 Before the pipeline is filled or any pressure applied, a period of 8 hours should be allowed to elapse to achieve the required degree of mechanical strength. Working pressure may then be applied, but a further period of 16 hours should elapse before a test pressure of 1½ times working pressure is applied. It may be noted that the joint will still be gaining in strength for a period of several weeks after completion.

5.2.6 Special cementing and test techniques are required for nominal size 8 and above, and in such cases the pipe manufacturer's advice should be obtained.

5.3 Pushfit (insertion) joints

5.3.1 The pushfit type of insertion joint, in which the elastomeric sealing component is automatically compressed to form a seal when the spigot is inserted into the socket, provides a rapid method of jointing pipes. The elastomeric sealing ring is housed in the socket; the cross section both of the sealing component and of the socket varies according to the manufacturer. The sealing rings used should be those supplied by the specific manufacturer for the particular joint. Where the elastomeric sealing component is not supplied locked in position, the ring housing should be cleaned, any grit removed, and the ring inserted correctly in the housing before assembly.

5.3.2 Manufacturers normally offer sealing rings made of natural rubber or of a mixture of natural and synthetic rubber complying with the requirements of BS 2494-1. Where a pipeline is to be used for drainage or sewerage purposes, the sealing rings may be made in compliance with BS 2494-2, which provides for alternative synthetic rubber sealing rings. Where chemical or corrosive liquids are to be carried, it may be necessary to specify rings in one of these synthetic materials, and accordingly, pipe makers should be consulted as to the best material for any particular application.

5.3.3 The pushfit insertion joint is not designed to resist end thrust. Where these joints are used in above ground installations, particular care should be taken to ensure that the pipeline is properly anchored.

Where pipelines are installed below ground, the end thrust forces should be taken care of by the provision of anchor blocks in accordance with normal practice for pressure pipelines. It is desirable to insulate the UPVC pipe from direct contact with the anchor block by means of a suitable flexible membrane. Typical arrangements are shown in Figure 1.

5.3.4 Jointing. The satisfactory completion of a pushfit insertion joint depends upon provision of a chamfer on the pipe end and the proper lubrication of the spigot end before insertion into the socket. Where the lubricant is not supplied by the pipe manufacturer, it should be one that has no deleterious effect upon the elastomeric sealing ring and, where the pipeline is required to carry potable water, it should also be non-toxic and not impart any taste to water.

As soon as the pipe end has been lubricated it should be inserted, after proper alignment, into the adjoining socket so as to avoid any opportunity to pick up dirt or deleterious material.

The spigot end should be inserted fully into the socket or as far as the locating mark put on the spigot by the manufacturer. The entry of the pipe through the socket sealing component will then ensure a pressure tight seal.

5.4 Mechanical joints

5.4.1 Compression joints (see Figure 2). These joints are similar to insertion joints except that the compression of the elastomeric sealing is completed by means of some type of external tightening device. An example of this type of joint is shown in Figure 2 and in this case the joint is bolted or screwed on to the body of the socket. Mechanical compression joints may be conveniently used for jointing to pipes of other materials, such as asbestos cement and cast iron, using where necessary appropriate adaptor couplers. To use the bolted or screwed gland types of joints made for these types of pipe, it may be necessary to purchase purpose-made sleeves or adaptors.

Care should be taken to avoid overtightening the elastomeric sealing component which is in contact with the UPVC pipe, otherwise it may deform under the forces exerted by the sealing component and the efficiency of the joint may be impaired. Because of the smooth surface of UPVC pipe, a lower degree of compression makes a seal on to it compared with that required to make a seal on, for example, cast iron.

5.4.2 Screwed joints (see Figure 3). UPVC pipe is generally unsuitable for screw threading. This is because the material is notch sensitive and the cutting of screw threads causes a degree of weakness to be imparted to the pipe wall. Provision is made in BS 3506 for certain thick walled pipe Class 7 which may be used for screw threading, but only up to nominal size 2.

A range of fittings with moulded threads is available.

Where threading is carried out on thick walled pipes, the thread should be cut with taper pipe threads conforming to the requirements of BS 21. The dies should be clean, and sharp and the thread should be cut in one pass. When pipe is threaded in this manner, it is suitable for working pressures not exceeding 9 bar³⁾.

PTFE (polytetrafluoroethylene) tape may be used as a sealant for assembly. Jointing with hemp and paste should not be used. The joint should be made to not more than one turn beyond hand tightness using only strap wrenches. It should be noted that there is not a well defined increase in tightness during assembly as there is with metal to metal fittings and these joints can be easily over-strained.

UPVC to metal connections with threaded joints may be made with the UPVC as the male component of the joint. Alternatively composite UPVC/metal fittings are available, and are to be preferred (see Figure 4).

5.4.3 Flanged joints. Flanges may be used for jointing UPVC pipes and for connecting pipes to valves and fittings provided with flanges. Joints are made by the compression of a gasket or a ring seal set in the face of the flange. Flanges may be fitted to pipe as follows.

- 1) By solvent cementing a moulded UPVC stub flange onto a pipe end with the use of a backing ring (see Figure 5 and Figure 6).
- 2) By solvent cementing a moulded UPVC full faced flange. The use of a backing ring or wide washers is necessary to distribute the bolt loads and prevent distortion of the UPVC flange (see Figure 7).
- 3) By flange adaptors.

5.5 Service connections

Both metal and plastics saddles are available for the off take of service connections from larger bore pipes (nominal size 2 and larger). One type of saddle consists of a half round moulded unplasticized PVC section which is solvent cemented to the pipe surface. The outside of the PVC section has a boss on to which the service connection may be screwed or cemented. Another type consists of two half round sections of metal or PVC which are held round the pipe by wedge grips. A seal is formed between the saddle and the pipe by a rubber "O"-ring compressed between the pipe and the under surface of the upper section. The service connection is taken from a boss on the upper section.

Conventional equipment for tapping under pressure may be employed with these service connections using a special trepanning cutter to pierce the pipe wall. Some ferrules have self-contained cutters for this purpose.

Ferrules should not be screwed directly into unreinforced PVC pipes without the introduction of a reinforcing saddle piece.

Some flexibility should be introduced into the connection to prevent breakage due to differential movement between the service and the main.

6 Bending

6.1 Cold bending

Although UPVC pipes have some degree of flexibility and may be cold bent to accommodate ground contours and road curvatures in sizes up to and including nominal size 6, this bending should not be less than a radius (in metres) equal to 5 times nominal size; i.e. a nominal size 6 pipe should not be bent to a radius less than 30 m. Pipes larger than nominal size 6 should generally be regarded as rigid and any changes in direction should be accommodated by the use of special bends or flexible couplings.

6.2 Hot bending

By using the thermoplastic nature of the material, bends of any radii can be produced. This is however a skilled operation and is not recommended for use on site. The limiting radius of the bend will vary between 3 and 5 times the diameter of the pipe, depending on its nominal size.

7 Storage, handling and transport

7.1 Storage

7.1.1 Pipes made from UPVC are strong though lightweight, being about one fifth the weight of equivalent steel or cast iron pipes. As a result pipes made of this material are very easily handled and there is a tendency for them to be thrown about much more than their metal counterparts. This should be discouraged and reasonable care should be taken in handling and storage to prevent damage to the pipes.

7.1.2 UPVC pipes should be stacked on a reasonably flat surface free from sharp projections, stones, or other protruberances likely to deform them.

7.1.3 Side supports should be provided at intervals of not less than 1.5 m and these supports should preferably consist of batons not less than 75 mm wide.

³⁾ 1 bar = 100kPa.

7.1.4 Pipes should be uniformly supported throughout the length. If this is not possible, then timber supports of at least 75 mm bearing width, at spacings not greater than 1 m centres, should be placed beneath the pipes. Pipes of different size and wall thickness should be stacked separately, or where this is not possible those with larger diameters and thicker walls should be at the bottom.

7.1.5 When socket and spigot pipes are stacked, the sockets should be placed at alternate ends of the stack with the sockets protruding so that the pipes are evenly supported along their entire length.

7.1.6 Pipe stacks should not exceed 7 layers in height, with a maximum height of 2 m.

7.1.7 Storage of pipes in heated areas exceeding 23 °C should be avoided.

7.1.8 The above requirements apply to the United Kingdom climatic conditions. In tropical climates stack heights should be reduced, and pipes stored under cover.

7.2 Handling

7.2.1 Care should be exercised in handling pipe to avoid damage to the wall surfaces. This is important when the ends of the pipe have been prepared, e.g. for socket and spigot jointing, or chamfered.

7.2.2 Pipes should not be dragged along rough ground.

7.2.3 The loading and unloading of pipes should be carried out by hand, and the use of skids avoided. Where mechanical handling is employed, the techniques used should ensure that no damage to the pipes can occur. Metal slings, hooks, and chains should not come into direct contact with the pipe.

7.2.4 Pipes should not be dropped on a hard surface.

7.2.5 When pipes have been transported one inside the other, the inner pipes should always be removed first, and stored separately.

7.2.6 The impact strength of UPVC is reduced somewhat in cold weather, therefore more care in handling should be exercised in wintry conditions. At -10 °C the reduction in impact strength becomes marked and UPVC pipes should not be laid in such conditions.

7.3 Transport

7.3.1 Vehicles with a flat bed should be used for the transport of pipe. The bed should be free from nails or other projections. The pipe should be supported uniformly along its length.

7.3.2 The vehicles should have adequate side supports at approximately 2 m spacing and the pipe should be effectively secured during transit. All uprights should be flat and free from sharp edges.

7.3.3 When loading socket and spigot pipes, these should be stacked in alternate layers so that the sockets do not carry any load.

7.3.4 Pipes should be loaded on a vehicle in such a way that the overhang is no more than 1 m.

7.3.5 Thick walled pipes should always be loaded before thin walled pipes.

8 Inspection

8.1 The pipes should be inspected by the purchaser or his representative on delivery.

8.2 The pipe markings should be checked to ensure that they comply with the requirements of the specification against which the pipe was ordered.

8.3 Damaged and/or missing items should be noted and checked against the delivery note.

9 Installation

9.1 General

9.1.1 Reasonable care should be taken in the handling and laying of UPVC pipe. Whilst in general its strength is more than sufficient to withstand treatment likely to be encountered in normal installations, it should be recognised that the material becomes less robust at the lower temperatures encountered during winter conditions.

9.1.2 Attention is drawn to the following Codes of Practice:

CP 99, *Frost precautions for water services.*

CP 310, *Water supply.*

CP 2005, *Sewerage.*

CP 2010, *Pipelines.*

CP 2010-1, *Installation of pipelines in land.*

9.2 Installation of buried pipes

9.2.1 Pipes made from UPVC are strong though lightweight, being about one fifth the weight of equivalent steel or cast iron pipes. As a result pipes of this material are very easily handled and there is a tendency for them to be thrown about much more than their metal counterparts. This should be discouraged and reasonable care should be taken in handling and storage to prevent damage to the pipes.

The importance of employing suitably selected soil material around the pipe, to provide a proper bed and adequate lateral support for the pipe at the sides, increases with diminishing pipe wall thickness and increasing external loadings.

As a general guide, however, it can be said that Class B (see BS 3867) pipe properly installed as recommended in this code should be adequate for use at depths not less than 1 m under roads carrying the maximum Department of the Environment loadings.

9.2.2 When laying solvent welded pipes in hot weather, it is recommended that the temperature of the pipe be reduced by partial backfilling before making the final connections and locating anchor blocks.

9.2.3 The pipe should be suitably anchored at all changes of direction and at fixed points. The anchors should be designed to withstand the maximum thrust developed during hydrostatic testing. Because of the flexible nature of the material the design of such anchors may need special consideration and the advice of the manufacturer should be sought.

9.2.4 Full details of trench preparation, bedding and sidefill, backfilling, and pipe laying without trenches are given in Section 15 in CP 312-1:1973.

9.3 Above ground installations

9.3.1 It is essential to note that UPVC pipes cannot withstand the expansion of freezing contents and provision should therefore be made for emptying and/or insulating sections likely to be exposed to frosty conditions.

The use of plastics pipes in services connected to the mains of water undertakings is governed by the byelaws of the undertakings and these must be strictly observed. They include requirements that pipes shall be located and protected so as to avoid damage by frost, and these are deemed to be satisfied if the recommendations of CP 99 are observed.

9.3.2 The linear thermal expansion of UPVC (1 mm per 20 m per 10 °C) is about six to seven times that of steel, so precautions have to be taken to compensate for it. The best way of doing this is to arrange piping in such a way that bends occur between anchoring points.

9.3.3 There are available telescopic expansion units for use where expansion loops cannot be employed. It is recommended that the advice of the pipe manufacturers should be sought in each specific case.

9.3.4 The pipeline should be installed in such a way as to minimize stresses.

9.3.5 Free-standing or continuous supports are required. Free-standing supports can be made of concrete, steel or wood, and no special construction is required, provided they are sufficiently robust and have a saddle or V-shaped top which holds the pipe. A continuous support is shown in Figure 8. The pipe is strapped to the support. The straps should not clamp the pipe tightly, but should allow free movement. The supports should have smooth surfaces to avoid wear of the pipe, and not be installed too near a bend.

9.3.6 Along walls and in pipe-racks, hanger supports, clamps, straps, U-bolts and spring hangers may be used.

9.3.7 UPVC pipelines should be located far enough from hot objects or pipes to prevent radiation of heat affecting the material.

9.3.8 All types of manual control (such as valves) should be provided with adequate support, to avoid stress on the pipeline. Pipelines should be provided with drains for emptying during freezing weather.

9.4 Support spacings

9.4.1 Recommended horizontal support spacings are given in Table 1; these are based on conveyance of cold water and closer spacing will be necessary when liquids at a higher temperature or of higher relative density or of greater hazard are to be conveyed.

9.4.2 Table 1 lists recommended horizontal spacings for use up to 40 °C but for temperatures above 40 °C closer supports are required (e.g. at 50 °C the distances should be halved). At 60 °C continuous support is necessary. Depending on the size and complexity of the installation, it is possible to increase the *vertical* support spacings up to double those given in Table 1.

Table 1 — Recommended spacing of support centres for horizontal UPVC pipes

Nominal size	Classes O, B and C	Classes D, E, 6 and 7
	m	m
$\frac{3}{8}$	—	0.6
$\frac{1}{2}$	—	0.8
$\frac{3}{4}$	—	0.8
1	—	0.9
1 $\frac{1}{4}$	—	1.0
1 $\frac{1}{2}$	—	1.1
2	1.1	1.2
2 $\frac{1}{2}$	1.2	1.4
3	1.4	1.5
4	1.5	1.7
5	1.7	1.9
6	1.8	2.1
7	2.0	2.3
8	2.1	2.5
9	2.3	2.7
10	2.4	2.9
12	2.6	3.1
14	2.9	3.4
16	3.1	3.7
18	3.4	3.7

Pipes above nominal size 18 to be supported at 3.7 m centres.

10 Test pressures and testing

10.1 Hydrostatic test pressures

10.1.1 Hydrostatic proof testing of an installation should be carried out at ambient temperature.

10.1.2 The test pressure should not exceed 1.5 times the maximum rated working pressure of the lowest rated component.

10.1.3 The test pressure should be applied for at least 1 hour but in any case it must not be applied for more than 24 hours.

10.2 Hydrostatic testing

10.2.1 After the completion of an installation, all pipework and fittings should be inspected and tested to ensure the safety and efficiency of the system. If the pipe system is a large one, it should be tested in sections.

10.2.2 Systems with solvent cement joints should not be pressure tested until a period of at least 24 hours has elapsed from the time of making the last joint.

10.2.3 Before testing, anchors should be allowed sufficient time to develop their strength e.g. concrete to set properly.

⁴⁾ 1 bar = 100 kPa.

10.2.4 Partial backfilling, leaving the joints exposed for inspection, is normally sufficient to restrain the pipeline. Temporary end caps require strutting.

10.2.5 Above ground pipelines should be correctly supported and anchored where necessary, dependent upon working conditions and environment.

10.2.6 All intermediate control valves should be positioned "OPEN" for the duration of the test. Where a system is being tested in sections, the ends should be temporarily closed using suitable fittings.

10.2.7 Pressure gauges should be read with reference to the levels at which they are positioned. Any air vents at high points should be open during the filling of the system.

10.2.8 The installation should be slowly filled with water from the lowest point, avoiding surge pressures and displacing all free air from the line.

10.2.9 The installation when fully charged with water should be allowed to stand for 24 hours. The air vents should be closed, and an initial inspection made to ensure all joints are tight.

10.2.10 Pressure should be applied slowly, preferably by a manually operated pump, until the required test level is obtained.

10.2.11 With the system isolated from the test pump for a period of one hour, the test should be deemed satisfactory if the quantity of water required to restore the required test pressure does not exceed the amount calculated by the formula:

3 litres per kilometre of pipe, per 25 mm of nominal bore, per 3 bar⁴⁾ of test pressure, per 24 hours.

10.2.12 A further inspection should be made of the entire system at normal working pressure, when valves may be checked for ease of operation and correct functioning.

10.2.13 Any defects revealed by proof testing should be rectified and further testing carried out until a satisfactory result is obtained.

11 Repairs

Various methods of effecting repairs are available from the manufacturers, whose instructions should be closely followed.

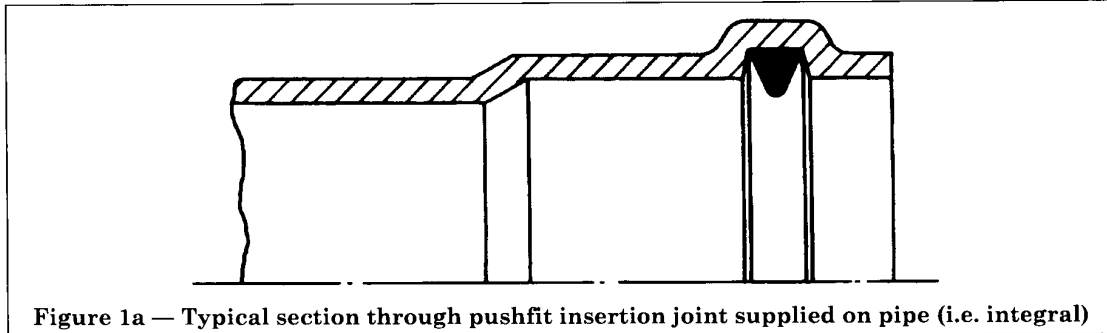


Figure 1a — Typical section through pushfit insertion joint supplied on pipe (i.e. integral)

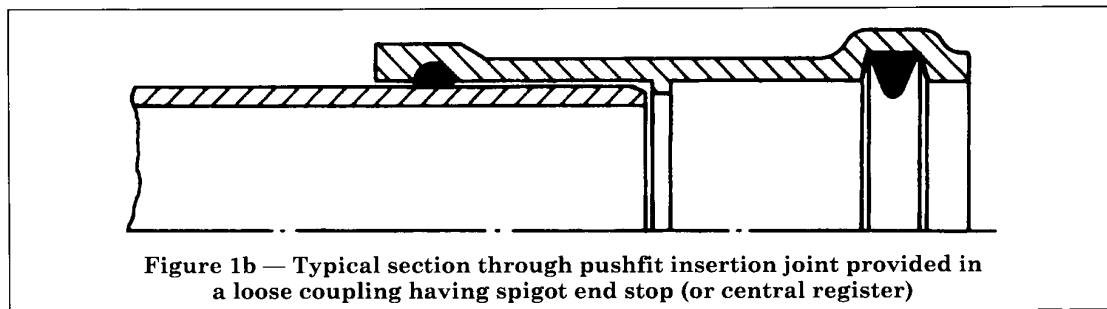
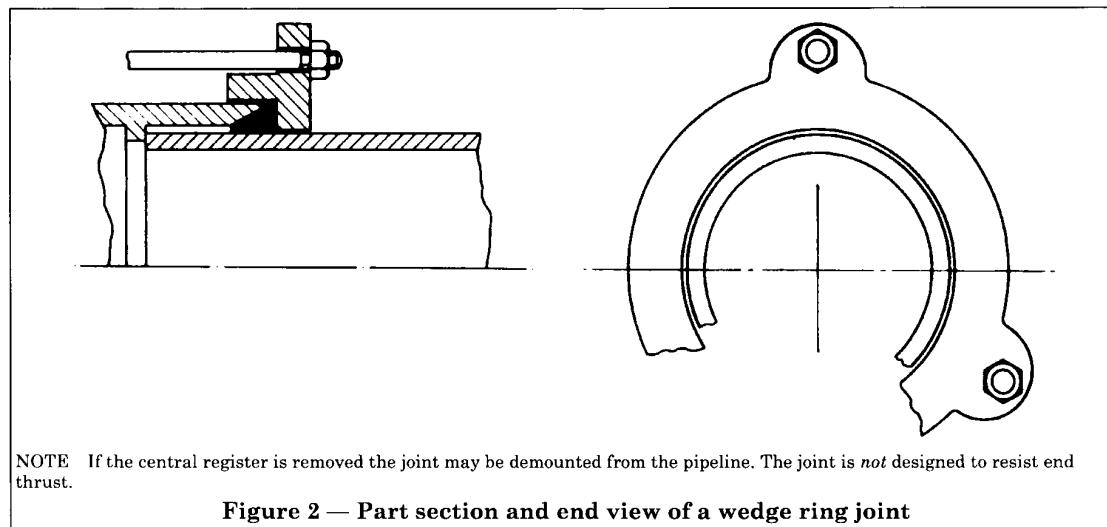
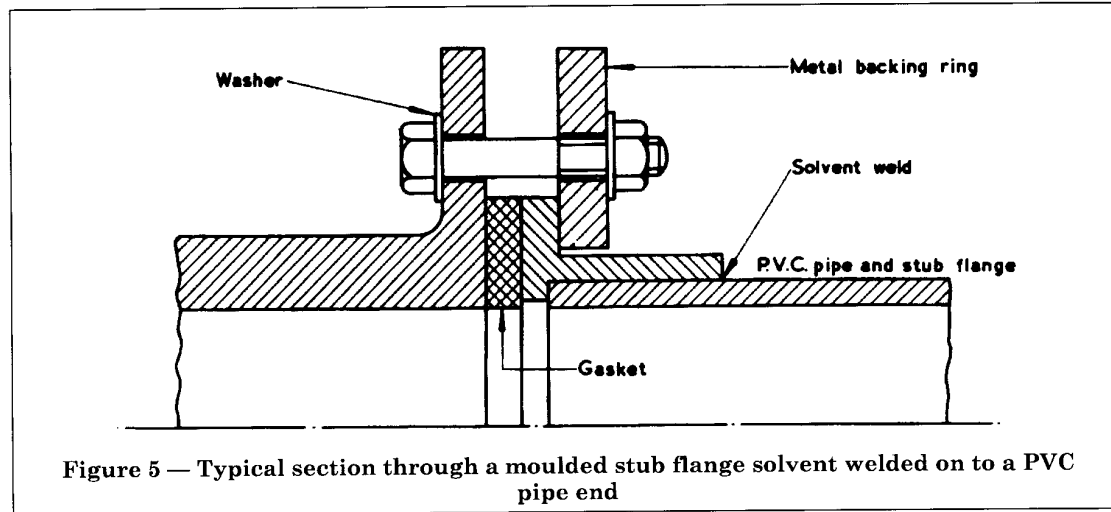
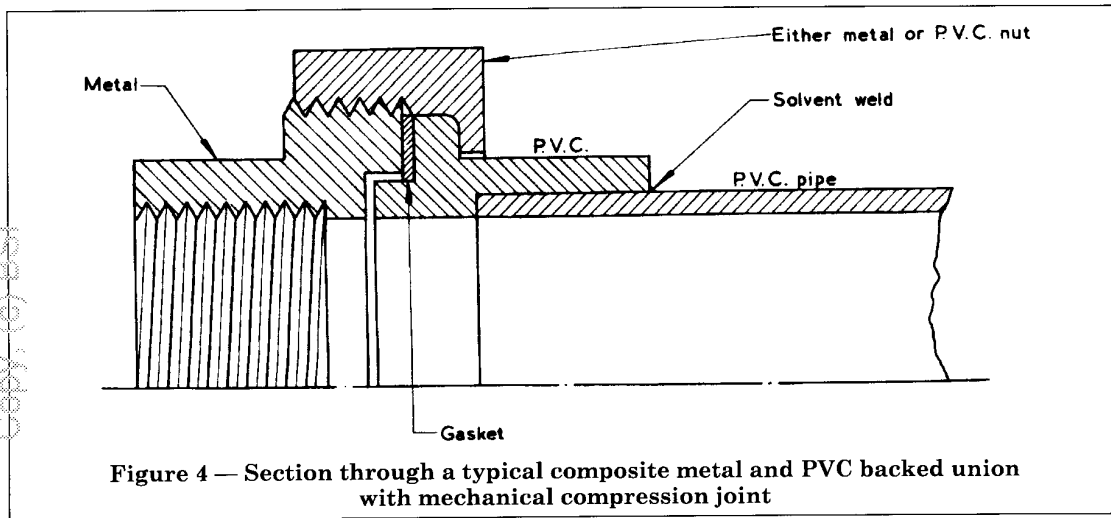
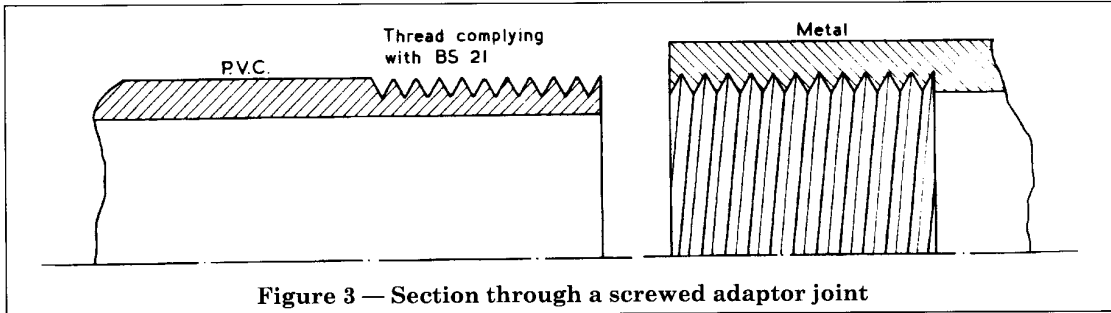


Figure 1b — Typical section through pushfit insertion joint provided in a loose coupling having spigot end stop (or central register)

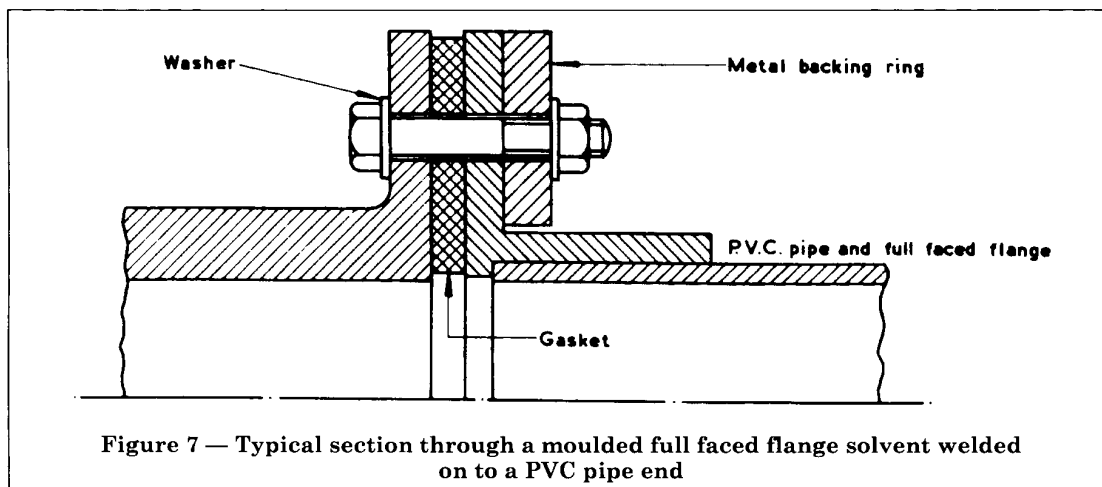
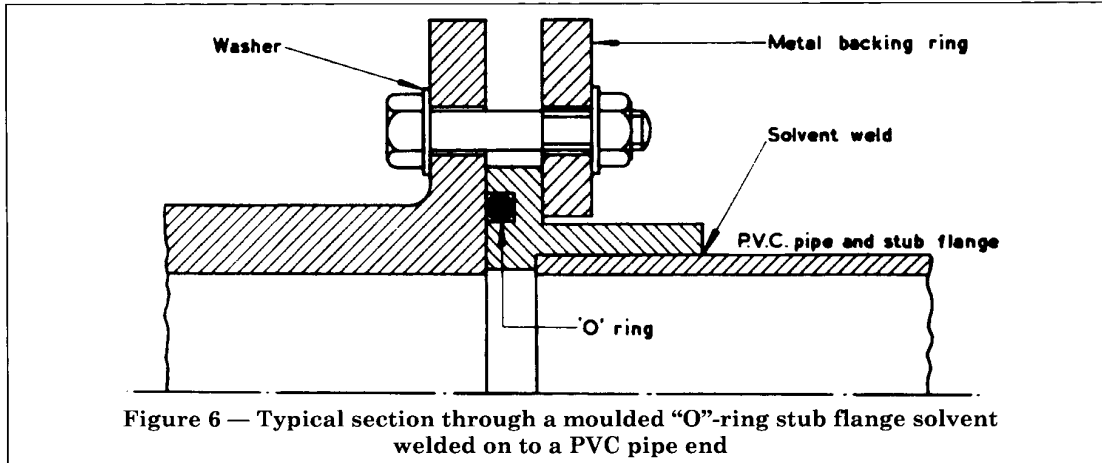


NOTE If the central register is removed the joint may be demounted from the pipeline. The joint is *not* designed to resist end thrust.

Figure 2 — Part section and end view of a wedge ring joint



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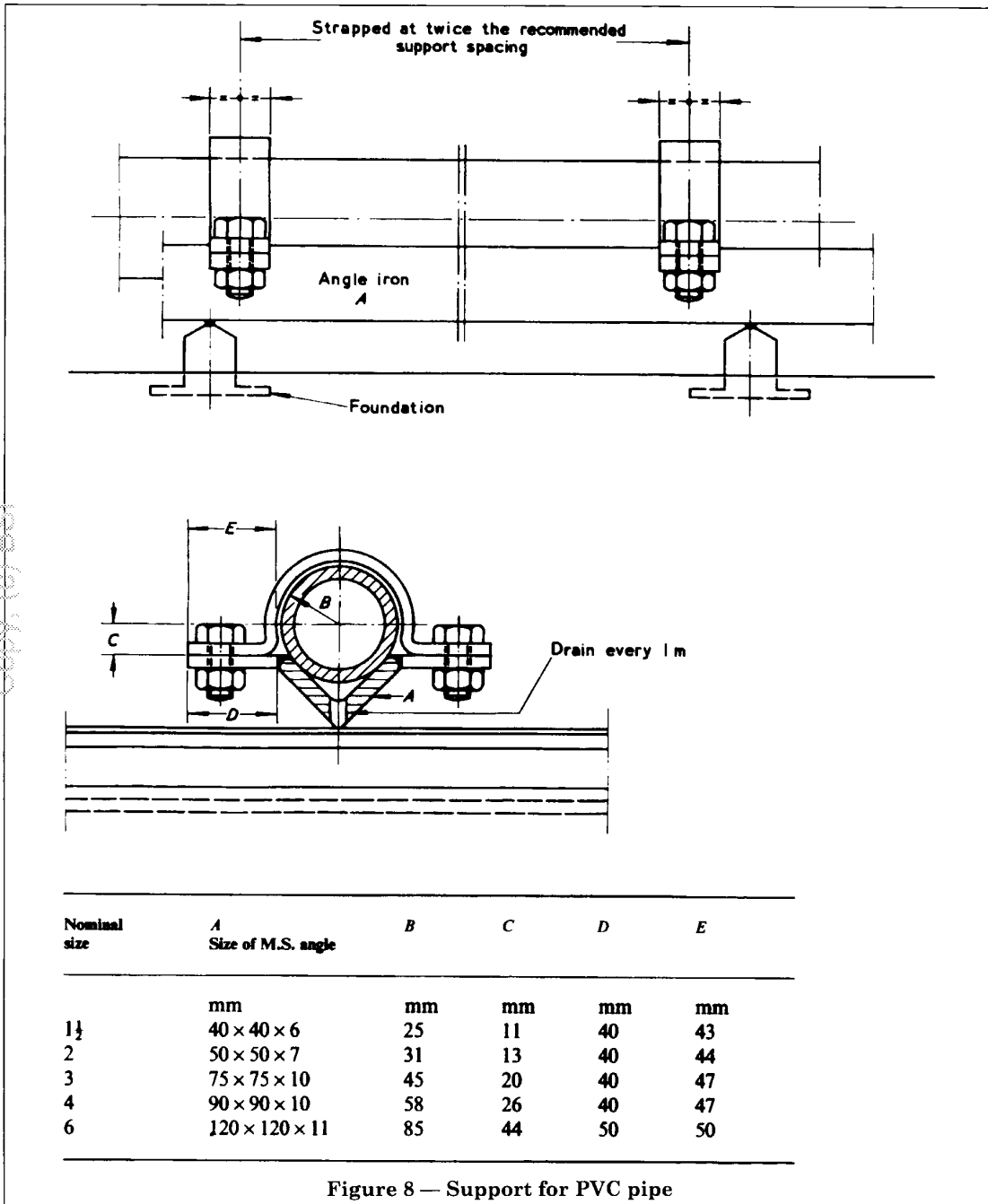
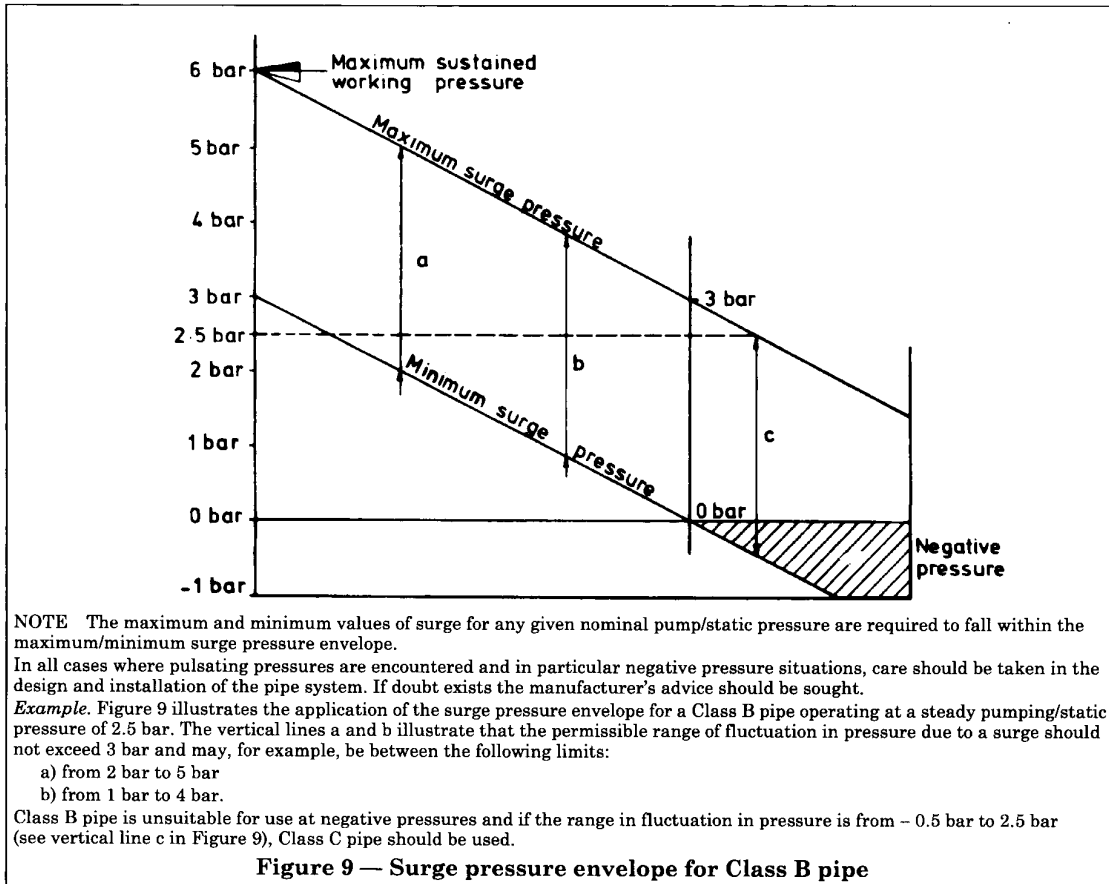
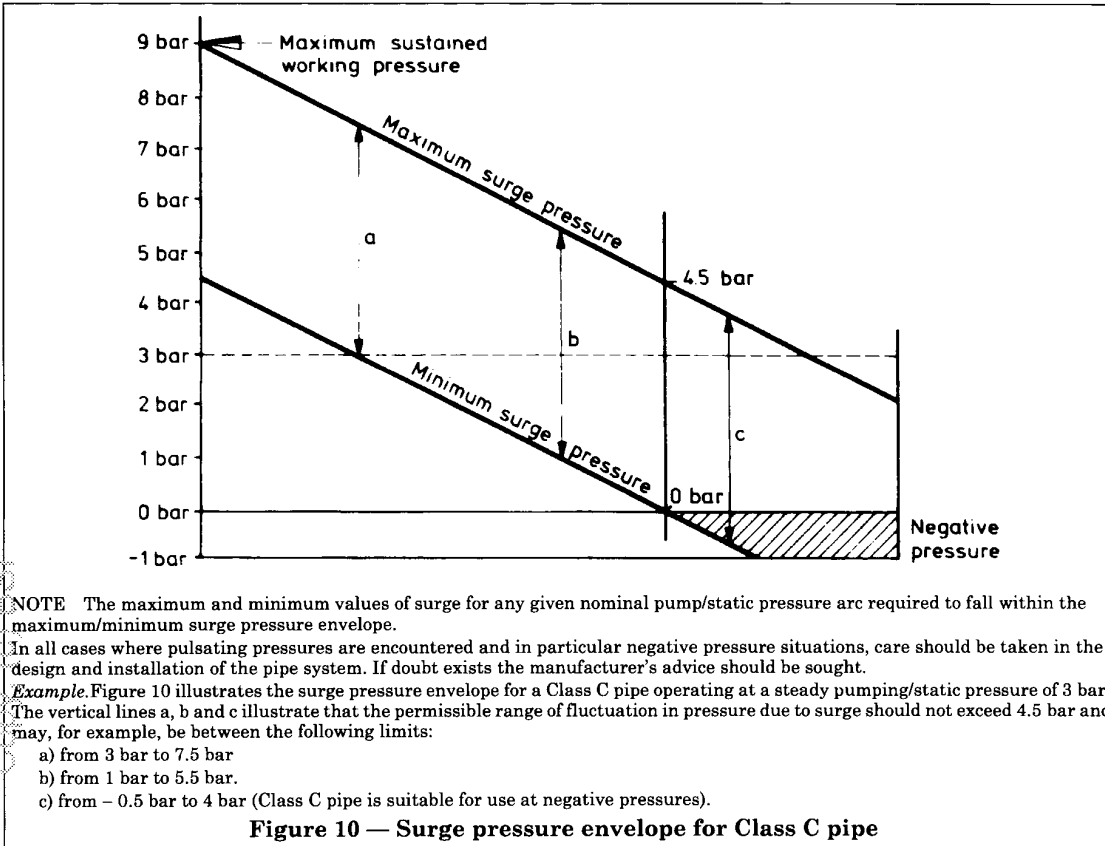
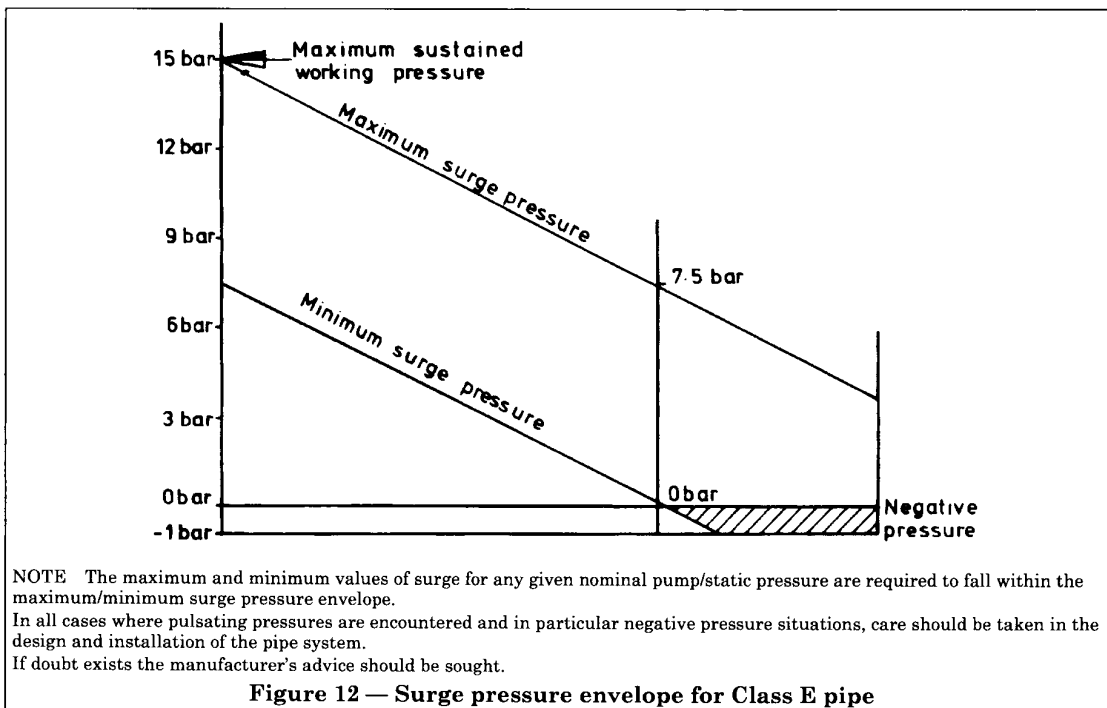
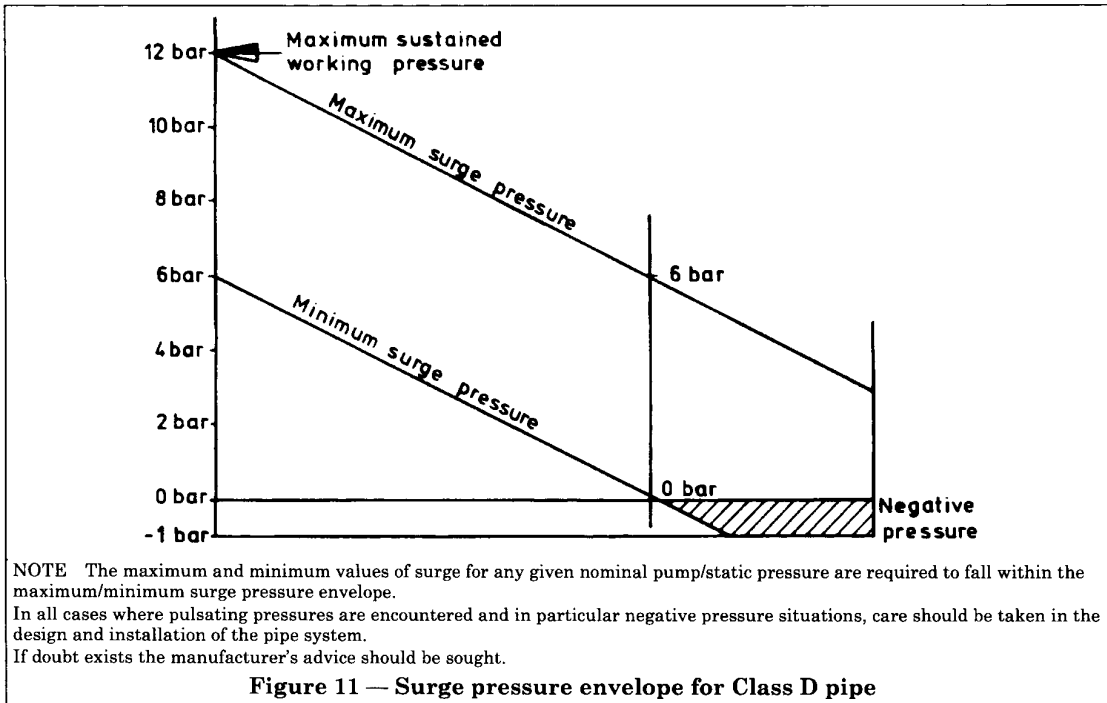


Figure 8 — Support for PVC pipe





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Publications referred to

This standard makes reference to the following British Standards and Codes of Practice:

BS 21, *Pipe threads.*

BS 2494, *Rubber joint rings for gas mains, water mains and drainage purposes.*

BS 2494-1, *Rubber joint rings for gas mains and water mains.*

BS 2494-2, *Rubber joint rings for drainage purposes.*

BS 3505, *Unplasticized PVC pipe for cold water services.*

BS 3506, *Unplasticized PVC pipe for industrial purposes.*

BS 3867, *Outside diameters and pressure ratings of pipe of plastics materials.*

BS 4346, *Joints and fittings for use with unplasticized PVC pressure pipes.*

CP 99, *Frost precautions for water services.*

CP 310, *Water supply.*

CP 312, *Plastics pipework (thermoplastics material).*

CP 312-1, *General principles and choice of material.*

CP 2005, *Sewerage.*

CP 2010, *Pipelines.*

CP 2010-1, *Installation of pipelines in land.*

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