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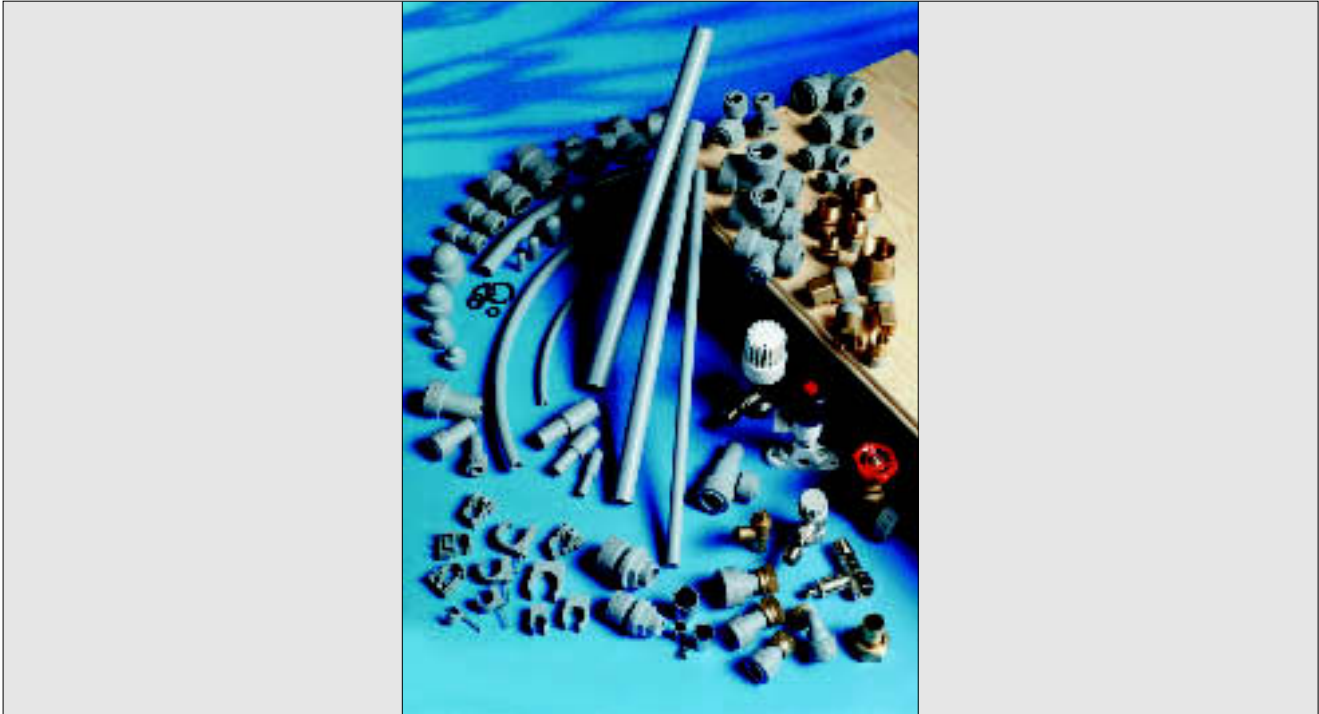
**Agrément  
Certificate  
No 00/3699**  
Second issue\*

Designated by Government  
to issue  
European Technical  
Approvals

## POLYPIPE POLYPLUMB PLUMBING SYSTEMS

Tubes et raccords  
Rohre und Anschlüsse

## Product



• THIS CERTIFICATE RELATES TO POLYPIPE POLYPLUMB PLUMBING SYSTEMS.

• The systems are for use in domestic plumbing services as described in the accompanying Detail Sheets.

These Front Sheets must be read in conjunction with the accompanying Detail Sheets, which provide information specific to certain components.

## Regulations — Detail Sheet 1

### 1 The Building Regulations 2000 (as amended) (England and Wales)



The Secretary of State has agreed with the British Board of Agrément the aspects of performance to be used by the BBA in assessing the compliance of plumbing systems with the Building Regulations. In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements.

Requirement: L1(a)(ii)

Conservation of fuel and power

Comment:

Plumbing systems incorporating the products can satisfy these Requirements. See the tinted area in the *Design Data* section of the accompanying Detail Sheets.

Requirement: Regulation 7

Materials and workmanship

Comment:

The systems are acceptable. See the tinted area in the *Durability* section of the accompanying Detail Sheets.

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## 2 The Building (Scotland) Regulations 2004



In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Regulations and related Mandatory Standards as listed below.

|             |      |   |
|-------------|------|---|
| Regulation: | 8    | Fitness and durability of materials and workmanship   |
| Regulation: | 8(1) | Fitness and durability of materials and workmanship   |
| Comment:    |      | The systems can contribute to a construction satisfying this Regulation. See the tinted area in the <i>Durability</i> section and the <i>Installation</i> part of the accompanying Detail Sheets.   |
| Regulation: | 9    | <b>Building standards — construction</b>  |
| Standard:   | 6.4  | Insulation of pipes, ducts and vessels  |
| Comment:    |      | Plumbing systems incorporating the products can satisfy this Standard with reference to clause 6.4.1 <sup>(1)</sup> (2). See the tinted areas in the <i>Design Data</i> section of the relevant accompanying Detail Sheets.<br>(1) Technical Handbook (Domestic).<br>(2) Technical Handbook (Non-Domestic). |

## 3 The Building Regulations (Northern Ireland) 2000



In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Building Regulations as listed below.

|             |    |  |
|-------------|----|--|
| Regulation: | B2 | Fitness of materials and workmanship   |
| Comment:    |    | The systems are acceptable. See the tinted areas in the <i>Durability</i> section of the accompanying Detail Sheets.   |
| Regulation: | F4 | Insulation of pipes, ducts and hot water storage vessels in all buildings  |
| Comment:    |    | Plumbing systems incorporating the products can satisfy this Standard. See the tinted areas in the <i>Design Data</i> section of the accompanying Detail Sheets. |

## 4 Construction (Design and Management) Regulations 1994 (as amended) Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

In the opinion of the BBA there is no information in this Certificate which relates to the obligations of the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

## 5 Water Supply (Water Fittings) Regulations 1999 England and Wales, Water Byelaws 2000, Scotland and the Water Regulations, Northern Ireland England and Wales

In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems satisfy the requirements of the Regulations, if used and installed in accordance with this Certificate.

### Scotland

In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems satisfy the requirements of the Water Byelaws, if used and installed in accordance with this Certificate.

### Northern Ireland

In the opinion of the BBA, Polypipe Polyplumb Plumbing Systems satisfy the requirements of the Water Regulations, if used and installed in accordance with this Certificate.

## Conditions of Certification

### 6 Conditions

6.1 This Certificate:

- (a) relates only to the product that is named, described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) is valid only within the UK;
- (d) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (e) is copyright of the BBA;
- (f) is subject to English law.

6.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, are references to such publication in the form in which it was current at the date of this Certificate.

6.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabrication including all related and relevant processes thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine; and

(c) are reviewed by the BBA as and when it considers appropriate.

6.4 In granting this Certificate, the BBA is not responsible for:

- (a) the presence or absence of any patent, intellectual property or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the actual works in which the product is installed, used and maintained, including the nature, design, methods and workmanship of such works.

6.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, Polypipe Polyplumb Plumbing Systems are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 00/3699 is accordingly awarded to Polypipe Building Products Ltd.

On behalf of the British Board of Agrément

Date of Second issue: 15th May 2006

A handwritten signature in black ink, appearing to read 'G. A. Cooper', is written over a light grey background.

Chief Executive

*\*Original Certificate issued on 29th March 2000. This amended version includes updated national Building Regulations, CDM Regulations and Conditions of Certification and the addition of a new Detail Sheet.*

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**British Board of Agrément**

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For technical or additional information,  
contact the Certificate holder (see  
front page).  
For information about the Agrément  
Certificate, including validity and  
scope, tel: Hotline 01923 665400,  
or check the BBA website.



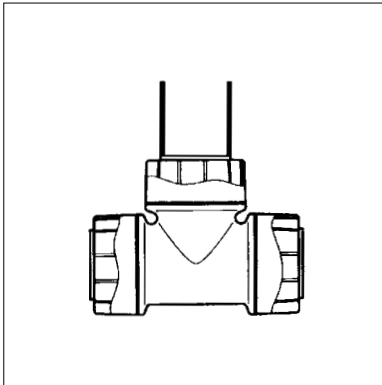
Polypipe plc

Certificate No 00/3699

**DETAIL SHEET 3**

**POLYPLUMB PB BARRIER PIPE**

## Product



- THIS DETAIL SHEET RELATES TO POLYPLUMB PB BARRIER PIPE OF 10 mm, 15 mm, 22 mm AND 28 mm OUTSIDE DIAMETERS.
- The pipes are for use in hot and cold water services (including potable water) in conjunction with Polyplumb Fittings (see Detail Sheet 2).
- The pipes are suitable for use for those service conditions defined as Class S in BS 7291 : Part 1 : 1990.

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification and the product's position regarding the Building Regulations, respectively.

## Technical Specification

### 1 Description

1.1 Polyplumb PB Barrier Pipe is manufactured from polybutylene (PB) and is grey in colour. It is available in the four sizes given in Table 1. The pipe consists of five layers: PB/adhesive/ethylene vinyl alcohol (EVOH)/adhesive/PB.

Table 1 Pipe dimensions

|                                |     |     |     |     |
|--------------------------------|-----|-----|-----|-----|
| nominal outside dimension (mm) | 10  | 15  | 22  | 28  |
| minimum wall thickness (mm)    | 1.5 | 1.7 | 2.0 | 2.6 |

1.2 In the middle of the pipe wall is an oxygen diffusion barrier of between 0.09 mm and 0.20 mm thick. This barrier is an EVOH polymer layer with hot melt adhesive layers on either side of the barrier.

1.3 Support sleeves are available for each pipe size and must be inserted into the pipe before jointing. The support sleeves are manufactured from stainless steel to BS 1449 : Part 2 : 1983.

1.4 Pipe runs must be secured with Polyplumb Pipe Clips. Two types of screw fixed clips are available: snap-fit for 10 mm, 15 mm, 22 mm and 28 mm diameter pipes; and Bulldog for 15 mm, 22 mm and 28 mm diameter pipes. In addition, Nail-in clips are also available for 10 mm, 15 mm, 22 mm and 28 mm diameter pipes.

1.5 A metal cold forming bend fixture is available for 15 mm and 22 mm pipes. The fixtures are used to ensure that sharp bends remain smoothly curved.

1.6 The polybutylene pipe, oxygen diffusion barrier layer and adhesive layers are produced by an extrusion process. Continuous quality control is carried out during manufacture including checks on dimensional accuracy and short-term pressure tests at 20°C and 95°C. The Polypipe plc quality system is registered by BSI Quality Assurance to BS EN ISO 9002 : 1994.

1.7 The stainless steel pipe support sleeves/inserts (see Detail Sheet 2) are bought in by Polypipe plc to an agreed specification. They are manufactured using conventional techniques.

### 2 Delivery to site and storage

2.1 Polyplumb PB Barrier Pipe is supplied in lengths of 3 m or 6 m or in coils of 25 m, 50 m, 100 m, 150 m or 200 m. The pipe bears a continuous mark showing the manufacturer's trademark, maximum operating temperature and pressure, time, day, month and year of production. The pipes are marked BARRIER in red at regular intervals. They are wrapped in white packaging with the legend barrier pipe on the label to distinguish them from non-barrier Polyplumb pipes. Packages of pipe lengths and of coils bear a label showing the BBA identification mark incorporating the number of this Certificate.

2.2 The fittings are supplied in polythene bags.

2.3 Polyplumb PB Barrier Pipe should be transported on a flat-bed vehicle. Straight pipes should be loaded to avoid any overhang or crushing.

2.4 Once unwrapped, pipes should be stored indoors or in a shaded area to prevent ultraviolet degradation; to prevent distortion, pipes should be stored in racks which give support to their whole length.

## Design Data

### 3 General

3.1 The Polyplumb pipes are for use in hot and cold water services installations designed in accordance with BS 5955 : Part 8 : 1990. The pipes are suitable for use for those applications and service conditions defined as Class S in BS 7291 : Part 1 : 1990.

3.2 The system can be installed easily in new or existing buildings.

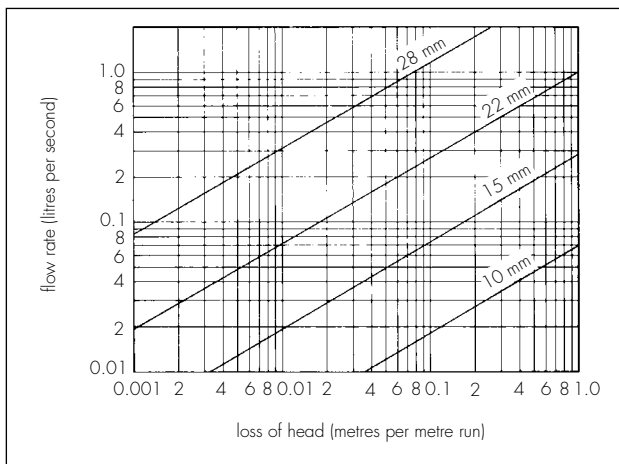
3.3 Care must be taken during installation to ensure that no damage occurs to the pipe, eg by nail penetration.

## 4 Design procedure

### Heating design

- 4.1 The heating demands for particular rooms are evaluated as detailed in the CIBSE Guide 1980, Part A.
- 4.2 To calculate the pressure drop in the pipes connected to each radiator, the total length of pipe is defined as the sum of the lengths of the flow and return pipes from the boiler to the radiator.
- 4.3 The flow characteristics of the pipes are calculated using the Colebrook-White equation (see Figure 1).

Figure 1 Flow characteristics of Polyplumb Barrier Pipe at 15°C



### Structural design

- 4.4 Floor constructions must be designed to comply with the relevant technical specifications selected from:
- BS 8110 : Part 1 : 1997
  - BS 5268 : Part 2 : 1996
  - Section 1, Part B, of Approved Document A 1/2 to the Building Regulations 1991 (as amended 1994) (England and Wales).
  - The Building Standards (Scotland) Regulations 1990 (as amended) Regulation 11 *Structure*, Standard C2.2 *Loads acting on a building*.
  - The Building Regulations (Northern Ireland) 1994, Part D *Structure*.

## 5 Safe working temperatures and pressures

The safe operating pressure and maximum temperature rating for Polyplumb PB Barrier Pipe is 7 bar at 82°C. The pipe can operate at 3 bar at 114°C for a limited period in the event of a malfunction. This ensures that there is an adequate safety factor to prevent damage to the pipe in the event of a boiler thermostat or other control failure.

## 6 Practicability of installation

The Polyplumb PB Barrier Pipe plumbing system is installed easily under normal site conditions.

## 7 Chemical resistance

- 7.1 The materials used in Polyplumb PB Barrier Pipe will not be adversely affected by accidental contact with linseed oil based sealing compounds or soldering flux, although these materials should not normally be used in making joints to the pipe.
- 7.2 Polybutylene will be unaffected by soft, hard or aggressive potable water.

## 8 Effect on water quality

Polyplumb PB Barrier Pipe and Polyplumb fittings have been tested in relation to the above and found satisfactory. They are listed in the Water Regulations Advisory Service Directory.

## 9 Properties in relation to fire

Where the pipe passes through an element of structure or cavity barrier the opening should be fire-stopped in a way that will permit thermal movement.

## 10 Flow characteristics

10.1 The bore of the 10 mm, 15 mm, 22 mm and 28 mm diameter Polyplumb PB Barrier Pipe is less than copper or stainless steel pipe of the equivalent outside diameter. The consequent reduction in flow rate for a given pressure head should be considered when designing hot and cold water distribution or central heating systems.

10.2 The insertion of support sleeves into the pipe does not affect the system flow characteristics.

## 11 Maintenance

- 11.1 The Polyplumb PB Barrier Pipe plumbing system does not require special maintenance unless it is damaged.
- 11.2 In the event of a leak in the pipe, eg due to local damage, repairs can be effected by a plumbing contractor using a new section of pipe.
- 11.3 To locate a leak in a non-conduit system installation in a suspended wooden floor, the removal of the floor deck may be necessary.

## 12 Durability

- 12.1 The EVOH oxygen barrier virtually eliminates the diffusion of oxygen into the heating system. Provided the system is correctly installed, the requirements for the addition of a corrosion inhibitor will be the same as that for a traditional installation with metal pipes and fittings.
- 12.2 The terminal fittings, eg thermostatic radiator valves (see Detail Sheet 2) are produced from materials known to be durable in plumbing applications. They may require replacement within the life of Polyplumb Barrier Pipe.
- 12.3 The Polyplumb PB Barrier Pipe plumbing system will have a life at least equivalent to that expected from a traditional installation with metal pipes and fittings.

## Installation

### 13 General

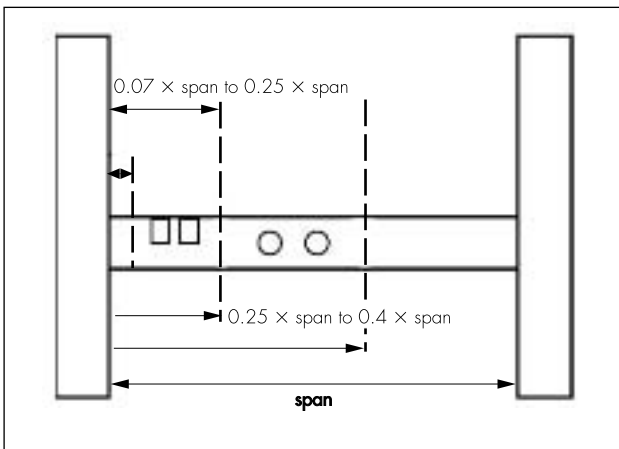
- 13.1 Installation must be carried out in accordance with the manufacturer's instructions *Polyplumb Installation Guide and Product Handbook*, BS 5955 : Part 8 : 1990 and BS 6700 : 1987. General installation details are shown in Figures 2 and 3.
- 13.2 Polyplumb PB Barrier Pipe must not be used within 350 mm of a concentrated heat source, such as a boiler, or in uncontrolled primary heating circuits where the safe operating pressure and maximum temperature rating may be regularly exceeded. The metal (copper) section of pipework should be used to form a transmission piece between the boiler and the first Polyplumb connection. The pipe must not be positioned in locations subjected to direct sunlight, close to a fire, light fitting or other source of direct heat which would raise the temperature of the pipe above safe limits.

13.3 Polyplumb PB Barrier Pipe is flexible and cannot be used to support fittings, eg circulating pumps or appliances.

Figure 2 Installation in a solid floor



Figure 3 Installation in a suspended floor



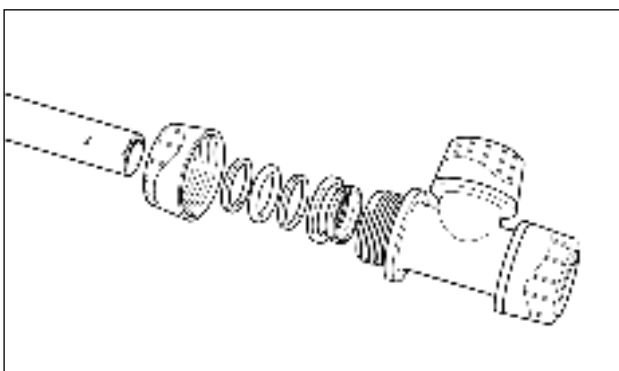
## 14 Procedure

### Jointing method

14.1 The pipe is cut to length using Polyplumb pipe cutters (available from Polypipe PLC). The cut end is checked to ensure that it is free from burrs, score marks and sharp edges before the support sleeve is inserted.

14.2 Joints can be made using the fittings listed in Detail Sheet 2. Stainless steel internal support sleeves are required. An example of a joint detail with a Polyplumb fitting and Barrier Pipe is shown in Figure 4.

Figure 4 Polyplumb fitting joint detail



### Over a concrete floor in a screed (see Figure 2)

14.3 The Polyplumb PB Barrier Pipe plumbing system should be contained in a conduit pipe. The system should be pressure tested before the concrete screed or cement-sand is laid over the conduit pipe. Should pressure testing take place in sub-zero temperatures, or if the system is to be left after pressure testing in sub-zero temperatures, all necessary precautions should be taken to avoid frost damage to radiators and fittings. The thickness of the screed will be dependent upon the loading requirements of the floor, but the cover to the pipe must never be less than 35 mm. The screed should be laid in accordance with the relevant requirements of BS 8204 : Part 1 : 1987.

### In a suspended wooden floor (see Figure 3)

14.4 Pipe runs are secured to joists using Polyplumb pipe clips. The recommended spacing of support centres is shown in Table 2.

Table 2 Spacing of support centres

| Nominal diameter of pipe (mm) | Horizontal runs <sup>(1)</sup> (m) | Vertical runs (m) |
|-------------------------------|------------------------------------|-------------------|
| 10                            | 0.3                                | 0.5               |
| 15                            | 0.3                                | 0.5               |
| 22                            | 0.5                                | 0.8               |
| 28                            | 0.8                                | 1.0               |

(1) In-line with joists.

14.5 The pipes are secured beneath the joists. Structural timbers should be notched only with the permission of the architect or structural engineer, and in accordance with BS 6700 : 1987, clause 13.7.9. The system should be pressure tested before nailing down the floor deck.

### Commissioning the system

14.6 When commissioning the system it must be flushed, filled with water, the pump started and residual air removed by opening the bleed valves in each circuit. The system must be checked for leaks after all the air has been removed and before the floor is covered with either concrete or wood.

14.7 A notice should be displayed in buildings when the system is installed, drawing attention to the risks of damage associated with nailing through the floor decks. To minimise this risk, the pipe runs should be kept clear of room perimeters and, where possible, doorways.

## Technical Investigations

The following is a summary of the technical investigations carried out on the Polyplumb PB Barrier Pipe plumbing system.

### 15 Tests

Test evidence was examined relating to:

- dimensional accuracy
- effect of thermal cycling on pipes and fittings\*
- oxygen diffusion to DIN 4726 and DIN 4727
- long-term hydrostatic pressure resistance of pipe\*
- resistance to pull-out of assembled joints†
- short-term hydrostatic pressure resistance of pipe at 20°C†
- short-term hydrostatic pressure resistance of pipe at 95°C†

resistance to cyclic pressure shock of assembled pipes and fittings\*

effect of freezing.

\*to BS 7291 : Part 1 : 1990

†to BS 7291 : Part 2 : 1990.

## 16 Other investigations

16.1 An examination was made of data relating to:

thermal stability of oxygen diffusion barrier

behaviour in fire

chemical resistance

effect of materials on water quality

practicability of installation

durability.

16.2 The *Polypipe Polyplumb Design and Installation Guide* was examined and compared to conventional practice in the UK.

16.3 The factory production control was examined and found to be in accordance with the guidance on quality control testing given in BS 7291 : Part 2 : 1990. The pipe and fittings are covered by the Kitemark.

## Bibliography

BS 1449 *Steel plate, sheet and strip*

Part 2 : 1983 *Specification for stainless and heat-resisting steel plate, sheet and strip*

BS 5268 *Structural use of timber*

Part 2 : 1996 *Code of practice for permissible stress design, materials and workmanship*

BS 5955 *Plastics pipework (thermoplastics materials)*

Part 8 : 1990 *Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold water services and heating systems*

BS 6700 : 1997 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages*

BS 7291 *Thermoplastic pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings*

Part 1 : 1990 *General requirements*

Part 2 : 1990 *Specification for polybutylene (PB) pipes and associated fittings*

BS 8110 *Structural use of concrete*

Part 1 : 1997 *Code of practice for design and construction*

BS 8204 *In-situ floorings*

Part 1 : 1987 *Code of practice for concrete bases and screeds to receive in-situ floorings*

BS EN ISO 9002 : 1994 *Quality systems — Model for quality assurance in production, installation and servicing*

DIN 4726 *Pipelines of plastic material used in warm water floor heating systems. General requirements*

DIN 4727 *Polybutylene pipework for hot water under floor heating systems. Special requirements and testing*



On behalf of the British Board of Agrément

Date of issue: 29th March 2000

A handwritten signature in black ink, appearing to read 'P. C. Newson'.

Chief Executive



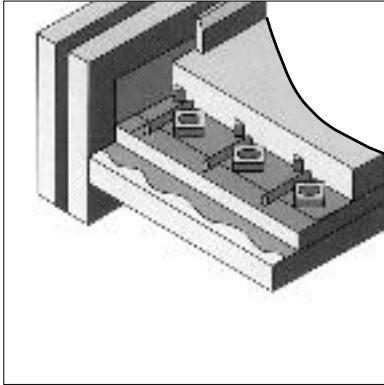
**Polypipe Building Products Ltd**

**Certificate No 00/3699**

**POLYPIPE POLYPLUMB 15 mm, 18 mm AND 20 mm UNDERFLOOR HEATING SYSTEM**

**DETAIL SHEET 4**  
Second issue\*

## Product



- THIS DETAIL SHEET RELATES TO THE POLYPIPE POLYPLUMB 15 mm, 18 mm AND 20 mm UNDERFLOOR HEATING SYSTEM, COMPRISING POLYBUTYLENE BARRIER PIPES, BRASS MANIFOLDS AND ANCILLARY COMPONENTS (SEE SECTION 1).
- The products are for use in conjunction with a source of heated water to provide a space heating system in domestic, commercial or public buildings where the system is designed in accordance with the guidelines of the Certificate holder.
- The Polypipe Polyplumb piping system is for use in new or existing floors as described in section 3 of this Detail Sheet.
- This Detail Sheet does not cover the boiler, pumps, or controls necessary to complete the heating system, which are assumed to be conventional items.

*This Detail Sheet must be read in conjunction with the Front Sheets which give the system's position regarding the Building Regulations, and Conditions of Certification, respectively.*

## Technical Specification

### 1 Description

#### General

1.1 The Polypipe Polyplumb 15 mm, 18 mm and 20 mm Underfloor Heating System comprises:

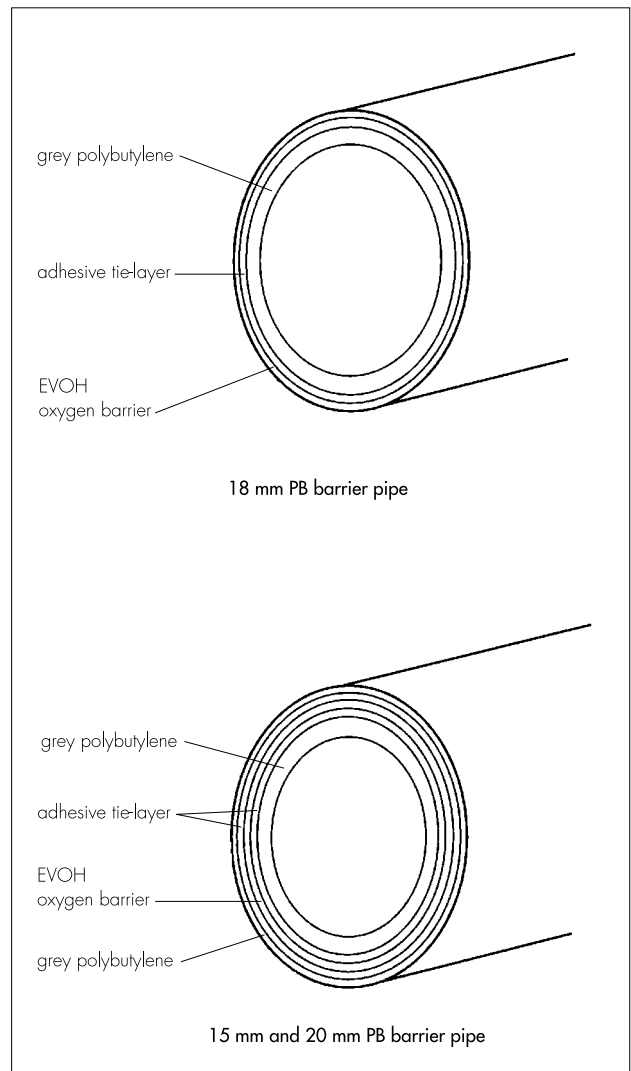
- Polyplumb PB barrier pipe
- Polyplumb manifold
- Polyplumb pipe inserts.

1.2 Other ancillary items used with the system but outside of the scope of the Certificate are:

- Polyplumb heat spreader plates
- Polyplumb floor panels
- Polyplumb corrugated conduit
- Polyplumb edge strips
- pipe stiffeners
- standard UFCH pipe clips
- floating floor panels
- UFCH valve actuators
- isolation valves
- UFCH mixing valves
- surface distribution box
- flush distribution box
- single room control unit.

1.3 The basic Polyplumb PB barrier pipe (see Figure 1) comprises a polybutylene barrier pipe of 15 mm, 18 mm or 20 mm nominal diameter with a wall thicknesses of 1.7 mm, 2.0 mm and 2.0 mm respectively. The oxygen diffusion barrier is an ethylene vinyl alcohol (EVOH) copolymer resin. On the 15 mm and 20 mm pipe the barrier is central within the pipe and on the 18 mm pipe the barrier is external to the pipe. An adhesive tie layer is co-extruded between each polybutylene and EVOH layer.

Figure 1 Polyplumb pipe



## Manifolds

1.4 The Polyplumb manifolds (see Figure 2) are vital to the system as they control the flow of heated water through the underfloor pipe circuits. These are cast from dezincification-resistant brass and mounted on galvanized brackets. The manifold options available range between two- to 12-port connections, and couplings are used for jointing from the pipe to the manifold. For the 15 mm pipe a Polyplumb push-fit fitting to BS 7291-2 : 1990 is used, for the 18 mm and 20 mm pipes compression fittings are used. The length of pipe from the manifold to the exit from the floor is protected using Polypipe corrugated conduit.

Figure 2 Polyplumb manifold



## Manufacture

1.5 The polybutylene pipe is produced by an extrusion process. The polybutylene adhesive tie layer and oxygen diffusion barrier layer are co-extruded. Continuous quality control is carried out during manufacture, including checks on dimensional accuracy, and short-term pressure tests at 20°C and 95°C.

1.6 Manifolds and brass components are manufactured using conventional techniques and bought in by the Certificate holder, to an agreed specification.

## 2 Delivery to site and storage

2.1 The Polyplumb PB barrier pipe is supplied in coils of length up to 150 m for the 15 mm, 300 m for the 18 mm and 200 m for the 20 mm diameter pipes. The pipe bears a continuous mark showing the manufacturer's trademark, dimension, maximum operating temperature and pressure, manufacturing code, year and week of production and a cutting mark. The pipe or packaging bear a label showing the BBA identification mark incorporating the number of this Certificate. The coils are protected by clear polyethylene wrapping.

2.2 The Polyplumb manifolds, distribution boxes and other small components are supplied in cardboard packaging.

2.3 All components should be stored under cover until required, to prevent UV exposure and site damage.

## Design Data

### 3 General

3.1 The Polypipe Polyplumb 15 mm, 18 mm and 20 mm Underfloor Heating System is suitable for use in domestic, commercial or public buildings, in underfloor heating systems.

3.2 The Certificate holder's technical literature contains data essential to the designer.

3.3 The system can be readily installed in new buildings and suspended floors in existing building.

### 4 Design procedure

#### Heating design

4.1 The procedures for system design are based on heat loss per room. Polypipe Building Products technical manual UFH 2, dated 1 January 2001, outlines the design methodology for each of the installation scenarios.

4.2 The heating demands for particular rooms are evaluated in the manner detailed in the CIBSE Guide 1980, Part A *Structural Design*.

4.3 Floor constructions must be designed to comply with the relevant technical specifications selected from:

BS 8110-1 : 1997

BS 5268-2 : 1996

the national Building Regulations:

#### *England and Wales*

Approved Document A 1/2, Section 1, Part B

#### *Scotland*

Regulation 11 *Structure*, Standard C2.2

#### *Northern Ireland*

Part D *Structure*.

### 5 Safe working temperatures and pressures

The safe operating pressure and maximum temperature rating for the Polyplumb PB barrier pipe is 4.0 bar at 60°C. The pipe can operate at 3.5 bar at 114°C for a limited period without damage. There is an adequate safety factor to ensure that damage to the pipe will not occur in the event of boiler thermostat or other control failure.

### 6 Practicability of installation

The Polypipe Polyplumb 15 mm, 18 mm and 20 mm Underfloor Heating System is installed easily under normal site conditions.

### 7 Chemical resistance

The polybutylene of the Polyplumb PB barrier pipe will be unaffected by soft, hard or aggressive potable water.

## 8 Effect on water quality

The Polyplumb PB barrier pipe and fittings are listed by the Water Regulations Advisory Scheme.

## 9 Properties in relation to fire

Where the Polyplumb PB barrier pipe passes through an element of structure or cavity barrier the opening should be fire-stopped in a way that will permit thermal movement.

## 10 Maintenance

10.1 The system as assessed, does not require special maintenance. Items such as the control equipment are outside the scope of this Certificate but may require routine maintenance.

10.2 The EVOH barrier in the Polyplumb PB barrier pipe virtually eliminates the diffusion of oxygen into the heating system provided the system is completely sealed. The checking and addition of a corrosion inhibitor is recommended on a yearly basis.

## 11 Durability

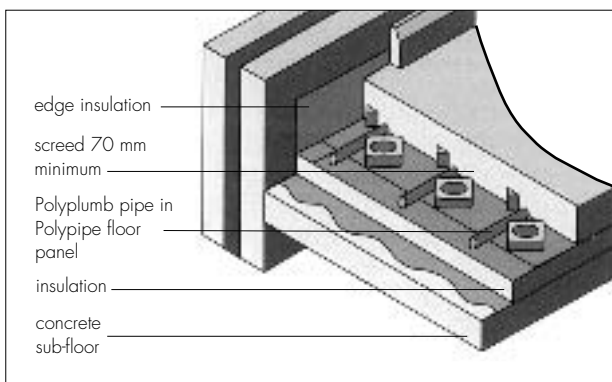
The Polyplumb PB barrier pipe material has been assessed as having a life of in excess of 50 years. The Polyplumb manifold is produced from materials known to be durable in plumbing applications. It may require replacement within the life of the pipe.

## Installation

### 12 General

Installation of Polypipe Polyplumb 15 mm, 18 mm and 20 mm Underfloor Heating System must be carried out in accordance with the manufacturer's instructions and BS 6700 : 1997. General installation details are shown in Figure 3.

Figure 3 Typical screed solid floor installation



### 13 Procedure

13.1 The procedures are detailed in the *Design and Installation Guide*, reference UFH 2, dated 1 January 2001. A summary is given in sections 13.2 to 13.7.

#### Solid concrete floor (see Figure 3)

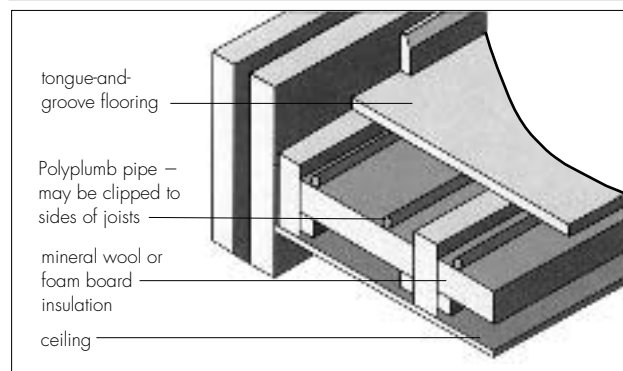
13.2 Polyplumb edge strip is positioned around the perimeter of the room. Expanded polystyrene is laid onto the concrete sub-base and covered with a polyethylene membrane. Polyplumb floor panels are recommended to secure the Polyplumb PB barrier pipe in standard installations.

13.3 The system should be pressure tested before the concrete screed or cement-sand is laid over the pipe. Should pressure testing take place in sub-zero temperatures, or if the system is to be left after pressure testing in sub-zero temperatures, all necessary precautions should be taken to avoid frost damage to the pipework. The thickness of the screed will be dependent upon the loading requirements of the floor, but the cover to the pipe must not be less than 40 mm. The screed should be laid in accordance with the relevant requirements of BS 8204-1 : 1987.

#### Suspended wooden floor (see Figure 4)

13.4 The system can be used in suspended floors with installation conducted from either over the top or bottom of the suspended floor. The pipework can be clipped to the joists or run in heat spreader plates along counter battens fitted at 300 mm centres. The voids between the joists should be filled with an appropriate mineral wool or foam. Some carpentry will be necessary to fit this system. Structural timbers should be notched only with the permission of the architect or structural engineer, and in accordance with BS 6700 : 1997, clause 3.1.7.9. The system should be pressure tested before nailing down the floor deck.

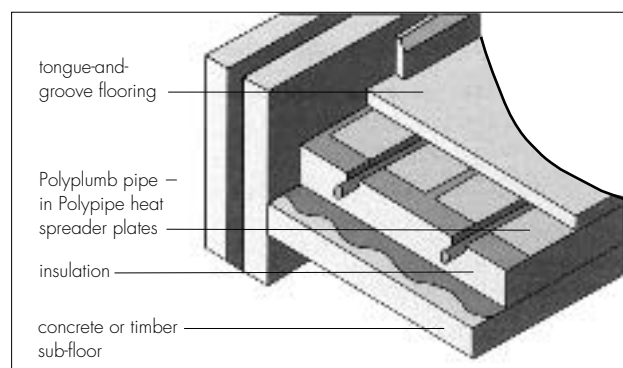
Figure 4 Suspended wooden floor



#### Floating floor (see Figure 5)

13.5 The floating floor insulation panels are laid on top of the existing floor. A polyethylene membrane must be used if required by the type of installation. The heat spreader plates are positioned on the insulation and the Polyplumb PB barrier pipe is rolled out over the floor in a zigzag configuration. The system can be connected and pressurised as detailed in the Certificate holder's instructions.

Figure 5 Floating floor



## Charging and pressure testing

13.6 Prior to screeding or concealing, the system must be flushed with water so that all the heating circuits are free from air. This is carried out circuit by circuit (ie with the valves for the other circuits remaining closed). When all air is bled from the pipe and manifolds, the system can be pressure tested. The system should be tested to 6.0 bar, but may require five or six applications of the pressure to achieve stability, as the pipe will expand slightly as it is pressurised. The pressure must remain stable for a minimum of 24 hours before the system has settled and is functioning satisfactorily. Special precautions are necessary if the pressure testing is to take place in sub-zero temperatures.

## Commissioning

13.7 Heat must not be applied until any screed has fully dried. Advice should be sought from the screed supplier for the drying times.

## Technical Investigations

The following is a summary of the technical investigations carried out on the Polypipe Polyplumb 15 mm, 18 mm and 20 mm Underfloor Heating System.

## 14 Tests

14.1 Tests were carried out to determine: resistance to short-term pressure at 20°C and 95°C at elevated pressure.

14.2 Test evidence was examined relating to:  
dimensional accuracy  
effect of thermal cycling on pipes and fittings  
oxygen diffusion  
long-term hydrostatic pressure resistance of pipe<sup>(1)</sup>  
short-term hydrostatic pressure resistance of fittings<sup>(1)</sup>  
(1) To BS 7291-1 : 1990.

## 15 Other investigations

15.1 An examination was made of data relating to:  
chemical resistance  
practicability of installation  
durability  
opacity.

15.2 The Polypipe Polyplumb system design and installation method was examined and compared to conventional practice in the UK.

15.3 The factory production control was examined and found to be satisfactory.

## Bibliography

- BS 5268 *Structural use of timber*  
BS 5268-2 : 1996 *Code of practice for permissible stress design, materials and workmanship*
- BS 6700 : 1997 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages*
- BS 7291 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings*  
BS 7291-1 : 1990 *General requirements*  
BS 7291-2 : 1990 *Specification for polybutylene (PB) pipes and associated fittings*
- BS 8110 *Structural use of concrete*  
BS 8110-1 : 1997 *Code of practice for design and construction*
- BS 8204 *Screeds, bases and in-situ floorings*  
BS 8204-1 : 1987 *Code of practice for concrete bases and screeds to receive in-situ floorings*



On behalf of the British Board of Agrément

Date of Second issue: 11th December 2001

A handwritten signature in black ink, appearing to read 'P. C. Newson'.

Chief Executive

\*Original Certificate issued on 6th February 2001. This amended version includes the addition of 20 mm pipe.



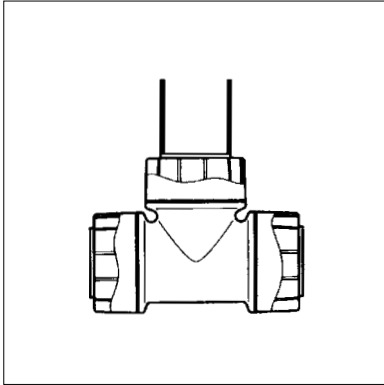
Polypipe Building Products Ltd

**POLYPLUMB 15 mm x 1.5 mm  
PB BARRIER AND STANDARD PIPE**

Certificate No 00/3699

**DETAIL SHEET 5**

## Product



- THIS DETAIL SHEET RELATES TO POLYPLUMB 15 mm OUTSIDE DIAMETER x 1.5 mm PB BARRIER AND STANDARD PIPE.
- The pipes are for use in hot and cold water services (including potable water) in conjunction with Polyplumb Fittings (see Detail Sheet 2).
- The pipes are suitable for use for those service conditions defined as Class S in BS 7291-1 : 2001.

This Detail Sheet must be read in conjunction with the Front Sheet and Detail Sheet 1, which give Conditions of Certification and the product's position regarding the Building Regulations, respectively.

## Technical Specification

### 1 Description

1.1 Polyplumb PB Barrier and Standard Pipe is manufactured from polybutylene (PB) and is grey in colour. It has a nominal outside diameter of 15 mm with a minimum wall thickness of 1.5 mm. The barrier pipe consists of five layers: PB/adhesive/ethylene vinyl alcohol (EVOH)/adhesive/PB.

1.2 In the middle of the barrier pipe wall is an oxygen diffusion barrier of between 0.14 mm and 0.18 mm thick. This barrier is an EVOH polymer layer with hot melt adhesive layers on either side of the barrier.

1.3 Support sleeves are available for 15 mm by 1.5 mm pipe and are chemically blacked for identification. They must be inserted into the pipe before jointing and are manufactured from stainless steel to BS 1449-2 : 1983.

1.4 Pipe runs must be secured with Polyplumb pipe clips. Two types of screw fixed clips are available: snap-fit and Bulldog. In addition, Nail-in clips are also available.

1.5 A metal cold forming bend fixture is available for 15 mm pipes. The fixtures are used to ensure that sharp bends remain smoothly curved.

1.6 The polybutylene pipe, oxygen diffusion barrier layer and adhesive layers are produced by an extrusion process. Continuous quality control is carried out during manufacture including checks on dimensional accuracy and short-term pressure tests at 20°C and 95°C. The Polypipe Building Products Ltd quality system is registered by BSI Quality Assurance to BS EN ISO 9002 : 1994.

1.7 The stainless steel pipe support sleeves/inserts (see Detail Sheet 2) are bought in by Polypipe Building Products Ltd to an agreed specification. They are manufactured using conventional techniques.

### 2 Delivery to site and storage

2.1 Polyplumb PB Barrier and Standard Pipe is supplied in lengths of 3 m or 6 m or in coils of 25 m, 50 m, 100 m, 150 m or 200 m. The pipe bears a continuous mark showing the manufacturer's trademark, maximum operating temperature and pressure, time, day, month and year of production. Barrier pipes are marked in red at regular intervals and wrapped in yellow packaging with the legend 'barrier pipe' on the label to distinguish them from the standard pipes which are marked in black and wrapped in white packaging, with the legend 'standard pipe' marked on the label. Packages of pipe lengths and coils bear a label showing the BBA identification mark incorporating the number of this Certificate.

2.2 The fittings are supplied in polythene bags.

2.3 Polyplumb PB Barrier and Standard Pipe should be transported on a flat-bed vehicle. Straight pipes should be loaded to avoid any overhang or crushing.

2.4 Once unwrapped, pipes should be stored indoors or in a shaded area to prevent ultraviolet degradation; to prevent distortion, pipes should be stored in racks which give support to their whole length.

## Design Data

### 3 General

3.1 The Polyplumb PB Barrier and Standard pipes are for use in hot and cold water services installations designed in accordance with BS 5955-8 : 1990. The pipes are suitable for use for those applications and service conditions defined as Class S in BS 7291-1 : 2001.

3.2 The system can be installed easily in new or existing buildings.

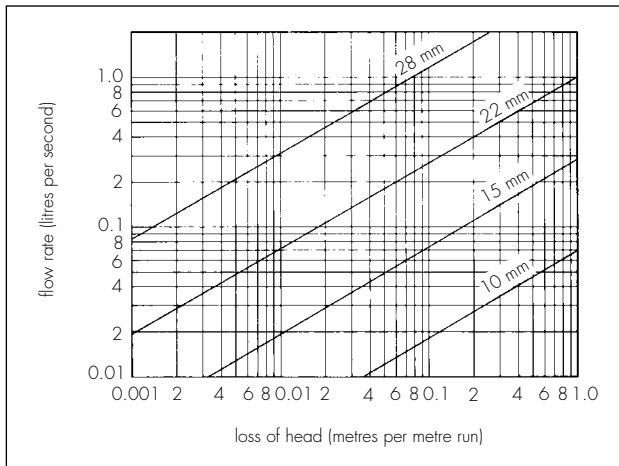
3.3 Care must be taken during installation to ensure that no damage occurs to the pipe, eg by nail penetration.

## 4 Design procedure

### Heating design

- 4.1 The heating demands for particular rooms are evaluated as detailed in the CIBSE Guide 1980, Part A.
- 4.2 To calculate the pressure drop in the pipes the total length of pipe is defined as the sum of the lengths of the flow and return pipes from the boiler to the radiator.
- 4.3 The flow characteristics of the pipes are calculated using the Colebrook-White equation (see Figure 1).

Figure 1 Flow characteristics of Polyplumb Barrier Pipe at 15°C



### Structural design

- 4.4 Floor constructions must be designed to comply with the relevant technical specifications selected from:  
BS 8110-1 : 1997  
BS 5268-2 : 1996

in accordance with the national Building Regulations:

#### England and Wales

Section 1, Part B of Approved Document A1/2

#### Scotland

Regulation 11 *Structure*, Standard C2.2 *Loads acting on a building*

#### Northern Ireland

Part D *Structure*.

## 5 Safe working temperatures and pressures

The safe operating pressure and maximum temperature rating for Polyplumb PB Barrier Pipe is 7 bar at 82°C. The pipe can operate at 3 bar at 114°C for a limited period in the event of a malfunction. This ensures that there is an adequate safety factor to prevent damage to the pipe in the event of a boiler thermostat or other control failure.

## 6 Practicability of installation

The Polyplumb PB Barrier and Standard Pipe plumbing system is installed easily under normal site conditions.

## 7 Chemical resistance

- 7.1 The materials used in Polyplumb PB Barrier and Standard Pipe will not be adversely affected by accidental contact with linseed oil-based sealing compounds or soldering flux, although these materials should not normally be used in making joints to the pipe.
- 7.2 Polybutylene will be unaffected by soft, hard or aggressive potable water.

## 8 Effect on water quality

Polyplumb PB Barrier and Standard Pipe and Polyplumb fittings have been tested in relation to the above and found satisfactory. They are listed in the Water Regulations Advisory Service Directory.

## 9 Properties in relation to fire

Where the pipe passes through an element of structure or cavity barrier the opening should be fire-stopped in a way that will permit thermal movement.

## 10 Flow characteristics

10.1 The bore of the 15 mm diameter Polyplumb PB Barrier and Standard Pipe is less than copper or stainless steel pipe of the equivalent outside diameter. The consequent reduction in flow rate for a given pressure head should be considered when designing hot and cold water distribution or central heating systems.

10.2 The insertion of support sleeves into the pipe does not affect the system flow characteristics.

## 11 Maintenance

11.1 The Polyplumb PB Barrier and Standard Pipe plumbing system does not require special maintenance unless it is damaged.

11.2 In the event of a leak in the pipe, eg due to local damage, repairs can be effected by a plumbing contractor using a new section of pipe.

11.3 To locate a leak in a non-conduit system installation in a suspended wooden floor, the removal of the floor deck may be necessary.

## 12 Durability

12.1 The EVOH oxygen barrier layer in the Barrier pipe virtually eliminates the diffusion of oxygen into the heating system. Provided the system is correctly installed, the requirements for the addition of a corrosion inhibitor will be the same as that for a traditional installation with metal pipes and fittings.

12.2 The terminal fittings, eg thermostatic radiator valves (see Detail Sheet 2) are produced from materials known to be durable in plumbing applications. They may require replacement within the life of Polyplumb Standard and PB Barrier Pipe.

12.3 The Polyplumb PB Barrier and Standard Pipe plumbing system will have a life at least equivalent to that expected from a traditional installation with metal pipes and fittings.

## Installation

### 13 General

13.1 Installation must be carried out in accordance with the manufacturer's instructions *Polyplumb Installation Guide and Product Handbook*, BS 5955-8 : 1990 and BS 6700 : 1997. General installation details are shown in Figures 2 and 3.

13.2 Polyplumb PB Barrier and Standard Pipe must not be used within 350 mm of a concentrated heat source, such as a boiler, or in uncontrolled primary heating circuits where the safe operating pressure and maximum temperature rating may be regularly exceeded. The metal (copper) section of pipework should be used to form a transmission piece between the boiler and the first Polyplumb connection. The pipe must not be positioned in locations subjected to direct sunlight, close

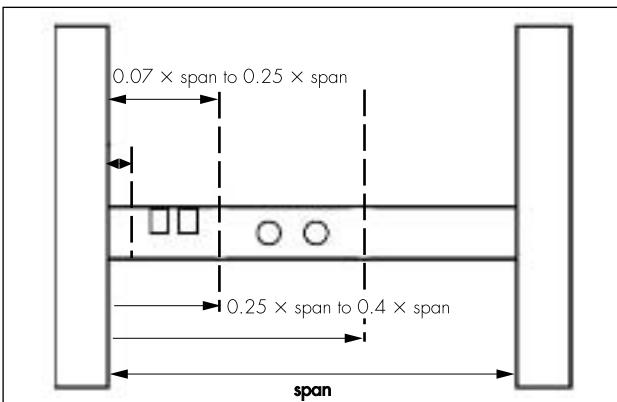
to a fire, light fitting or other source of direct heat which would raise the temperature of the pipe above safe limits.

1.3.3 Polyplumb PB Barrier and Standard Pipe is flexible and cannot be used to support fittings, eg circulating pumps or appliances.

Figure 2 Installation in a solid floor



Figure 3 Installation in a suspended floor



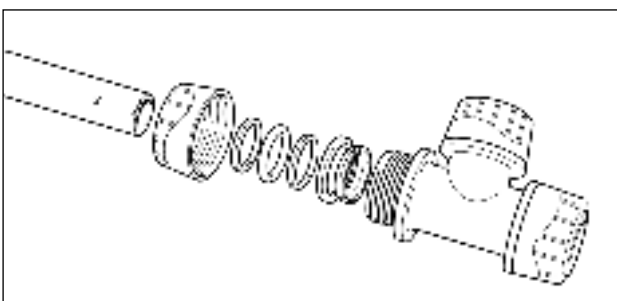
## 14 Procedure

### Joining method

14.1 The pipe is cut to length using Polyplumb pipe cutters (available from Polypipe Building Products Ltd). The cut end is checked to ensure that it is free from burrs, score marks and sharp edges before the support sleeve is inserted.

14.2 Joints can be made using the fittings listed in Detail Sheet 2. Stainless steel internal support sleeves are required. An example of a joint detail with a Polyplumb fitting and Barrier Pipe is shown in Figure 4.

Figure 4 Polyplumb fitting joint detail



### Over a concrete floor in a screed (see Figure 2)

14.3 The Polyplumb PB Barrier and Standard Pipe plumbing system should be contained in a conduit pipe. The system should be pressure tested before the concrete screed or cement-sand is laid over the conduit pipe. Should pressure testing take place in sub-zero temperatures, or if the system is to be left after pressure testing in sub-zero temperatures, all necessary precautions should be taken to avoid frost damage to radiators and fittings. The thickness of the screed will be dependent upon the loading requirements of the floor, but the cover to the pipe must never be less than 35 mm. The screed should be laid in accordance with the relevant requirements of BS 8204-1 : 1987.

### In a suspended wooden floor (see Figure 3)

14.4 Pipe runs are secured to joists using Polyplumb pipe clips. The recommended spacing of support centres is shown in Table 1.

Table 1 Spacing of support centres

| Nominal diameter of pipe (mm) | Horizontal runs <sup>(1)</sup> (m) | Vertical runs (m) |
|-------------------------------|------------------------------------|-------------------|
| 10                            | 0.3                                | 0.5               |
| 15                            | 0.3                                | 0.5               |
| 22                            | 0.5                                | 0.8               |
| 28                            | 0.8                                | 1.0               |

(1) In-line with joists.

14.5 The pipes are secured beneath the joists. Structural timbers should be notched only with the permission of the architect or structural engineer, and in accordance with BS 6700 : 1997, clause 13.7.9. The system should be pressure tested before nailing down the floor deck.

### Commissioning the system

14.6 When commissioning the system it must be flushed, filled with water, the pump started and residual air removed by opening the bleed valves in each circuit. The system must be checked for leaks after all the air has been removed and before the floor is covered with either concrete or wood.

14.7 A notice should be displayed in buildings when the system is installed, drawing attention to the risks of damage associated with nailing through the floor decks. To minimise this risk, the pipe runs should be kept clear of room perimeters and, where possible, doorways.

## Technical Investigations

The following is a summary of the technical investigations carried out on the Polyplumb 15 mm x 1.5 mm PB Barrier and Standard Pipe plumbing system.

### 15 Tests

Test evidence was examined relating to:

dimensional accuracy

effect of thermal cycling on pipes and fittings<sup>(1)</sup>

oxygen diffusion to DIN 4726 : 1993 and DIN 4727 : 1988

long-term hydrostatic pressure resistance of pipe<sup>(1)</sup>

resistance to pull-out of assembled joints<sup>(2)</sup>

short-term hydrostatic pressure resistance of pipe at 20°C<sup>(2)</sup>

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short-term hydrostatic pressure resistance of pipe at 95°C<sup>(2)</sup>  
resistance to cyclic pressure shock of assembled pipes and fittings<sup>(1)</sup>  
effect of freezing.

- (1) to BS 7291-1 : 2001  
(2) to BS 7291-2 : 2001.

## 16 Other investigations

16.1 An examination was made of data relating to:  
thermal stability of oxygen diffusion barrier  
behaviour in fire  
chemical resistance  
effect of materials on water quality  
practicability of installation  
durability.

16.2 The *Polypipe Polyplumb Design and Installation Guide* was examined and compared to conventional practice in the UK.

16.3 The factory production control was examined and found to be in accordance with the guidance on quality control testing given in BS 7291-2 : 2001. The Polyplumb fittings are covered by the Kitemark licence.

## Bibliography

BS 1449 *Steel plate, sheet and strip*  
BS 1449-2 : 1983 *Specification for stainless and heat-resisting steel plate, sheet and strip*  
BS 5268 *Structural use of timber*  
BS 5268-2 : 1996 *Code of practice for permissible stress design, materials and workmanship*

BS 5955 *Plastics pipework (thermoplastics materials)*  
BS 5955-8 : 1990 *Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold water services and heating systems*

BS 6700 : 1997 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages*

BS 7291 *Thermoplastic pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings*

BS 7291-1 : 2001 *General requirements*  
BS 7291-2 : 2001 *Specification for polybutylene (PB) pipes and associated fittings*

BS 8110 *Structural use of concrete*  
BS 8110-1 : 1997 *Code of practice for design and construction*

BS 8204 *In-situ floorings*  
BS 8204-1 : 1987 *Code of practice for concrete bases and screeds to receive in-situ floorings*

BS EN ISO 9002 : 1994 *Quality systems — Model for quality assurance in production, installation and servicing*

DIN 4726 : 1993 *Pipelines of plastic material used in warm water floor heating systems. General requirements*

DIN 4727 : 1988 *Polybutylene pipework for hot water under floor heating systems. Special requirements and testing*



On behalf of the British Board of Agrément

Date of issue: 25th March 2002

A handwritten signature in black ink, appearing to read 'P. C. Newson'.

Chief Executive



Polypipe Building Products Ltd

**POLYPLUMB OVERLAY  
FLOOR HEATING SYSTEM**

Certificate No 00/3699

**DETAIL SHEET 6**

Second issue\*

## Product



- THIS DETAIL SHEET RELATES TO THE POLYPLUMB OVERLAY FLOOR HEATING SYSTEM.
- The system comprises Polyplumb 10 mm or 12 mm PB barrier pipe, floor overlay panels, manifold or Zonal Regulation unit, and ancillary components.
- The system is for use in conjunction with a source of heated water and appropriate components to provide a space heating system in domestic and commercial buildings.
- The system is for use on new or existing floors with provision of damp-proof courses and membranes, for refurbishment, conservatories and extensions.
- The Zonal Regulation Unit (ZRU) is used in single rooms or extensions up to 25 m<sup>2</sup> and controls the system. Conventional Polyplumb underfloor heating manifolds are used in multiple room installations.
- The Overlay Floor Panels are installed over floors and have a low profile.
- This Certificate does not cover the boiler, existing pumps and controls necessary to complete the heating system, which are assumed to be conventional items.

*This Detail Sheet must be read in conjunction with the Front Sheets and Detail Sheet 1, which give Conditions of Certification and the products' position regarding the Building Regulations, respectively.*

## Technical Specification

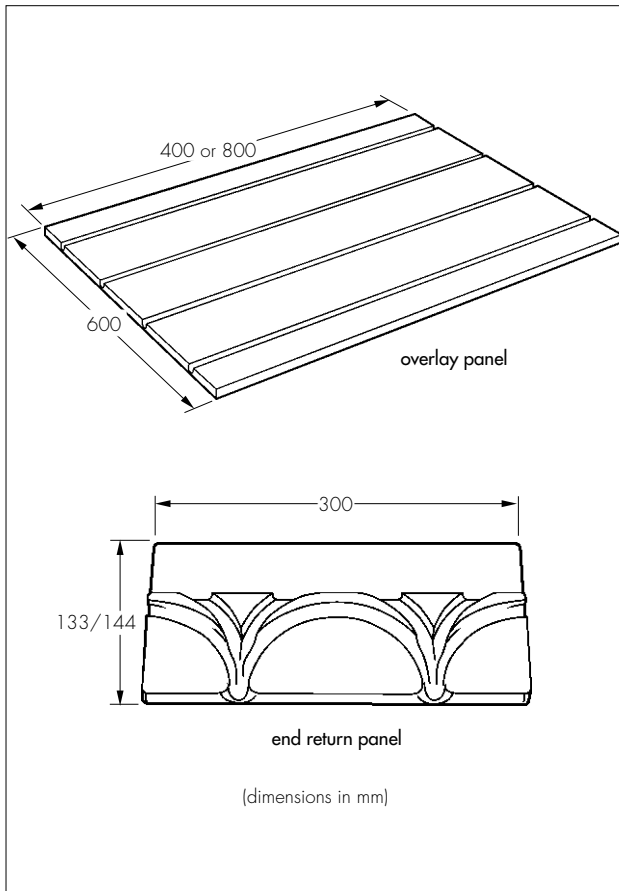
### 1 Description

1.1 The Polyplumb Overlay Floor Heating System comprises:

- Polyplumb PB Barrier Pipe — manufactured from polybutylene (PB) and is grey in colour. It is available in two sizes: 10 mm and 12 mm nominal outside diameter. The pipe consists of five layers: PB/adhesive/ethylene vinyl alcohol (EVOH)/adhesive/PB. In the middle of the pipe wall is an oxygen diffusion barrier of between 0.09 mm and 0.20 mm thick. This barrier is an EVOH polymer layer with hot melt adhesive layers on either side of the barrier
  - Overlay Floor Panels — (see Figure 1) manufactured from light grey, cellulose-fibre-reinforced, gypsum fire-resistant fibreboard in two sizes, 400 mm or 800 mm long by 600 mm wide and 18 mm deep, density 1180 kgm<sup>-3</sup>.
- Each panel has four grooves at 150 mm centres, milled along its length to suit the Polyplumb pipe diameter
- End Return Panels — (see Figure 1) manufactured from polypropylene (PP) with matching grooves in the floor panels at 150 mm centres. Available in two sizes:
    - 300 mm by 133 mm for 10 mm pipe, and
    - 300 mm by 144 mm for 12 mm pipe.
  - Polyurethane Expanding Foam Adhesive — used to fix together adjacent Overlay Floor Panels and End Return Panels
  - Jointing Staples, type 80, 14 mm — used to fix together adjacent Overlay Floor Panels and End Return Panels
  - Adaptor Sets — manufactured from brass and reduce the diameter from 15 mm to suit 12 mm or 10 mm pipe. Each set is supplied with pipe stiffeners which must be inserted into the pipe end before jointing

- The Zonal Regulation Unit (ZRU) — allows single rooms and extensions (up to 25 m<sup>2</sup>) to be connected to an existing radiator heating system. The ZRU controls the water flow and temperature to suit the underfloor heating system. The ZRU can also be used with conventional underfloor heating systems employing 15 mm diameter polybutylene pipe in single rooms with an area up to 25 m<sup>2</sup>.

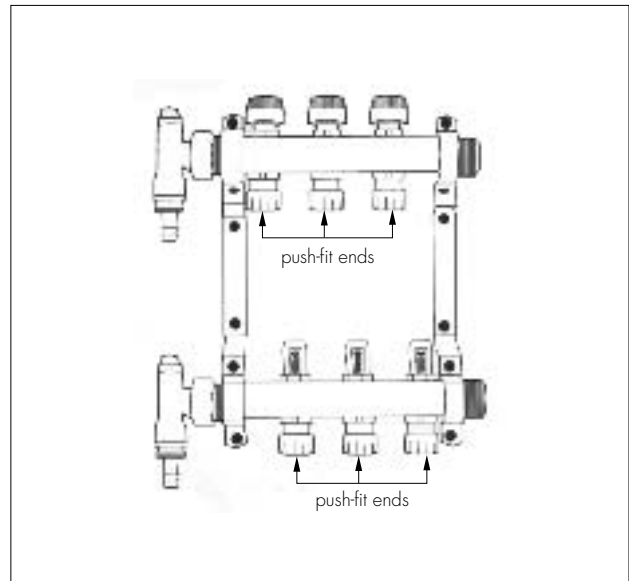
Figure 1 Overlay Floor and End Return Panels



1.2 Ancillary items that can be used with the system are:

- Manifold (see Figure 2) — used where more than one room is fitted with the system and is available with a standard 15 mm diameter connection and 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12 ports. The manifold is supplied with mounting brackets, drain cock and air bleed, and push-fit ends for pipe connection.
- Isolation Valve — 25 mm diameter, available to connect the manifold unit to both the UFCH control pack and the modulating pump unit
- Mixing Valve — available in two sizes, 22 mm and 28 mm
- The UFCH control pack — comprises a pump, two-port motorised valve, mixer valve and isolation valve in one unit
- The Modulating Pump Unit — comprises a modulating pump, mixer valve and thermometer in one unit.

Figure 2 Manifolds



## 2 Delivery and site handling

2.1 Polyplumb PB Barrier Pipe (10 mm and 12 mm diameter) is supplied in coils of 80 m. The pipe bears a continuous mark showing the manufacturer's trademark, maximum operating temperature and pressure, time, day, month and year of production. The pipes are marked BARRIER in red at regular intervals. The pipes are wrapped in yellow packaging with the legend 'barrier pipe' on the label to distinguish them from non-barrier Polyplumb pipes. Pipes are marked with the BBA Certificate number and Detail Sheet number (BBA 00/3699 DS6).

2.2 Once unwrapped, pipes should be stored indoors or in a shaded area to prevent ultraviolet degradation.

2.3 Overlay Floor Panels are supplied shrink-wrapped on a pallet of either 10 (approximately 4.8 m<sup>2</sup> floor coverage) or 30 panels (approximately 14.4 m<sup>2</sup> floor coverage). The panels should be stored on their pallets, indoors, on a level surface until ready for installation to prevent site damage.

## Design Data

### 3 General

3.1 The Polyplumb Overlay Floor Heating System is suitable for use in domestic and commercial buildings, and can be installed in new or existing buildings with concrete and timber floors.

3.2 Walls and ground-supported sub-floors of existing buildings must incorporate suitable damp-proof courses and membranes to prevent ground moisture reaching the inside of the building. Where a concrete sub-floor does not already incorporate suitable damp-proofing, a polyethylene membrane

of 250 micron thickness should be laid over the sub-floor.

3.3 The system is controlled by either a manifold and a modulating pump unit (for multi-room installations) or a ZRU (for single rooms with an area up to 25 m<sup>2</sup>).

3.4 Care must be taken during installation to ensure that no damage occurs to the pipe, eg by nail penetration.

## 4 Design procedure

4.1 The heating demands for particular rooms are evaluated as detailed in the CIBSE Guide 1980, Part A *Structural Design*. Such designs are outside the scope of this Detail Sheet.

4.2 In new-build applications, floor construction must be designed to comply with the relevant technical specifications selected from:

BS 8110-1 : 1997

BS 5268-2 : 2002

the national Building Regulations:

### *England and Wales*

Approved Document A 1/2, Section 1B

### *Scotland*

Mandatory Standard 1.1(a)(b), clause 1.1.1<sup>(1)(2)</sup>.

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

### *Northern Ireland*

Technical Booklet D.

## 5 Safe working temperatures and pressures

5.1 The maximum permissible operating temperature of the system is 50°C. This temperature is maintained at the inlet to the manifolds, or ZRU by a mixing valve set at 50°C.

5.2 The safe operating pressure and maximum temperature rating for 10 mm and 12 mm Polyplumb PB Barrier Pipe is 7 bar at 82°C. The pipe can operate at 3 bar at 114°C for a limited period in the event of a malfunction. This ensures that there is an adequate safety factor to prevent damage to the pipe in the event of a boiler thermostat or other control failure.

5.3 The ZRU supplements the water flow which ensures that the Polyplumb Overlay Floor Heating System is not reliant on the pump pressure from the existing heating system. Water is thermostatically blended by the unit to provide safe flow of temperature-controlled water around the Overlay Panel piping. Sensors ensure that the unit only operates when heated water is available from the existing heating system.

## 6 Practicability of installation

The Polyplumb Overlay Floor Heating System and ZRU can be installed under normal site conditions.

## 7 Chemical resistance

7.1 The materials used in 10 mm and 12 mm Polyplumb PB Barrier Pipe will not be adversely affected by accidental contact with linseed oil-based sealing compounds or soldering flux, although these materials must not be used in making joints to the pipe.

7.2 Polybutylene pipe will be unaffected by soft, hard or aggressive, potable water.

## 8 Properties in relation to fire

Where the Polyplumb PB Barrier Pipe passes through elements of structure, compartment walls, and floors or cavity barrier the opening should be fire-stopped to prevent the passage of smoke and flame. However, such fire-stopping provisions must permit thermal movement.

## 9 Maintenance

9.1 The system does not require special maintenance. All peripheral items, ZRU and control equipment may be replaced easily.

9.2 If the heat output from the system reduces during its lifetime it may be necessary to periodically flush the pipework to remove any residue that may have formed.

## 10 Durability

10.1 The Polyplumb Overlay Floor Heating System is made from durable materials that have a life at least equivalent to that expected from a traditional installation with pipes and fittings, when incorporated in correctly designed systems.

10.2 The EVOH oxygen barrier of the Polyplumb pipe virtually eliminates the diffusion of oxygen into the heating system. Provided the system is correctly installed, the requirements for the addition of a corrosion inhibitor<sup>(1)</sup> will be the same as that for a traditional installation with metal pipes and fittings.

(1) It is recommended that such a corrosion inhibitor is used.

10.3 The manifolds, ZRU, mixer valves and other components of the system are constructed from materials known to be durable in plumbing applications. They may require replacement within the life of the Polyplumb PB Barrier Pipe.

## Installation

### 11 General

11.1 Installation of the Polyplumb Overlay Floor Heating System must be carried out in accordance with the manufacturer's Installation instructions and BS 6700 : 1997. General installation details are shown in Figure 3.

11.2 The installation of the system must be carried out on a level, clean and dry surface, using a self-levelling compound to fill any minor dips. During installation, self-levelling granules can also be brushed in to fill any minor dips under the panels.

11.3 All skirting boards should be removed prior to commencing installation.

11.4 Walls and ground-supported sub-floors must incorporate suitable damp-proof courses and membranes to prevent ground moisture reaching the inside of the building. Where a concrete sub-floor does not already incorporate suitable damp-proofing, a polyethylene membrane of 250 micron thickness should be laid over the sub-floor, allowing a 75 mm overlap at the sides and edges to be fixed behind the skirting board. Care must be taken to ensure the dpm is not pierced during the entire installation.

11.5 During installation, adequate ventilation to the room is required to avoid dust build-up when cutting panels.

### 12 Procedure

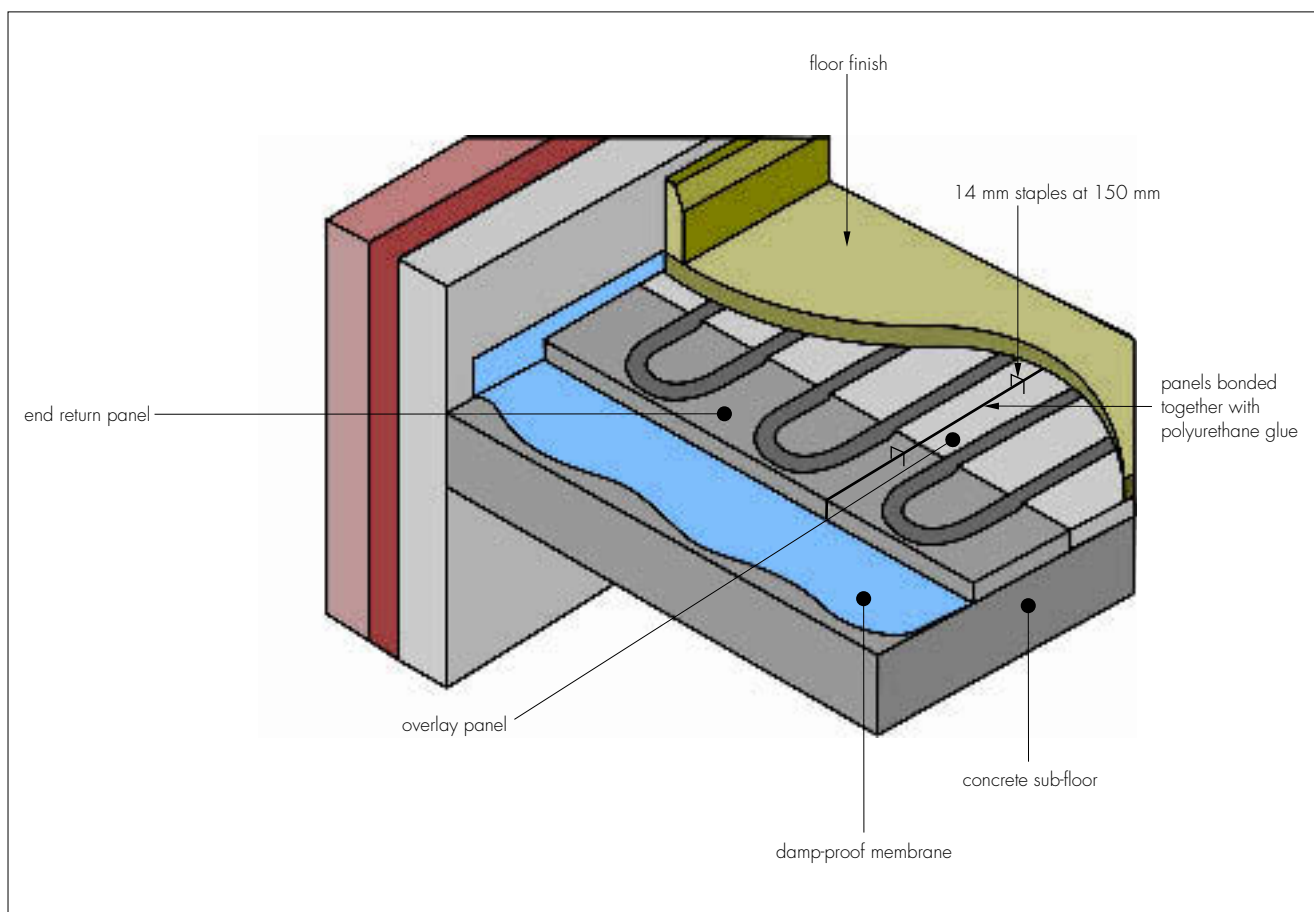
12.1 The orientation of the panels and pipe runs are made in the direction of the longest edge of the room with the return bends on the shortest walls. This will ensure the minimum required amount of return bends.

12.2 The first two return bend panels are placed at each end of the room.

12.3 Using an expanding polyurethane adhesive, a continuous bead of glue is applied to the end of the first panel and laid against the return bends, ensuring the bead is at the centre of the board and that the glue does not flow into the pipe grooves or on top of board surface. Care must be taken that the corners of the overlay panels are not broken when moving and glueing.

12.4 Overlay Panels must be jointed within 10 minutes of applying the adhesive and must not be walked on for a further 10 to 15 minutes to ensure joints are not broken by movement whilst the adhesive sets. Adhesive should only be applied to the end of each panel prior to butting up the previous panel.

Figure 3 Typical installation



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12.5 When the two return bends and the overlay panel are in place the joint is stapled using Type 80, 14 mm staples, every 150 mm across the joints between the panels. The staples should be central between the pipe grooves in the panels.

12.6 When nearing the end of the first run of panels, an allowance is made for the return bends and a panel is cut to size to complete the run using a handsaw or an electric jigsaw set at a slow speed. To ensure the overlay panels are correctly aligned with the Return End Panels, four short pieces of Polyplumb pipe can be used across the joints of the panel grooves.

12.7 Flow and return pipes are run at the sides/ends of rooms.

12.8 The panels are laid along the length of the room with staggered joints and the end returns along the wall as work proceeds backwards.

12.9 All dust and debris must be removed from the pipe grooves prior to fitting pipes into the panel grooves.

12.10 The pipe is inserted into the grooves and care taken to avoid kinking the pipes. If necessary, a soft head mallet can be used to tap the pipes carefully into the grooves. Enough pipe should be allowed at the start and end of each circuit to connect to the ZRU or manifolds.

12.11 When the pipe is installed, the system can be connected to the ZRU, covering pipes entering and exiting the ZRU using the ZRU Pipe Shroud. The pipes are connected to the Polyplumb ZRU (if used) using a 15 mm by 12 mm brass adaptor or a 15 mm by 10 mm PB adaptor. Multiple circuits can be accommodated by using 15 mm Polyplumb tees and elbows and manifolds. All normal installation procedures must be observed when installing Polyplumb pipes and fittings.

12.12 The system is filled and pressure tested in accordance with the *Polyplumb Design and Installation Guide*.

12.13 The positioning of the ZRU and manifold (if appropriate) is determined by the most convenient location of heating supply. The final return is run along the short edge of the room back to the ZRU or manifold.

12.14 When the room floor dictates that more than one circuit is required, the system flow from the ZRU is taken to the furthest point, working back to the unit. This will ensure the furthest run is the warmest.

## Finishing

12.15 Any excess adhesive can be removed with a chisel.

12.16 Tiles or wood/laminate floor can be applied directly over the system using staples, ensuring not to staple through pipes.

12.17 It is recommended that a 4 mm thick waterproof plywood cover is installed over the overlay panels and pipes when carpet is to be fitted as the floor finish.

12.18 Once the floor covering has been applied, the skirting board can be fixed by floating above the finished floor.

## Technical Investigations

The following is a summary of the technical investigations carried out on the Polyplumb Overlay Floor Heating System.

### 13 Tests

Test evidence was examined relating to:

- dimensional accuracy
- effect of thermal cycling on pipes and fittings
- long-term hydrostatic pressure resistance of pipe
- hydrostatic pressure resistance of manifolds
- resistance to cyclic pressure
- pull-out resistance of manifold connections
- performance of the mixing valve
- thermal and flow performance of a system when controlled by a ZRU.

### 14 Investigations

14.1 An examination was made of data relating to:

- thermal stability of oxygen diffusion barrier
- behaviour in fire
- chemical resistance
- effect of materials on water quality
- practicability of installation
- durability.

14.2 The *Polyplumb Design and Installation Guide* was examined and compared to conventional practice in the UK.

14.3 The factory production control was examined and found to be in accordance with the guidance on quality control testing given in BS 7291-2 : 2001. The pipe and fittings are covered by the Kitemark.

## Bibliography

BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*

BS 6700 : 1997 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages*

BS 7291-2 : 2001 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Specification for polybutylene (PB) pipes and associated fittings*

BS 8110-1 : 1997 *Structural use of concrete — Code of practice for design and construction*



On behalf of the British Board of Agrément

Date of Second issue: 15th May 2006



Chief Executive

*\*Original Detail Sheet was issued 14th February 2005. This amended version includes omission of damp-proof membrane and associated items as supplied items and reference to the revised national Building Regulations.*



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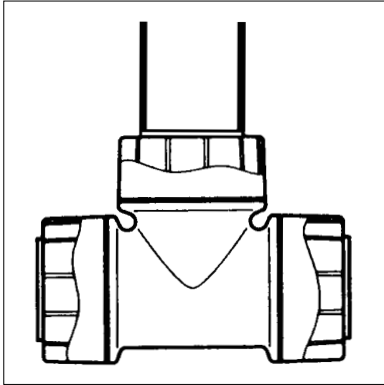
Polypipe Building Products Ltd

Certificate No 00/3699

**POLYPLUMB IRISH PB  
BARRIER PIPE AND FITTINGS**

**DETAIL SHEET 7**

## Product



• THIS DETAIL SHEET RELATES TO POLYPLUMB IRISH PB BARRIER PIPE AND FITTINGS OF 1/2", 3/4", and 1" NOMINAL DIAMETERS.

• The pipes and fittings are for use in hot and cold water and central heating.

• The pipes and fittings are suitable for use for those service conditions defined as Class S in BS 7291-1 : 2001.

• These products are marketed by Polypipe (Ireland), Dromore Road, Lurgan, Craigavon, County Armagh BT66 7HL; Tel: 028 3888 1270, Fax: 028 3882 2344.

This Detail Sheet must be read in conjunction with the Front Sheets, which give the product's position regarding the Building Regulations and the Conditions of Certification respectively.

## Technical Specification

### 1 Description

1.1 Polyplumb Irish PB Barrier Pipe and Fittings are manufactured from polybutylene (PB) and are grey in colour. The pipes and fittings are available in three sizes: 1/2", 3/4" and 1".

1.2 The pipe consists of five layers, comprising PB, adhesive, ethylene vinyl alcohol (EVOH), adhesive and PB. In the middle of the pipe wall is an oxygen diffusion barrier of between 0.10 mm and 0.12 mm thick. This barrier is an EVOH polymer layer with hot melt adhesive layers on either side of the barrier. The dimensions can be seen in Table 1.

Table 1 Pipe dimensions

| Nominal pipe size              | 1/2" | 3/4" | 1"   |
|--------------------------------|------|------|------|
| Minimum wall thickness (mm)    | 1.65 | 2.05 | 2.60 |
| Mid-mean outside diameter (mm) | 14.7 | 21.0 | 27.4 |

1.3 The push-fit fittings are also available in three sizes 1/2", 3/4" and 1" and have a grey body, injection moulded from PB and black nylon cap-nuts. The range covered by this Detail Sheet is shown in Table 2.

1.4 Pipe stiffeners are available for each pipe size and must be inserted into the pipe before jointing. They are manufactured from polysulphone.

1.5 Pipe runs must be secured with Polyplumb Pipe clips. Two types of screw fixed clips are available, snap-fit and bulldog. In addition, nail-in clips are also available for all pipe sizes.

1.6 Cold forming bend fixture is available for 1/2" and 3/4" pipes. The fixtures are used to ensure that bends remain smoothly curved.

Table 2 Range of push-fit fittings

| Fitting type                   | Normal size (inches)        | Product code                                  |
|--------------------------------|-----------------------------|---|
| Coupler                        | 1/2, 3/4, 1                 | PB012, PB034, PB01                            |
| Elbow                          | 1/2, 3/4, 1                 | PB112, PB134, PB11                            |
| Tee                            | 1/2, 3/4, 1                 | PB212, PB234, PB151                           |
| Tank connector                 | 1/2, 3/4                    | PB3812, PB3834                                |
| Tap connector                  | 1/2 x 1/2, 3/4 x 3/4        | PB712, PB 734                                 |
| Bent tap connector             | 1/2 x 1/2                   | PB1712  |
| MBSB adaptor                   | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB4312, PB4334, PB431                         |
| FBSP adaptor                   | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB4412, PB4434, PB441                         |
| FBSP wall plate elbow          | 1/2 x 1/2                   | PB1312  |
| Spigot blanking cap            | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB912, PB934, PB91                            |
| Socket blanking cap            | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB1912, PB1934, PB191                         |
| Pipe stiffener                 | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB6412, PB6434, PB641                         |
| Spares pack                    | 1/2 x 1/2, 3/4 x 3/4, 1 x 1 | PB9512, PB9534, PB951                         |
| Socket x spigot reducer        | 3/4, 1                      | PB1834, PB181                                 |
| Socket x socket reducer        | 3/4                         | PB5834  |
| End reduced tee                | 3/4 x 1/2 x 3/4             | PB1434  |
| Branch reduced tee             | 3/4 x 3/4 x 1/2             | PB1134  |
| Branch and one end reduced tee | 3/4 x 1/2 x 1/2             | PB1534  |
| Shut-off valve                 | 1/2                         | PB3912 <sup>(1)</sup>                         |
| Appliance valve                | 1/2                         | PB6112 <sup>(1)</sup>                         |
| Stop-cock                      | 1/2, 3/4                    | PB2612 <sup>(1)</sup> , PB2634 <sup>(1)</sup> |

(1) Only the Irish push-fit connections of the valves have been assessed by the BBA. The metric connections of the valves are covered by a Kitemark licence and are referenced in Detail Sheet 2 of this Certificate.

1.7 The polybutylene pipe, oxygen diffusion barrier layer and adhesive layers are produced by an extrusion process. Continuous quality control is carried out during manufacture including checks on dimensional accuracy and short-term pressure tests at 20°C and 95°C. The Polypipe Building Products Ltd quality system is registered by BSI Quality Assurance to BS EN ISO 9001 : 2001.

## 2 Delivery to site and storage

2.1 The pipe is supplied in lengths of 3 m or 6 m or in coils of 25 m, 50 m, 100 m, 150 m or 200 m. The pipe bears a continuous mark showing the manufacturer's trademark, maximum operating temperature and pressure, time, day, month and year of production. The pipes are marked BARRIER in green at regular intervals. They are wrapped in green packaging with the legend barrier pipe on the label to distinguish them from non-barrier Polyplumb pipes. The BBA Certificate number is printed directly onto the pipe.

2.2 The fittings and pipe stiffeners are supplied in polythene bags labelled with nominal size, code number and product standard (where applicable).

2.3 The pipe should be transported on a flat-bed vehicle. Straight pipes should be loaded to avoid any overhang or crushing.

2.4 Once unwrapped, pipes should be stored indoors or in a shaded area to prevent ultraviolet degradation; to prevent distortion, pipes should be stored in racks which give support to their whole length.

## Design Data

### 3 General

3.1 Polyplumb Irish PB Barrier Pipe and Fittings are for use in hot and cold water services installations designed in accordance with BS 5955-8 : 2001. The pipes are suitable for use for those applications and service conditions defined as Class S in BS 7291-1 : 2001.

3.2 The products can be installed easily in new or existing buildings.

3.3 Care must be taken during installation to ensure that no damage occurs to the pipe, eg by nail penetration.

### 4 Design procedure

#### Heating design

4.1 The heating demands for particular rooms are evaluated as detailed in the CIBSE Guide A *Environmental Design*, 2006.

4.2 To calculate the pressure drop in the pipes connected to each radiator, the total length of pipe

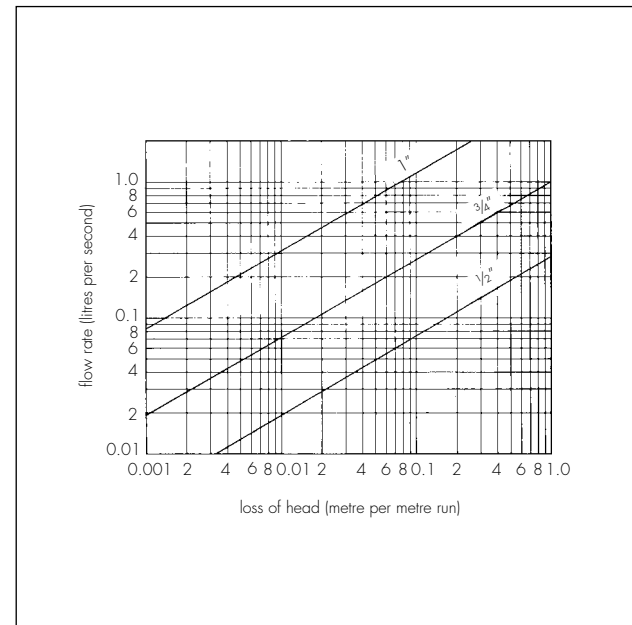
is defined as the sum of the lengths of the flow and return pipes from the boiler to the radiator.



4.3 Where pipes pass through areas not contributing to space heating they should be insulated.

4.4 The flow characteristics of the pipes are calculated using the Colebrook-White equation (see Figure 1).

Figure 1 Flow characteristics at 15°C



### Structural design

4.5 Floor constructions must be designed to comply with the relevant technical specifications selected from:

- BS 8110-1 : 1997
- BS 5268-2 : 2002
- the national Building Regulations.

#### England and Wales

Approved Document A1/2, Section 1B

#### Scotland

Mandatory Standard 1.1(a)(b), clause 1.1.1<sup>(1)(2)</sup>.

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

#### Northern Ireland

Part D *Structure*.

### 5 Safe working temperatures and pressures

The safe operating pressure and maximum temperature rating for the pipe is 7 bar at 82°C. The pipe can operate at 3 bar at 114°C for a limited period in the event of a malfunction. This ensures that there is an adequate safety factor to prevent damage to the pipe in the event of a boiler thermostat or other control failure.

## 6 Practicability of installation

The pipe and fittings are installed easily under normal site conditions.

## 7 Chemical resistance

7.1 The materials used in the pipe will not be adversely affected by accidental contact with linseed oil-based sealing compounds or soldering flux, although these materials should not normally be used in making joints to the pipe.

7.2 Polybutylene will be unaffected by soft, hard or aggressive potable water.

## 8 Effect on water quality

The pipe and fittings have been tested in relation to the above and found satisfactory. The PB material they are manufactured from, is listed in the Water Regulations Advisory Service Directory.

## 9 Properties in relation to fire

Where the pipe passes through an element of structure or cavity barrier the opening should be fire-stopped in a way that will permit thermal movement.

## 10 Flow characteristics

10.1 The bore of the  $\frac{1}{2}$ " ,  $\frac{3}{4}$ " and 1" diameter pipe is less than copper or stainless steel pipe of the equivalent outside diameter. The consequent reduction in flow rate for a given pressure head should be considered when designing hot and cold water distribution or central heating systems.

10.2 The insertion of support sleeves into the pipe does not affect the system flow characteristics.

## 11 Maintenance

11.1 The pipe and fittings do not require special maintenance unless they are damaged.

11.2 In the event of a leak in the pipe, eg due to local damage, repairs can be effected by a plumbing contractor using a new section of pipe.

11.3 To locate a leak in a non-conduit system installation in a suspended wooden floor, the removal of the floor deck may be necessary.

## 12 Durability

12.1 The EVOH oxygen barrier virtually eliminates the diffusion of oxygen into the heating system. Provided the system is correctly installed, the requirements for the addition of a corrosion inhibitor will be the same as that for a traditional installation with metal pipes and fittings.

12.2 The pipe and fittings will have a life at least equivalent to that expected from a traditional installation with metal pipes and fittings.

## Installation

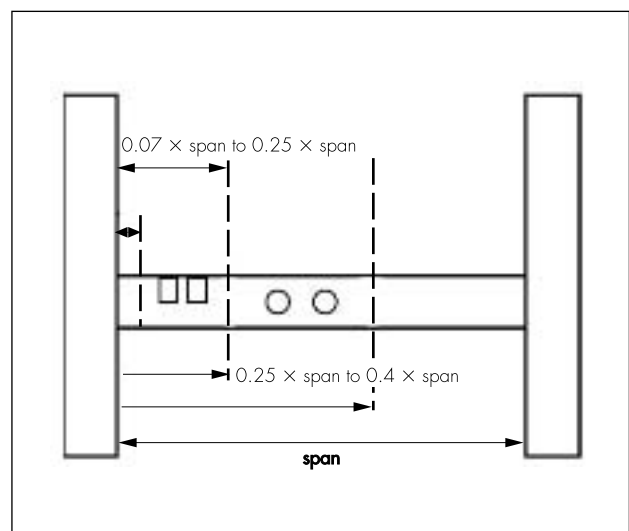
### 13 General

13.1 Installation of Polyplumb Irish PB Barrier Pipe and Fittings must be carried out in accordance with the manufacturer's instructions *Polyplumb Installation Guide and Product Handbook*, BS 5955-8 : 2001 and BS 6700 : 1997. General installation details are shown in Figures 2 and 3.

Figure 2 Installation in a solid floor



Figure 3 Installation in a suspended floor (all dimensions in mm)



13.2 The pipe must not be used within 350 mm of a concentrated heat source, such as a boiler, or in uncontrolled primary heating circuits where the safe operating pressure and maximum temperature rating may be regularly exceeded. The metal (copper) section of pipework should be used to form a transmission piece between the boiler and the first Polyplumb connection. The pipe must not be positioned in locations subjected to direct

sunlight, close to a fire, light fitting or other source of direct heat which would raise the temperature of the pipe above safe limits.

13.3 The pipe is flexible and cannot be used to support fittings, eg circulating pumps or appliances.

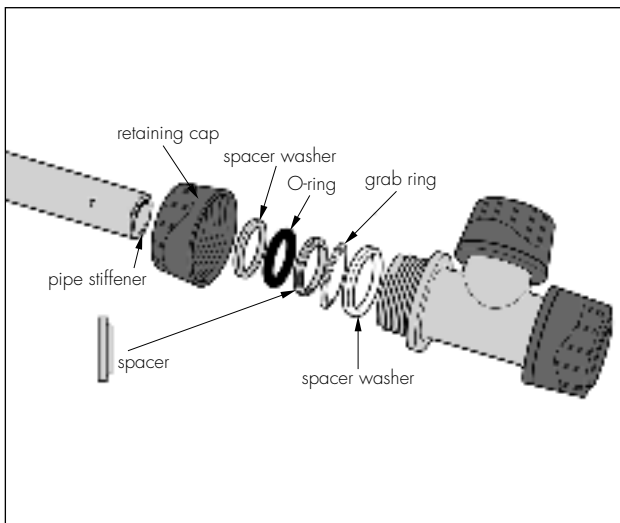
## 14 Procedure

### Joining method

14.1 The pipe is cut to length using Polyplumb pipe cutters (available from Polypipe Building Products Ltd). The cut end is checked to ensure that it is free from burrs, score marks and sharp edges before the polysulphone pipe stiffener is inserted. Wherever possible the pipe should be cut on a depth insertion mark. These 'K' shaped marks are equally spaced along the pipe and indicate the depth required for full insertion into a push-fit fitting.

14.2 Joints can be made using the fittings listed in this Detail Sheet. An example of a joint detail with a fitting and pipe is shown in Figure 4.

Figure 4 Fitting joint detail



14.3 The pipe should be inserted into the fitting to full socket depth, such that the insertion depth mark aligns with the outer end of the cap nut on the fitting. A quick tug on the pipe will confirm that the pipe is inserted past the grab ring. It does not, however, ensure that the pipe is fully inserted, as this can only be confirmed by using the depth insertion mark.

### Over a concrete floor in a screed (see Figure 2)

14.4 When installed in a system, the pipe should be contained in a conduit pipe. The system should be pressure tested before the concrete screed or cement-sand is laid over the conduit pipe. Should pressure testing take place in sub-zero temperatures, or if the system is to be left after pressure testing in sub-zero temperatures, all necessary precautions should be taken to avoid frost damage to radiators and fittings. The thickness of the screed will be dependent upon the loading requirements of the floor, but the cover to the pipe must never be less than 35 mm. The screed should be laid in accordance with the relevant requirements of BS 8204-1 : 2002.

### In a suspended wooden floor (see Figure 3)

14.5 Pipe runs are secured to joists using Polyplumb pipe clips. The recommended spacing of support centres is shown in Table 3.

Table 3 Spacing of support centres

| Nominal diameter of pipe (mm) | Horizontal runs <sup>(1)</sup> (m) | Vertical runs (m) |
|-------------------------------|------------------------------------|-------------------|
| 1/2"                          | 0.3                                | 0.5               |
| 3/4"                          | 0.5                                | 0.8               |
| 1"                            | 0.8                                | 1.0               |

(1) In-line with joists.

14.6 The pipes are secured beneath the joists. Structural timbers should be notched only with the permission of the architect or structural engineer, and in accordance with BS 6700 : 1997, Clause 13.7.9. The system should be pressure tested before nailing down the floor deck.

### Commissioning the system

14.7 When commissioning a system it must be flushed, filled with water, the pump started and residual air removed by opening the bleed valves in each circuit. The system must be checked for leaks after all the air has been removed and before the floor is covered with either concrete or wood.

14.8 A notice should be displayed in buildings when the system is installed, drawing attention to the risks of damage associated with nailing through the floor decks. To minimise this risk, the pipe runs should be kept clear of room perimeters and, where possible, doorways.

The following is a summary of the technical investigations carried out on Polyplumb Irish PB Barrier Pipe and Fittings.

### 15 Tests

Test evidence was examined relating to:

- dimensional accuracy
- effect of thermal cycling on pipes and fittings<sup>(1)</sup>
- oxygen diffusion to DIN 4726 : 2000
- long-term hydrostatic pressure resistance of pipe<sup>(1)</sup>
- hydrostatic pressure resistance of the fittings<sup>(1)</sup>
- resistance to pull-out of assembled joints<sup>(2)</sup>
- short-term hydrostatic pressure resistance of pipe at 20°C<sup>(1)</sup>
- short-term hydrostatic pressure resistance of pipe at 95°C<sup>(1)</sup>
- short-term hydrostatic pressure resistance of assembled pipes and fittings<sup>(2)</sup>
- resistance to cyclic pressure shock of assembled pipes and fittings<sup>(1)</sup>
- elongation of pipe.

(1) To BS 7291-1 : 2001

(2) To BS 7291-2 : 2001.

### 16 Investigations

16.1 An examination was made of data relating to:

- thermal stability of oxygen diffusion barrier
- chemical resistance
- effect of materials on water quality
- practicability of installation
- durability.

16.2 The *Polypipe Polyplumb Design and Installation Guide* was examined and compared to conventional practice in the UK.

16.3 The factory production control was examined and found to be in accordance with the guidance on quality control testing given in BS 7291-2 : 2001.

## Bibliography

BS 5268-2 : 1996 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*

BS 5955-8 : 2002 *Plastics pipework (thermoplastics materials) — Specification for the installation of thermoplastics pipes and associated fittings for use in domestic hot and cold services and heating systems in buildings*

BS 6700 : 1997 *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages*

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

BS 7291-2 : 2001 *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Specification for polybutylene (PB) pipes and associated fittings*

BS 8110-1 : 1997 *Structural use of concrete — Code of practice for design and construction*

BS 8204-1 : 2002 *Screeds, bases and in-situ floorings — Concrete bases and cement sand levelling screeds to receive floorings — Code of practice*

BS EN ISO 9001 : 2000 *Quality management systems — Requirements*

DIN 4726 : 2000 *Warm water floor heating systems and radiator pipe connecting — Piping of plastic materials*



On behalf of the British Board of Agrément

Date of issue: 15th May 2006

A handwritten signature in black ink, appearing to read 'G. A. Cooper', is written over a light grey background.

Chief Executive



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