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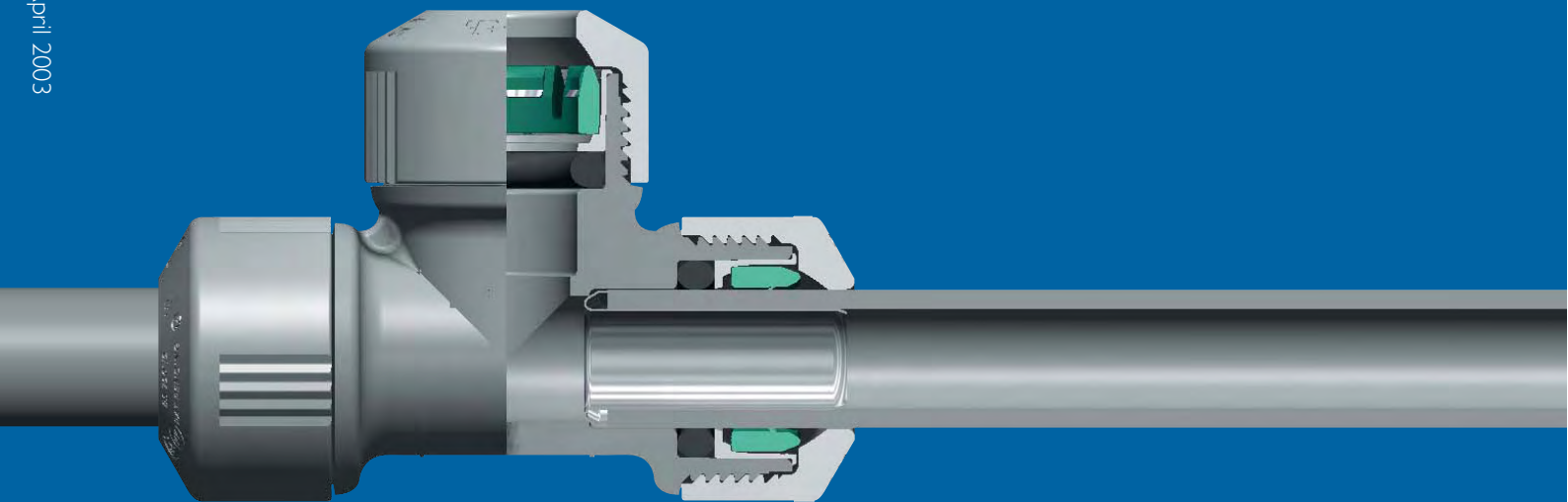
April 2003



Hep₂O[®]

The Flexible
Push-fit
Plumbing System

Technical Handbook



Hep₂O The flexible push-fit plumbing system

Technical Handbook

April 2003





Making Connections

Delivering Results



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Introduction to Hepworth

The Company

Hepworth Building Products is a global company with the vision to provide solutions that assist water cycle management across the world. Here in the UK, we face ever-increasing challenges – from dealing with devastating flooding, to taking responsibility for our environment by using sustainable materials in new and refurbished developments.

Hepworth's three divisions:

- Hepworth Plumbing Products
- Hepworth Drainage
- Hepworth Concrete

manufacture and supply products and services to meet modern challenges and turn vision into reality. All Hepworth products play a key role in realising this vision.

Quality System Standards

The quality of **Hep₂O[®]** plumbing components and materials is assured by the application of the Hepworth Building Products' Quality Management Programme.

This has been assessed and approved, and is regularly monitored by the British Standards Institution and complies with BS EN ISO 9001.



Expertise and Experience

Hepworth Building Products are the most integrated multi-material supplier of products and services, with the knowledge and capability to meet the burgeoning demands of modern day water management. Advice and technical assistance is available to all professional users of the **Hep₂O[®]** flexible, push-fit plumbing system to help design efficient and cost-effective services layouts.

Continuing Research and Development

The innovative **Hep₂O[®]** plumbing solutions are underpinned by a rigorous and continuing research and development programme. This, in turn, is augmented by feedback from customers.

Working with Others

To further consolidate our continuing product development, and ensure current and future building requirements are met, Hepworth Plumbing Products has industrial affiliation with the Institute of Plumbing, the Scottish & Northern Ireland Plumbing Employer's Federation (SNIPEF), and the National Association of Plumbing, Heating & Mechanical Services Contractors (APHC).

Environmental Policy

Hepworth Building Products is committed not only to compliance with environmental laws and the adoption of acceptable standards, but also to the introduction of measures to limit the adverse effects of its operations on the environment.

As a major extractor of raw materials and user of energy, we therefore operate an environmental policy that is fully integrated with all aspects of company activities, to substantially reduce our impact on the environment.

The environmental policy sets the standards for site emissions, noise levels and overall good housekeeping, within a continuous improvement regime using the Best Available Techniques Not Entailing Excessive Costs (BATNEEC) guidelines from the 1990 Environmental Protection Act.

New processes and procedures for both manufacturing and services are systematically assessed to ensure that efficiencies are optimised without sacrificing environmental benefits.



GUARANTEE

As a result of its rigorous Quality Management Programme, Hepworth Building Products offer a 50 year guarantee against defects in materials or manufacturing of all Hep₂O pipe and fittings.



BS 7291





Introduction

Hep₂O[®] is an innovative, flexible, push-fit plumbing system especially developed for use by architects, designers and professional installers.

The **Hep₂O[®]** system is particularly suitable for domestic hot and cold water supply, including potable water, and central heating.

The system comprises flexible 'straight coil' polybutylene pipework connected to polybutylene fittings that incorporate an integral push-fit mechanism. Unlike other forms of coiled plastics pipes, **Hep₂O[®]** pipes utilising 'straight coil' technology do not return to their coiled state when uncoiled from their convenient **SmartPack™** dispensers but instead remain straight with no loss of flexibility. These characteristics provide a significantly faster, safer and more cost effective installation when compared to rigid pipe systems.

With rigid pipe systems, joists must be notched and the pipes installed prior to the laying of flooring boards. This has a number of disadvantages:

- the plumber must work on open joists increasing the risk of injury
- the plumber must return after floors are laid, to connect radiators and other fixtures
- the plumber often finds that the tails originally installed, have been moved by other tradesmen, and must therefore be reinstated.



Flexibility and Adaptability

Flexible pipe on the other hand, can be fixed below previously installed flooring boards because it is easily cabled *through* joists into the correct location, avoiding the awkward manoeuvring associated with the installation of rigid straight lengths. This allows for safer working and for the exact positioning of tails through the floor. There is also less risk of puncturing the pipe with nails used for fixing the flooring boards and therefore no need to use protective devices such as 'joist clips'.

Specially prepared lengths of pipe to form straight and offset connections usually associated with rigid systems are unnecessary as the natural flexibility of the **Hep₂O[®]** polybutylene pipe is used to overcome the likelihood of misalignment, thereby also eliminating dry runs. This flexibility, in conjunction with long coil lengths and guaranteed joint performance, enables installations to be completed with fewer joints, minimising the drop in operational flow rates and potential weak points in the system.

Without the use of flux and solder (and therefore no naked flames or exposure to noxious fumes when working in confined spaces), effective, high performance joints are assured with the unique **Hep₂O[®]** push-fit fittings. Each fitting consists of a high integrity grab wedge and robust pre-lubricated 'O' ring, allowing joints to be formed by the insertion of pipes into fittings using only hand pressure. Available in both Demountable and SlimLine form, the wide variety of fittings is complemented by a comprehensive range of auxiliary and ancillary products. **Hep₂O[®]** fittings are also designed to accept copper as well as **Hep₂O[®]** pipe, enabling rigid and flexible systems to be mixed if required.

The **Hep₂O[®]** System incorporates a comprehensive range of spigot tees and spigot manifold fittings, offering 360° rotation, that can be used individually or in groups to enhance systems based on conventional UK design.

The adaptability of the **Hep₂O[®]** system is further extended with a choice of **Standard Pipe** or **Barrier Pipe**. Barrier pipe incorporates an oxygen barrier within the pipe wall thickness to inhibit oxygen permeation when used for central heating systems. **Hep₂O[®] Underfloor Heating Pipe**, also incorporating an oxygen diffusion barrier, is specially designed for underfloor central heating systems.

Also available is the **Conduit System** that allows access to fittings in walls and floors, and for **Hep₂O[®]** pipes to be withdrawn for inspection. A time and labour saving variation is the **Hep₂O[®] Pipe in Pipe System** that incorporates **Hep₂O[®] Barrier Pipe** in a pre-sheathed conduit ready for underscreed installation.

In addition, straight lengths of **Hep₂O[®]** pipe (as flexible as coiled pipes) are also available mostly for exposed pipework where neatness is important or where only short lengths are required.

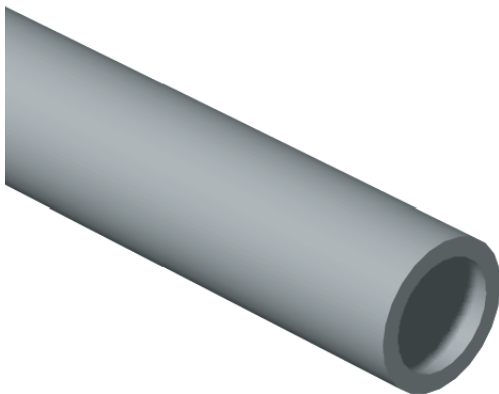
Appearance

Hep₂O[®] pipe, and most of the plastics fittings, are light grey in colour. Other plastics fittings within the range are white. Brass fittings are natural in colour. Radiator and ball valves have chromed or nickel plated brass bodies.

The Handbook

This handbook describes the technical characteristics and uses of the **Hep₂O[®]** system, and its proven advantages over rigid pipe systems.

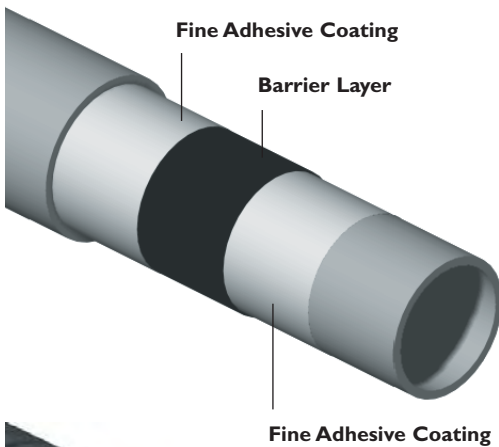




Standard Pipe

Hep₂O[®] Standard Pipe is made from polybutylene in straight coiled or cut lengths, and manufactured to BS 7291: Parts 1 and 2, Class S.

Hep₂O[®] Standard Pipe allows a very small amount of oxygen (not air) to enter the system but is negligible compared with that which can enter via header tanks, valve glands and pumps.



Demountable Fittings

Hep₂O[®] Demountable fittings are made predominantly from polybutylene.

3 precision-made internal components ensure that the push-fitted joint is robust and watertight yet remains rotatable and, if required, easily dismantled.

Barrier Pipe

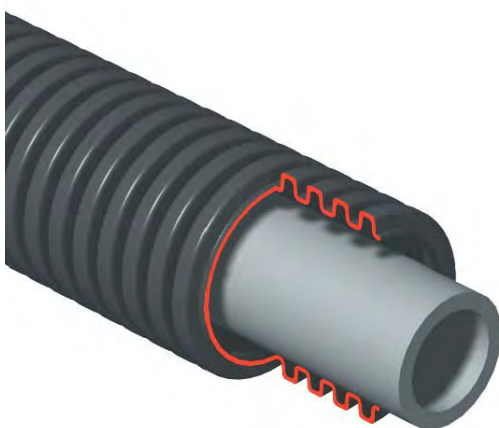
Hep₂O[®] Barrier Pipe has a layer of ethylene vinyl alcohol that prevents the diffusion of oxygen through the pipe wall. The barrier layer also has a fine adhesive coating on each side thus making 5 layers in total.

Hep₂O[®] Barrier Pipe, available in straight coiled or cut lengths, is covered by Agrément Certificate 92/2823 and manufactured to BS 7291: Parts 1 and 2, Class S.



Conduit Pipe

Hep₂O[®] Conduit Pipe is made from flexible polypropylene. It forms part of the **Hep₂O[®]** Conduit System that allows pipes to be withdrawn for inspection.



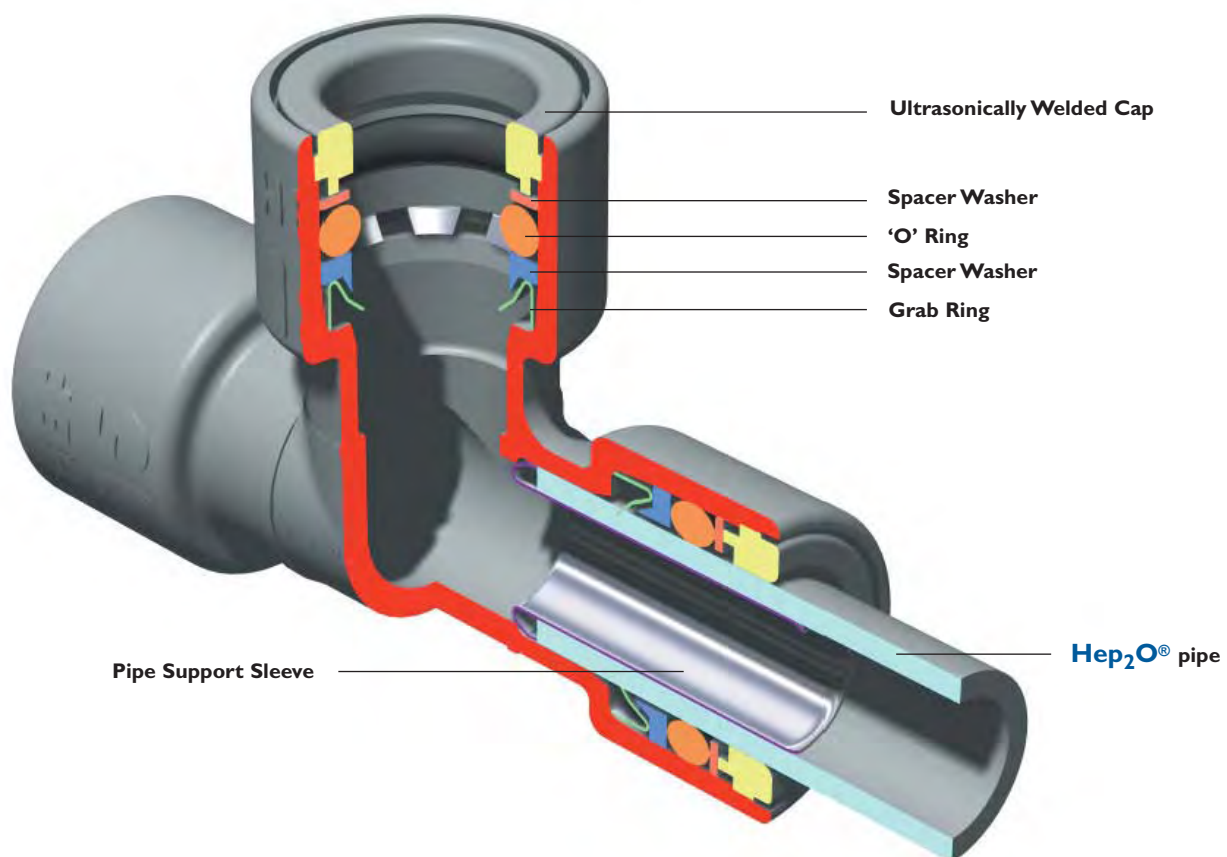
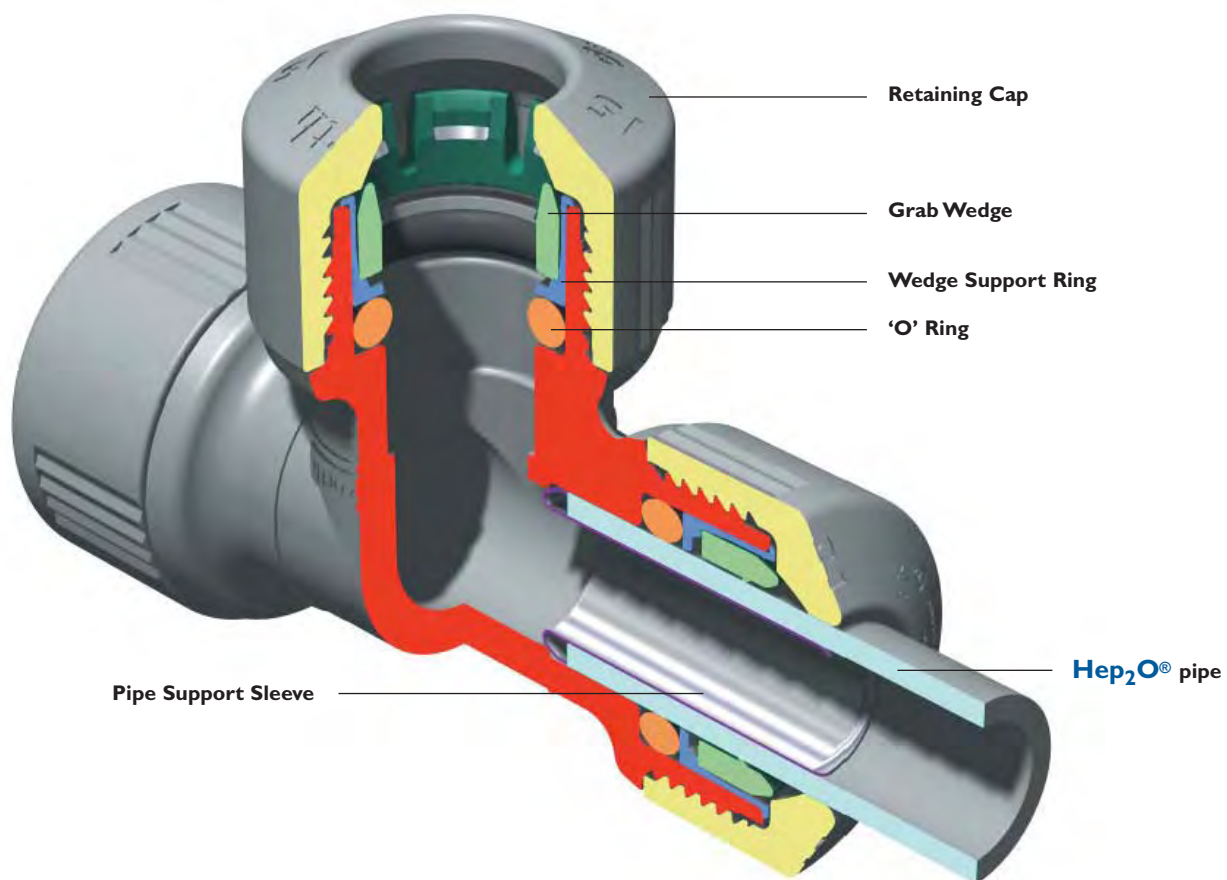
SlimLine Fittings

Hep₂O[®] SlimLine fittings are made predominantly from PVDF.

4 precision-made internal components ensure that the push-fit joint is robust and watertight yet remains rotatable but cannot be dismantled.

Pipe in Pipe System

Hep₂O[®] Pipe in Pipe system incorporates **Hep₂O[®]** 15mm Barrier Pipe in a pre-sheathed plastics Conduit ready for underscreed installation, saving time and effort.



The Basics of Cutting and Jointing



Stage 1

Use only **Hep₂O[®]** Pipe Cutters (types HD74, HD75, HD77 or HD78) to cut the pipe. Never use a hacksaw.

Whenever possible, cut the pipe at the 'V' marks provided.

To ensure a clean, square cut, rotate the pipe whilst maintaining pressure on the cutter until the pipe is severed.



Stage 2

Ensure the pipe end is clean, and free from burrs and surface damage.

Insert a **Hep₂O[®]** Support Sleeve (HX60) into the pipe end.



Stage 3

Push the pipe firmly into the pre-lubricated fitting.

A secure joint has been made when the end of the retaining cap has reached the next 'V' mark on the pipe.

Never knock the fitting onto the pipe, or slacken the retaining cap prior to pipe insertion as these actions will not ease jointing.



Stage 4

Tug back on the pipe to ensure the grab wedge engages correctly.

Do not undo the retaining cap after pipe insertion.



Typical Plumbing Connections



Wash hand basin 10mm



Bath



Wash hand basin 15mm



Washing machine/dishwasher



Sink



Cylinder cupboard



W.C.



Cylinder cupboard



Boiler

Installation Benefits

Cabling Ability

The flexibility of **Hep2O®** enables pipework to be threaded or 'cabled' through holes in the centre of joists without the need for top notching. As a result:

- flooring boards can be laid before pipes are installed.
- balancing on open joists is no longer necessary.
- the risk of pipes being damaged by nails during or after construction is eliminated.
- other trades can progress more quickly and safely.
- there will be less contact noise from expanding heating pipes because a hole drilled through the centre of a joist can be twice the size allowed for a notch.



Straight Coil Technology

Straight coiled **Hep2O®** pipes are dispensed from their packaging in a controlled manner, only releasing the amount of pipe required.

Less Jointing

Supplied in 25, 50 and 100 metre coils, **Hep2O®** pipework can be cabled in long continuous runs, therefore:

- fewer straight connectors and 90° bends are needed, as the pipe is flexible.
- less risk of installer error.
- minimises potential reduction in operational water flow rates.
- fewer weak points in the system.

Low Wastage

Supplied in lengths of 25, 50 and 100 metres, fewer short ends of **Hep2O®** pipe are created when pipes are cut to length.

Measured and Cut In-Situ

During installation, **Hep2O®** pipe can be held alongside a fitting, cut at the insertion depth, and then inserted into the fitting. This:

- reduces installation time, especially where bends are required.
- eliminates setting up of 'dry runs' usually required for rigid systems.



High Impact Resistance

Hep2O® pipes resist impact by momentarily deforming and then returning to shape.

Rotatable Fittings

Hep2O® fittings will rotate even under pressure, allowing for flexible installation practices, and includes:

- folding back valves when not in use to create more space in cylinder cupboards.
- designing pumps to swing out of inaccessible positions without being disconnected.



Easily Handled

Supplied in coils and about one quarter the weight of lengths of rigid copper pipe, **Hep2O®** is:

- easier to carry and manoeuvre on site and requires 40% less space for storage.
- lighter and easier to manoeuvre when installing long runs of pipe.



'Less Risk' Jointing

Hep2O® fittings do not require soldered joints. As a result:

- no naked flame to potentially harm people or damage property.
- no build-up of noxious fumes within confined spaces.
- **Hep2O®** is a clean installation as no flux is needed, keeping hands free of dirt and reducing contamination of other fittings.



Jointing Compatibility

Hep2O® pipe and fittings are designed to be compatible with traditional pipe materials and jointing techniques.





Performance Benefits

No Scale Build-Up

The smooth bore of **Hep2O**® pipes, and also their tendency to expand, prevents accumulations of lime scale when used in hard water areas. Therefore:

- the pipes will retain their bore throughout their life.
- maintenance costs are reduced.
- fuel costs are reduced.



Corrosion Free

In soft water areas **Hep2O**® pipes will remain corrosion free.



No Burst Pipes

Hep2O® pipe will accommodate the increase in volume that happens when water changes to ice, and then return to its original shape during a thaw, ready again to accommodate further freezing.



Suitable for Potable Water

Hep2O® polybutylene pipe and fittings do not taint or reduce the quality of potable water.

Quieter in Use

The flexible nature of polybutylene results in **Hep2O**® installations being almost silent. This is due to:

- the use of bends as an integral part of the pipe length, instead of 90° elbows, which creates less turbulence in the system again reducing noise levels. (1)
- less contact noise between expanding heating pipes and adjacent construction because of generous sized cabling holes. (2) See also 'Cabling Ability'.
- the drastic reduction of noise problems associated with 'water hammer'.



Cooler to the Touch

The lower diffusivity of polybutylene relative to that of copper results in pipework being cooler to the touch.

This property also reduces the risk of condensation on cold pipes.



Solder Free

The robust push-fit mechanism requires no need for solder, thereby ensuring that a **Hep2O**® installation conforms to the requirements of the Water Regulations.



Easily Modified

A cold or hot water system can be easily extended when using **Hep2O**® push-fit plumbing, thereby affording considerable flexibility in design.

Hep2O® Demountable or SlimLine pipe fittings can also be easily blanked off temporarily during installation for later connection of services equipment. (1 and 2)

Last-minute alterations can be made to joints using Demountable fittings, with the aid of the Wedge Removal Tool (HX79) obtainable from Hepworth. (3)



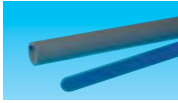
Pipes



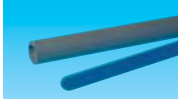
Straight Coiled Pipe Standard
(p.12)



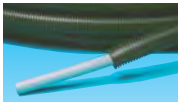
Straight Coiled Pipe Barrier
(p.12)



Cut Length Standard
(p.13)



Cut Length Barrier
(p.13)



Pipe in Pipe System
(p.13)

Demountable Fittings



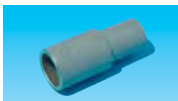
Straight Connector
(p.14)



Socket Reducer
(p.14)



Adaptor
(p.14)



Double Spigot Reducer
(p.15)



Elbow 90°
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Elbow 90° Single Socket
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Bend 135° Single Socket
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Equal Tee
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End Reduced Tee
(p.16)



Branch Reduced Tee
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Branch & One End Reduced Tee
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Branch Reduced Tee - Spigot
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Tank Connector
for cold water use only
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Straight Tap Connector
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Bent Tap Connector
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SlimLine Fittings



Straight Connector
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Socket Reducer
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Elbow 90°
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Elbow 90° Single Socket
(p.20)



Equal Tee
(p.20)



End Reduced Tee
(p.20)



Branch Reduced Tee
(p.21)



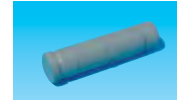
Branch & One End Reduced Tee
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Straight Tap Connector
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Bent Tap Connector
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Blanking Plug
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Auxiliary Fittings



Adaptor - Male BSP/Hep₂O[®]
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Adaptor - Female BSP/Hep₂O[®]
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Adaptor - Male BSP/Hep₂O[®]
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Adaptor - Female BSP/Hep₂O[®]
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Draincock
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Adaptor - Tap Connector
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Cylinder Connector
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Gate Valve - Hot/Cold
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Stopcock - Cold Water, Hep₂O[®]/Hep₂O[®]
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Stopcock - Cold Water, Hep2O®/MDPE
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Lever Ball Valve
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Thermostatic Radiator Valve
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Radiator or Lockshield Valve
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Two Port Manifold - Closed Spigot
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Two Port Manifold - All Socket
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Four Port Manifold - Closed Spigot
(p.29)



Four Port Manifold - All Socket
(p.30)



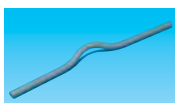
Four Port Manifold - Closed Spigot, Ports One Side
(p.30)



Four Port Manifold - All Socket, Ports One Side
(p.30)



Radiator Connectors & Escutcheon Plates
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Pipe Step Over
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Ancillary Items



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Pipe Clip - Screw Type
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Pipe Clip Spacer
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Pipe Clip - Cable Type
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Fitting Clip
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Conical Tap Connector Washer
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Flat Tap Connector Washer
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Blanking Peg - Demountable Fittings
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Wedge Removal Tool - Demountable Fittings
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Copper Pipe Cut End Protector
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'O' Ring Seal
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Grab Wedge
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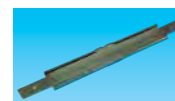
Conduit System



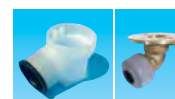
Conduit Pipe
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Conduit Junction Box
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Terminal Back Plate
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Accessories



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Hep2O® Central Heating & Water Services Calculator
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Hep2O® Joint Test Kit
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Routabout System



Spacer Ring
(p.40)



Cutter
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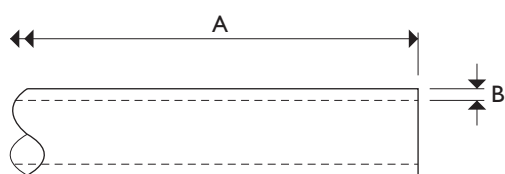


Template
(p.40)

All product dimensions on the following Product Range pages, are in mm unless otherwise stated

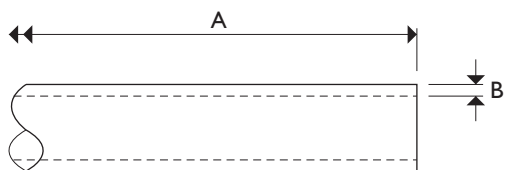
Hep₂O[®] Pipes

Straight Coiled Pipe - Standard



Code	Nominal Diameter	A	B
HXP50/10	10	50m	1.65
HXP100/10	10	100m	1.65
HXP25/15	15	25m	1.85
HXP50/15	15	50m	1.85
HXP100/15	15	100m	1.85
HXP25/22	22	25m	2.15
HXP50/22	22	50m	2.15

Straight Coiled Pipe - Barrier

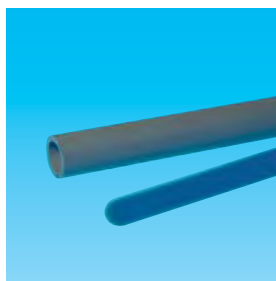
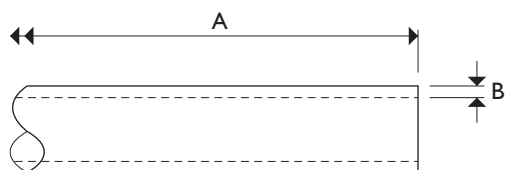


Code	Nominal Diameter	A	B
HXX50/10	10	50m	1.65
HXX100/10	10	100m	1.65
HXX25/15	15	25m	1.85
HXX50/15	15	50m	1.85
HXX100/15	15	100m	1.85
HXX25/22	22	25m	2.15
HXX50/22	22	50m	2.15
HXX25/28	28	25m	2.75
HXX50/28	28	50m	2.75



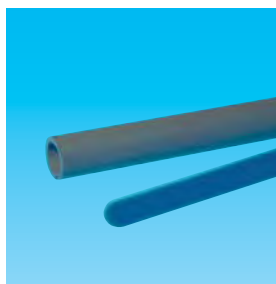
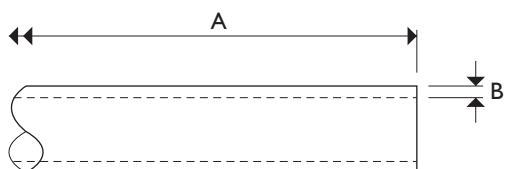
Hep₂O® Pipes

Cut Lengths - Standard



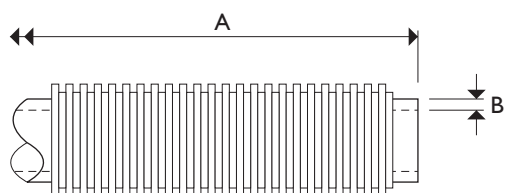
Code	Nominal Diameter	A	B
HXP03/15	15	3m	1.85
HXP06/15	15	6m	1.85
HXP03/22	22	3m	2.15
HXP06/22	22	6m	2.15
HXP03/28	28	3m	2.75
HXP06/28	28	6m	2.75

Cut Lengths - Barrier



Code	Nominal Diameter	A	B
HXX03/15	15	3m	1.85
HXX06/15	15	6m	1.85
HXX03/22	22	3m	2.15
HXX06/22	22	6m	2.15
HXX03/28	28	3m	2.75
HXX06/28	28	6m	2.75

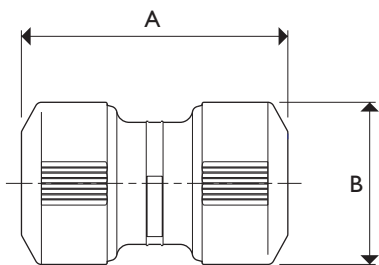
Pipe in Pipe System



Code	Nominal Diameter	A	B
HXXC2515	15	25m	1.85
HXXC5015	15	50m	1.85

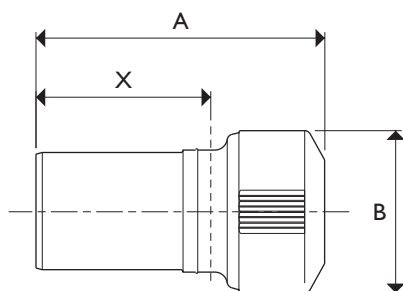
Hep₂O[®] Demountable Fittings

Straight Connector



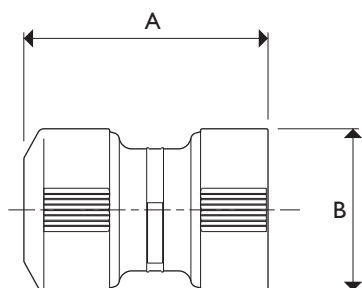
Code	Nominal Diameter	A	B
HD1/10	10	57	24
HD1/15	15	62	31
HD1/22	22	65	39
HD1/28	28	76	48

Socket Reducer



Code	Nominal Diameter	A	B	X
HD2/15	15	53	24	28
HD2/22	22	63	31	31
HD2/28	28	70	39	38

Adaptor

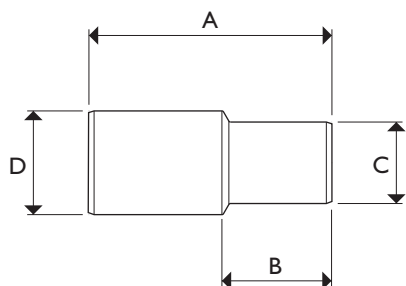


Code	Nominal Diameter	A	B
HD3A/22	22	61	39



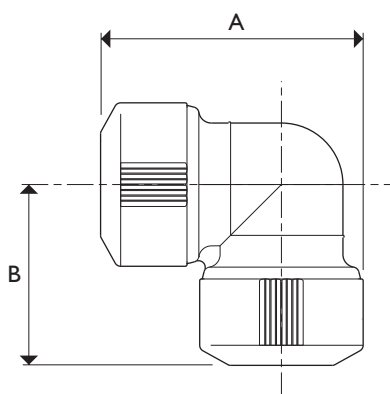
Hep₂O® Demountable Fittings

Double Spigot Reducer



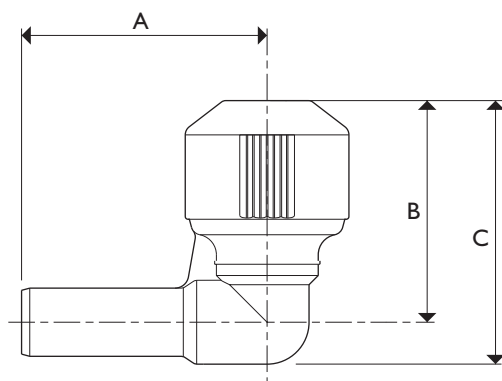
Code	Nominal Diameter	A	B	C	D
HX310/15 (Plastics)	15	51	23	10	15
HX42/10 (Brass)	10	40	19	8	10
HX42/28 (Plastics)	28	67	30	22	28

Elbow 90°



Code	Nominal Diameter	A	B
HD5/10	10	43	31
HD5/15	15	53	37
HD5/22	22	66	43
HD5/28	28	75	52

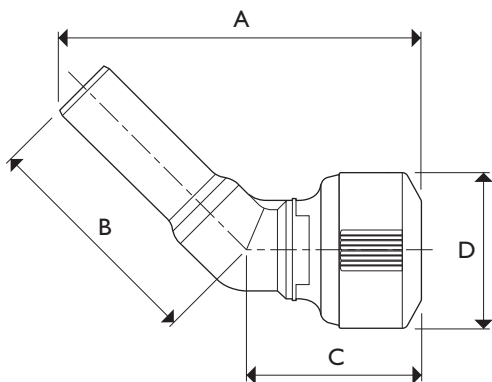
Elbow 90° Single Socket



Code	Nominal Diameter	A	B	C
HD4/10	10	37	28	34

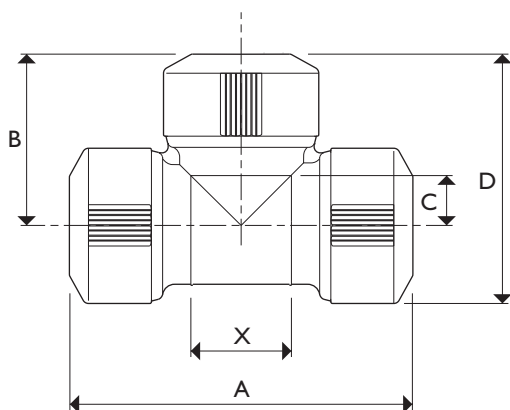
Hep₂O[®] Demountable Fittings

Bend 135° Single Socket



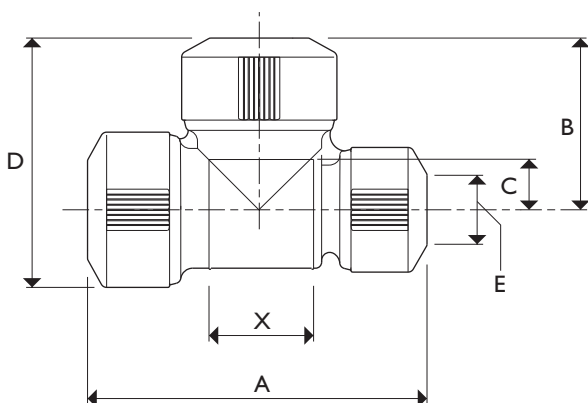
Code	Nominal Diameter	A	B	C	D
HD8/10	10	51.3	35	23	24
HD8/15	15	64.8	41	30.5	31
HD8/22	22	73.6	45	34	39

Equal Tee



Code	Nominal Diameter	A	B	C	D	X
HD10/10	10	63	31	7	43	15
HD10/15	15	75	38	9	54	19
HD10/22	22	85	42	12	61	25
HD10/28	28	105	53	16	75	30

End Reduced Tee

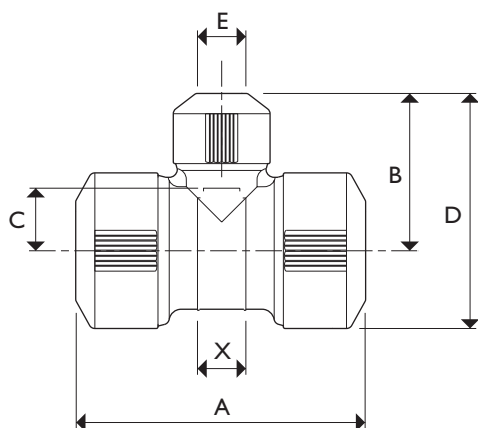


Code	Nominal Diameter	A	B	C	D	E	X
HD12/22	22	84	42	12	62	15	26
HD12/28	28	96	53	16	76	22	31



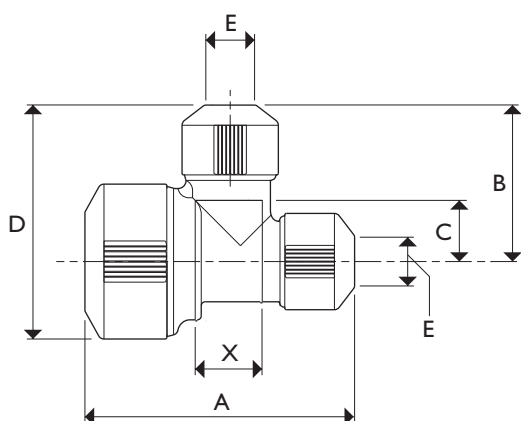
Hep₂O® Demountable Fittings

Branch Reduced Tee



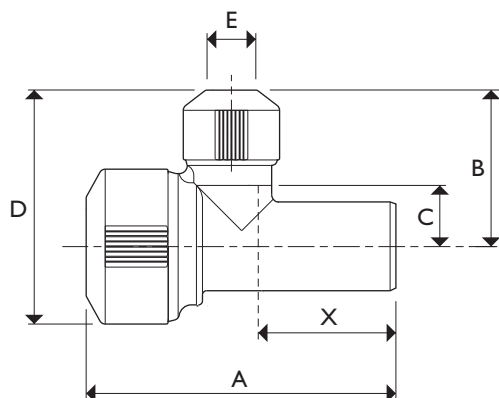
Code	Nominal Diameter	A	B	C	D	E	X
HD13/15	15	64	30	11	45	10	14
HD13/22	22	77	40	13	60	15	17
HD13A/22	22	73	40	16	58	10	12
HD13/28	28	98	45	18	77	22	23
HD13A/28	28	96	46	18	71	15	16

Branch & One End Reduced Tee



Code	Nominal Diameter	A	B	C	D	E	X
HD14/15	15	65	36	12	51	10	12
HD14/22	22	76	40	12	60	15	18
HD14A/22	22	68	40	16	59	10	13
HD14/28	28	89	45	17	67	22	25

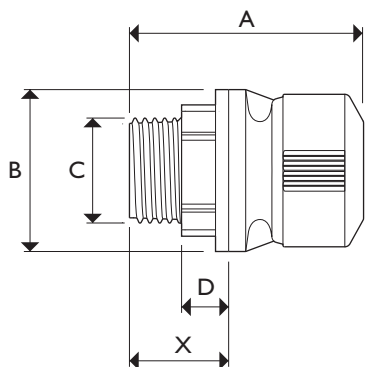
Branch Reduced Tee - Spigot



Code	Nominal Diameter	A	B	C	D	E	X
HD15/15	15	71	30	11	46	10	41
HD15/22	22	81	33	9	56	15	54

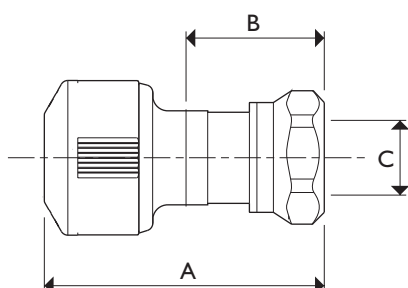
Hep₂O[®] Demountable Fittings

Tank Connector



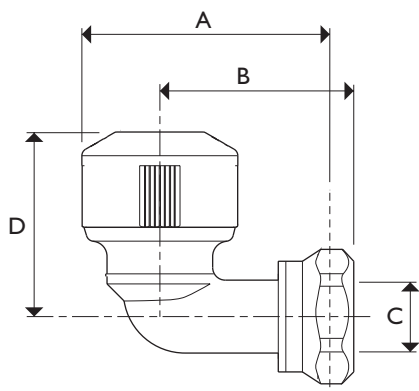
Code	Nominal Diameter	A	B	C	D	X
HX20/15	15	55	34	3/4" BSP	13	22
HX20/22	22	57	41	1" BSP	12	24

Straight Tap Connector



Code	Nominal Diameter	A	B	C
HD25A/15	15	56	29	1/2" BSP
HD25B/15	15	56	29	3/4" BSP
HD25B/22	22	58	30	3/4" BSP

Bent Tap Connector

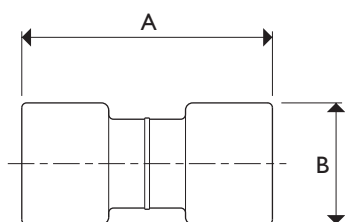


Code	Nominal Diameter	A	B	C	D
HD27/15	15	52	48	1/2" BSP	37



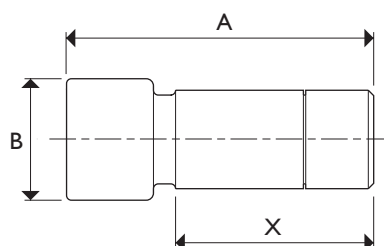
Hep₂O® SlimLine Fittings

Straight Connector



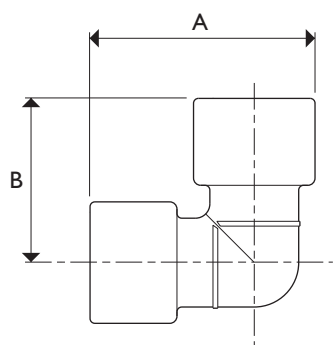
Code	Nominal Diameter	A	B
HX1/10	10	43	19
HX1/15	15	52	25
HX1/22	22	54	32

Socket Reducer



Code	Nominal Diameter	A	B	X
HX2/15	15	47	19	24
HX2/22	22	52	25	24

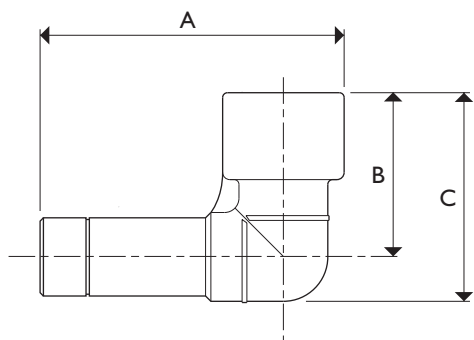
Elbow 90°



Code	Nominal Diameter	A	B
HX5/10	10	37	27
HX5/15	15	47	34
HX5/22	22	55	39

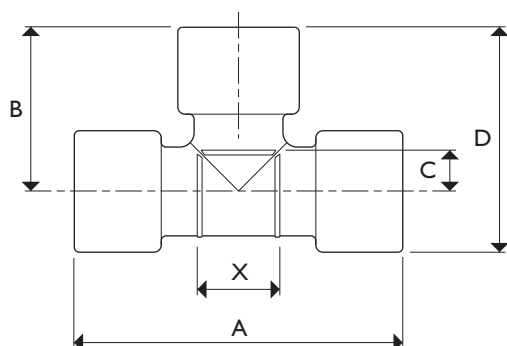
Hep₂O[®] SlimLine Fittings

Elbow 90° Single Socket



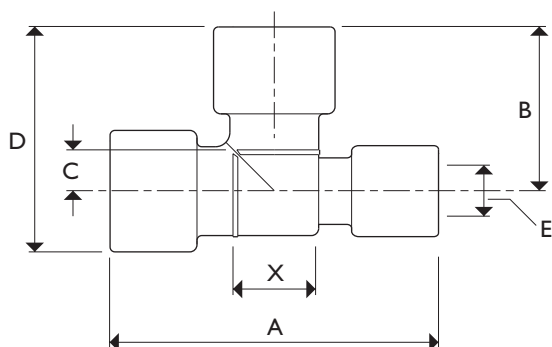
Code	Nominal Diameter	A	B	C
HX4/10	10	37	27	33
HX4/15	15	57	36	45
HX4/22	22	64	39	51

Equal Tee



Code	Nominal Diameter	A	B	C	D	X
HX10/10	10	55	27	7	37	14
HX10/15	15	68	34	9	47	17
HX10/22	22	77	39	12	55	24

End Reduced Tee

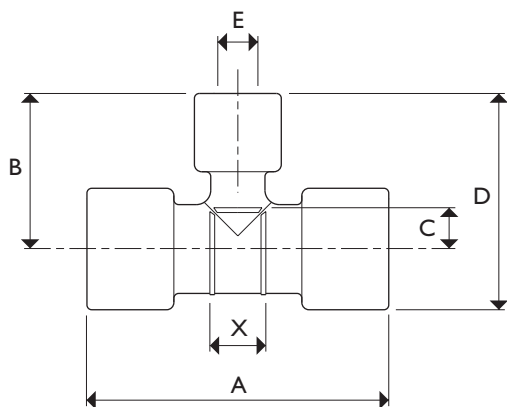


Code	Nominal Diameter	A	B	C	D	E	X
HX12/22	22	77	39	12	55	15	25



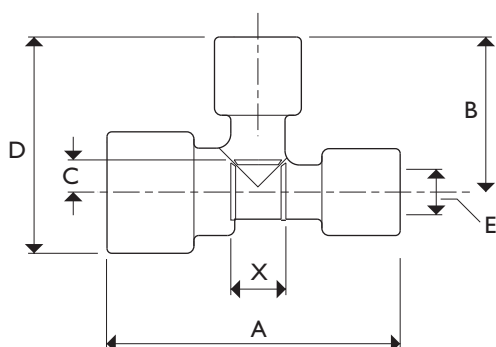
Hep₂O® SlimLine Fittings

Branch Reduced Tee



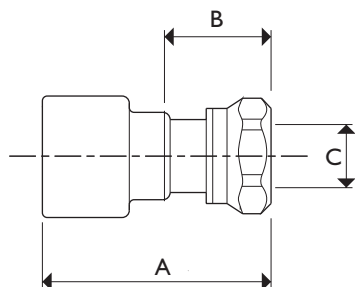
Code	Nominal Diameter	A	B	C	D	E	X
HX13/15	15	63	29	9	42	10	12
HX13/22	22	70	35	12	54	15	17

Branch & One End Reduced Tee



Code	Nominal Diameter	A	B	C	D	E	X
HX14/22	22	70	38	12	54	15	17

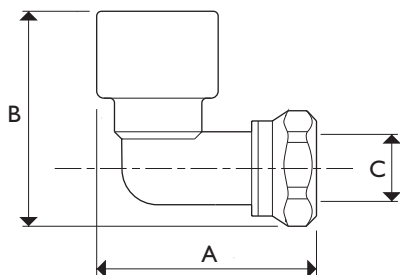
Straight Tap Connector



Code	Nominal Diameter	A	B	C
HX25A/15	15	53	18	1/2" BSP
HX25B/15	15	45	24	3/4" BSP

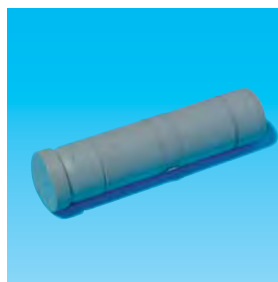
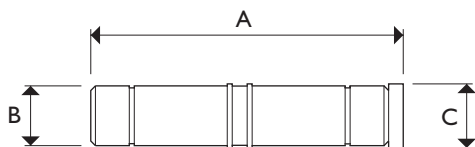
Hep₂O[®] SlimLine Fittings

Bent Tap Connector



Code	Nominal Diameter	A	B	C
HX27/15	15	49	46	1/2" BSP

Blanking Plug

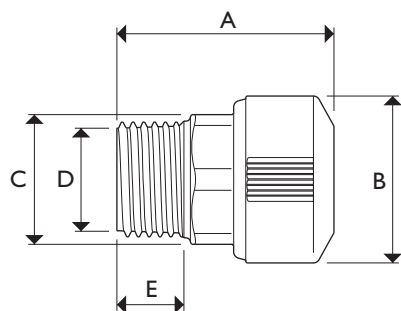


Code	Nominal Diameter	A	B	C
HX41/15	15	63	15	16
HX41/22	22	66	22	24



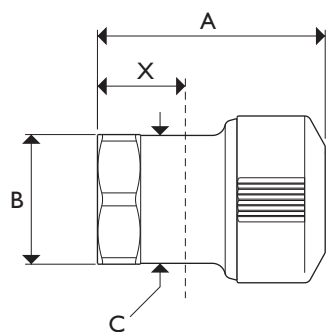
Hep₂O® Auxiliary Fittings

Adaptor - Male BSP/Hep₂O® Socket



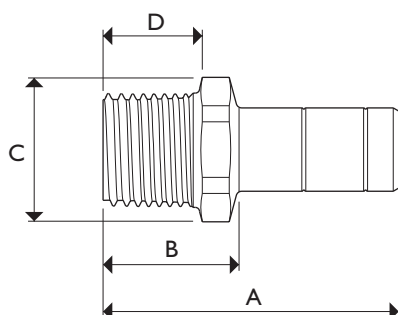
Code	Nominal Diameter	A	B	C	D	E
HX29/15	15	47	31	26	1/2" BSP	15
HX29/22	22	51	39	30	3/4" BSP	17
HX29/28	28	57	48	36	1" BSP	20

Adaptor - Female BSP/Hep₂O® Socket



Code	Nominal Diameter	A	B	C	X
HX28/15	15	50	26	25	18
HX24/15	15	49	30	30	19
HX28/22	22	53	30	30	19
HX28/28	28	63	36	36	24

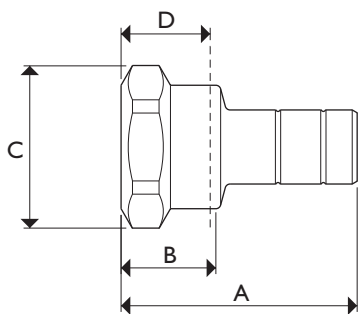
Adaptor - Male BSP/Hep₂O® Spigot



Code	Nominal Diameter	A	B	C	D
HX31/15	15	50	23	23	16
HX31/22	22	53	25	30	28
HX31/28	28	68	31	36	39

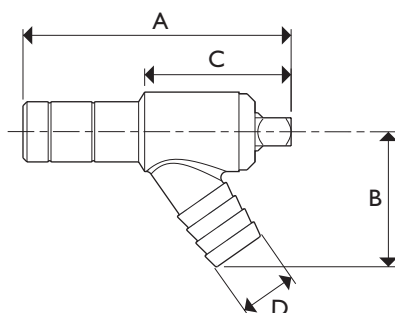
Hep₂O[®] Auxiliary Fittings

Adaptor - Female BSP/Hep₂O[®] Spigot



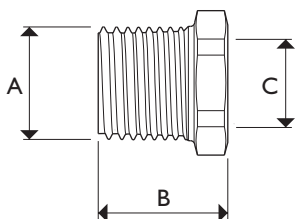
Code	Nominal Diameter	A	B	C	D
HX30/15	15	48	21	25	18
HX30/22	22	50	21	30	19
HX30/28	28	63	26	36	23

Draincock



Code	Nominal Diameter	A	B	C	D
HX32/15	15	65	34	38	14

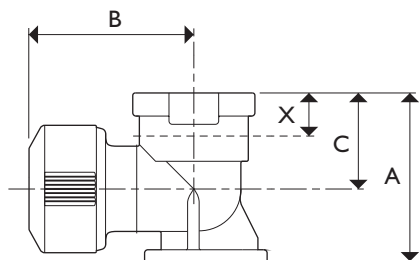
Adaptor - Tap Connector



Code	Nominal Diameter	A	B	C
HX39/15	15	1/2" BSP	18	3/8" BSP

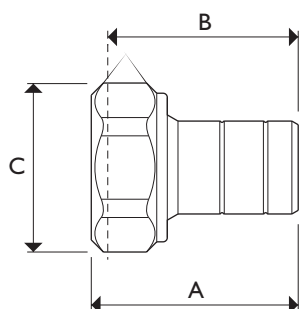
Hep₂O® Auxiliary Fittings

Wall Plate Elbow



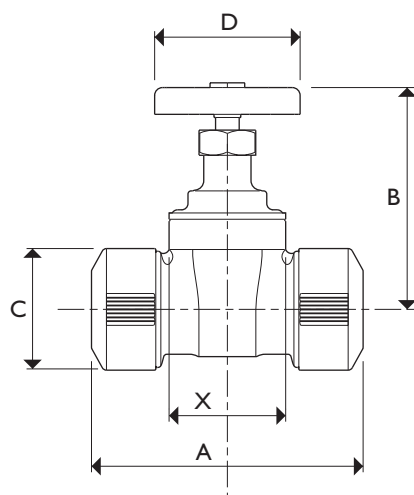
Code	Nominal Diameter	A	B	C	X
HX6/15	15	42	37	25	15
HX6/22	22	51	40	29	17

Cylinder Connector



Code	Nominal Diameter	A	B	C
HX34/22	22	49	46	36

Gate Valve - Hot/Cold

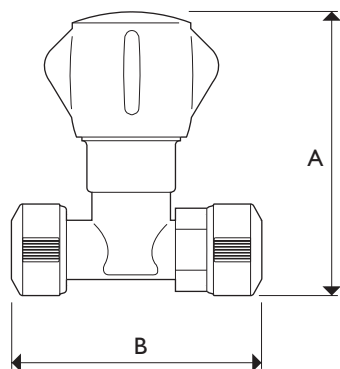


Code	Nominal Diameter	A	B	C	D	X
HX35/15	15	75	65	31	50	29
HX35/22	22	86	76	39	50	36

- This product is suitable for central heating

Hep₂O[®] Auxiliary Fittings

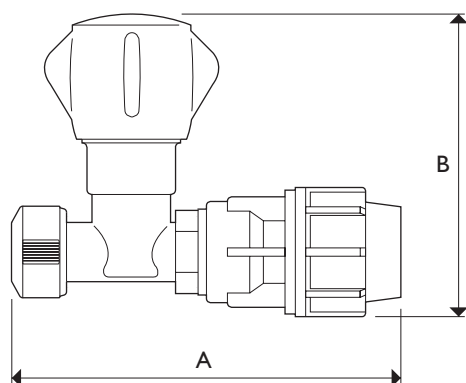
Stopcock - Hep₂O[®]/Hep₂O[®]



Code	Nominal Diameter	A	B
HX36/15	15	93	81
HX36/22	22	102	91

- This product is for cold water use only

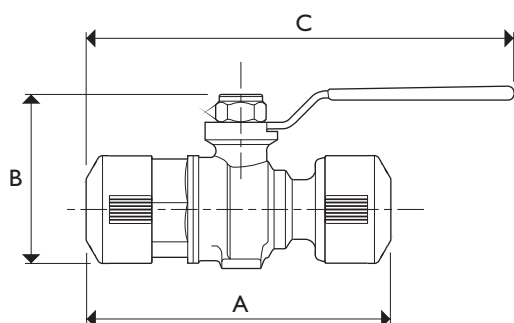
Stopcock - Hep₂O[®]/MDPE



Code	Nominal Diameter	A	B
HX43/22	22	168	125

- This product is for cold water use only

Lever Ball Valve

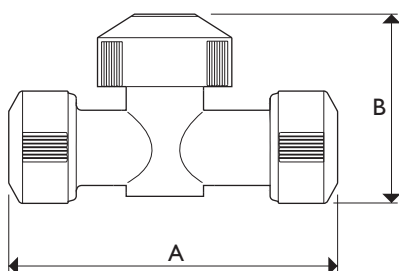


Code	Nominal Diameter	A	B	C
HX22/15	15	85	50	120
HX22/22	22	96	60	142

- This product is suitable for central heating

Hep₂O® Auxiliary Fittings

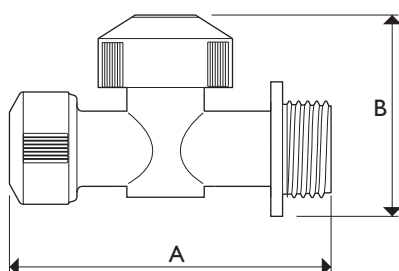
Shut-off Valves - Hot/Cold



Code	Nominal Diameter	A	B
HX37H/15	15	94	50
HX37C/15	15	94	50

- This product is not for use with central heating
- Indicator disc is reversible to denote hot or cold water

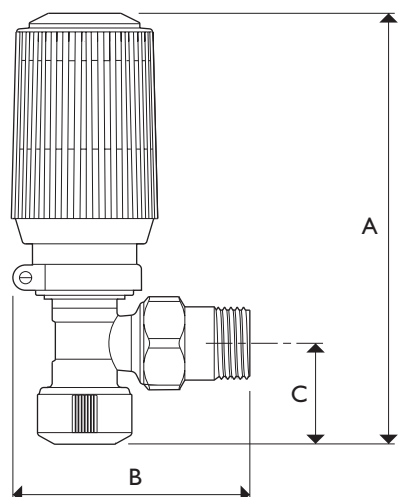
Appliance Valves - Hot/Cold



Code	Nominal Diameter	A	B
HX38H/15	15	89	53
HX38C/15	15	89	53

- This product is not for use with central heating
- Indicator disc is reversible to denote hot or cold water

Thermostatic Radiator Valve

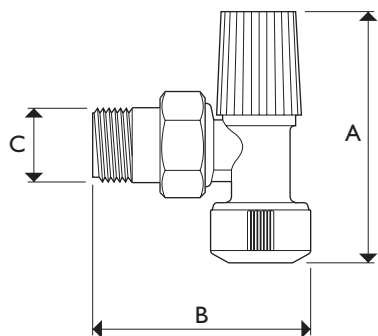


Code	Nominal Diameter	A	B	C
HX71/10	10	130	77	29
HX71/15	15	132	77	35

All dimensions are in mm unless otherwise stated

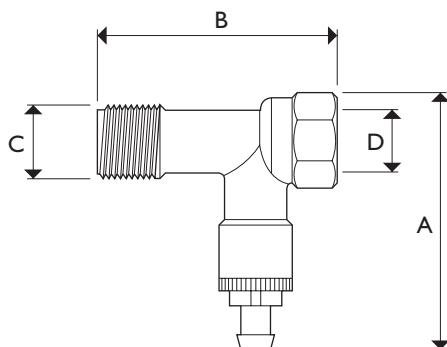
Hep₂O[®] Auxiliary Fittings

Radiator or Lockshield Valve



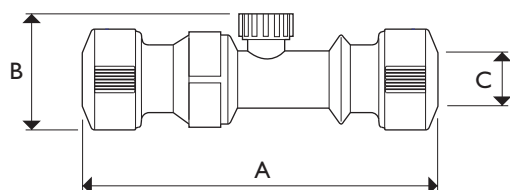
Code	Nominal Diameter	A	B	C
HX73/10	10	68	39	1/2" BSP
HX73/15	15	78	49	1/2" BSP

Radiator Draincock



Code	Nominal Diameter	A	B	C	D
HX23/15	15	64	59	1/2" BSP	1/2" BSP

Double-Check Valve

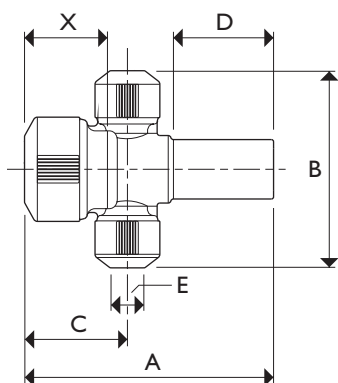


Code	Nominal Diameter	A	B	C
HX72/10 (Brass)	10	103	26	10
HX72/15 (Plastics)	15	112	37	15
HX72/22 (Brass)	22	133	41	22



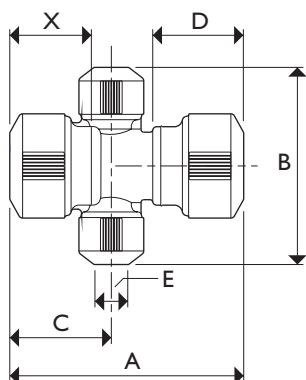
Hep₂O® Auxiliary Fittings

Two Port Manifold - Closed Spigot



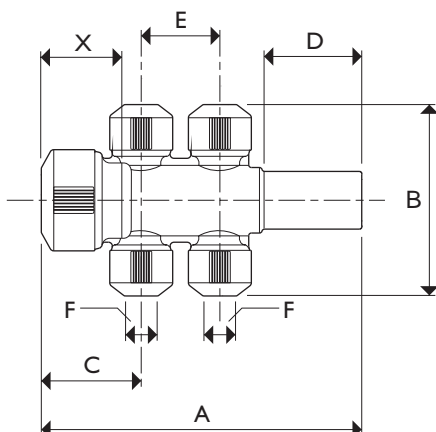
Code	Nominal Diameter	A	B	C	D	E	X
HX92/22	22	92	74	37	39	10	31

Two Port Manifold - All Socket



Code	Nominal Diameter	A	B	C	D	E	X
HX92B/22	22	87	74	37	31	10	31

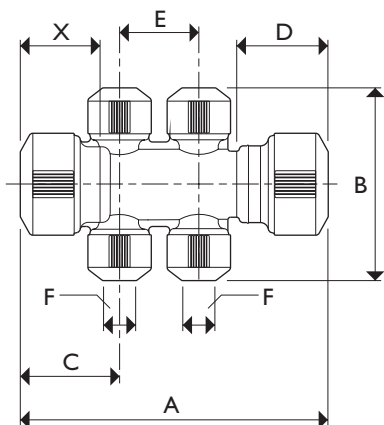
Four Port Manifold - Closed Spigot



Code	Nominal Dia	A	B	C	D	E	F	X
HX94/22	22	123	74	39	40	30	10	31

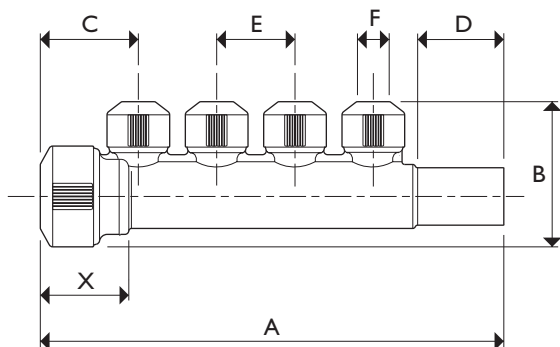
Hep₂O[®] Auxiliary Fittings

Four Port Manifold - All Socket



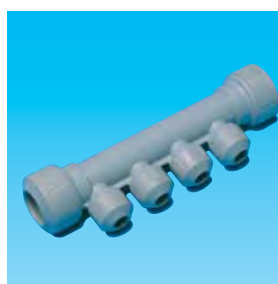
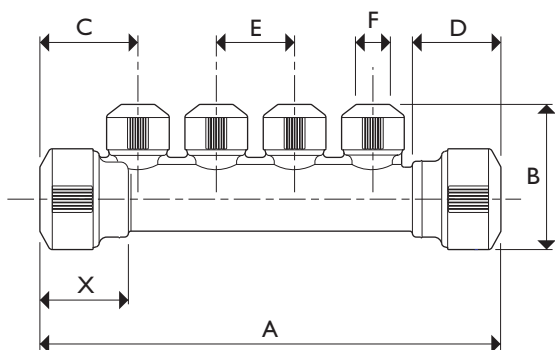
Code	Nominal Dia	A	B	C	D	E	F	X
HX94B/22	22	118	74	38	31	30	10	31

Four Port Manifold - Closed Spigot, Ports One Side



Code	Nominal Dia	A	B	C	D	E	F	X
HX96/22	22	184	56	38	38	30	10	31

Four Port Manifold - All Socket, Ports One Side

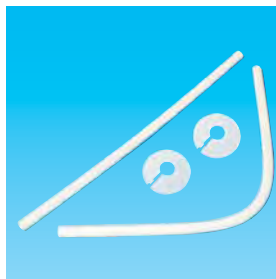
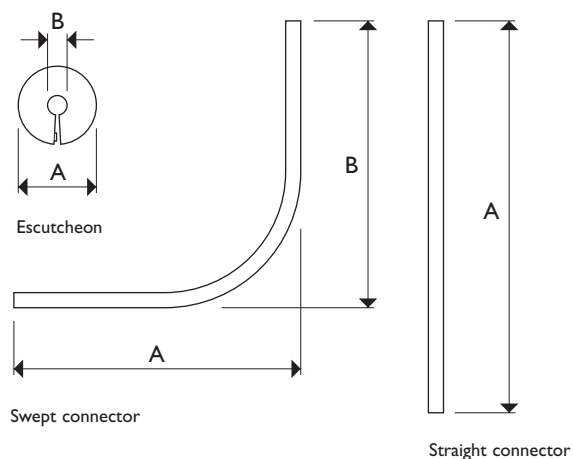


Code	Nominal Dia	A	B	C	D	E	F	X
HX96B/22	22	178	56	38	31	30	10	31



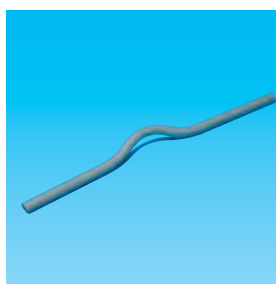
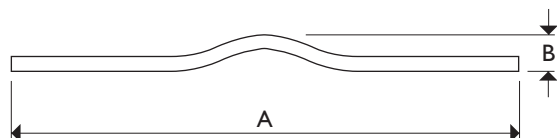
Hep₂O® Auxiliary Fittings

Radiator Connectors & Escutcheon Plates



Code	Nominal Dia	A	B
HX77/10 (straight connector)	10	300	–
HX78/10 (swept connector)	10	200	200
HX83/10 (escutcheon plate)	10	50	10
HX83/15 (escutcheon plate)	15	55	15

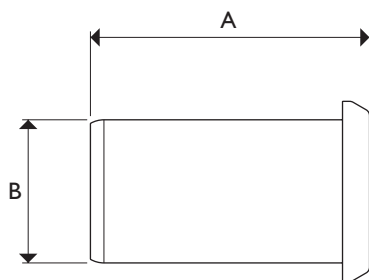
Pipe Step Over



Code	Nominal Diameter	A	B
HX82/15	15	460	45
HX82/22	22	475	55

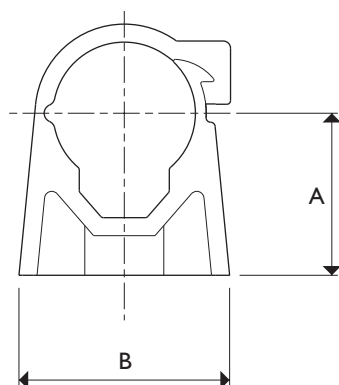
Hep₂O[®] Ancillary Items

Pipe Support Sleeve



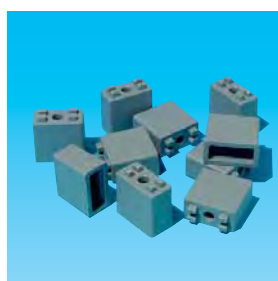
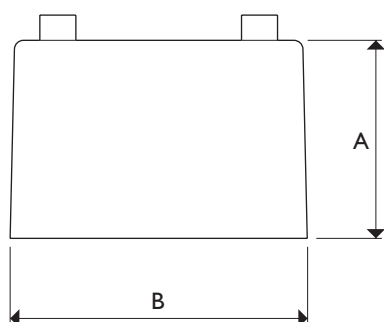
Code	Nominal Diameter	A	B
HX60/10	10	26	10
HX60/15	15	29	15
HX60/22	22	31	22
HX60/28	28	35	28

Pipe Clip - Screw Type



Code	Nominal Diameter	A	B
HX85/15	15	18	23
HX85/22	22	22	32
HX85/28	28	25	32

Pipe Clip Spacer

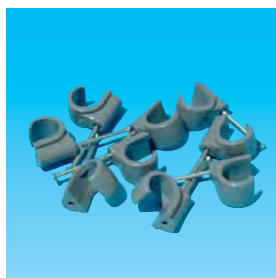
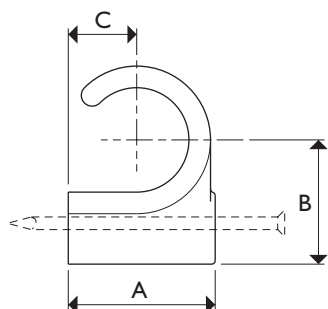


Code	Nominal Diameter	A	B
HX86/15	15	22	24
HX86/22	22	22	32



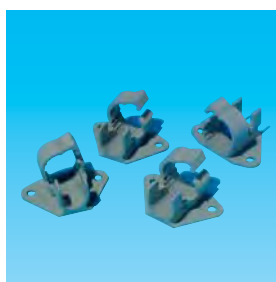
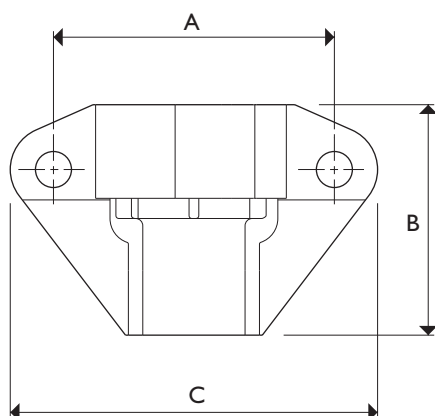
Hep₂O[®] Ancillary Items

Pipe Clip - Cable Type



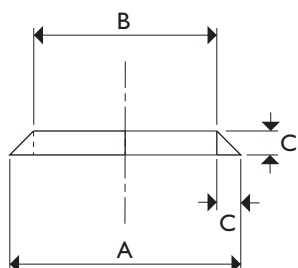
Code	Nominal Diameter	A	B	C
HX65/10	10	26	18	7
HX65/15	15	20	17	9.5
HX65/22	22	27	21	13
HX65/28	28	29	23	15

Fitting Clip



Code	Nominal Diameter	A	B	C
HX84/10	10	39	32	51

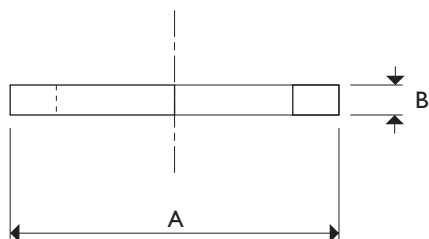
Conical Tap Connector Washer



Code	Nominal Diameter	A	B	C
HX57/15	15	18	14	3
HX57/22	22	23	19	3

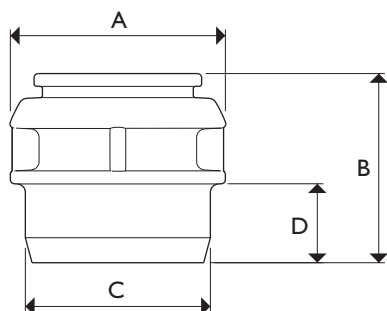
Hep₂O[®] Ancillary Items

Flat Tap Connector Washer



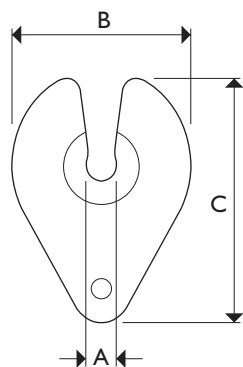
Code	Nominal Diameter	A	B
HX58/15	15	11	2
HX58/22	22	18	2

Blanking Peg - Demountable Fittings



Code	Nominal Diameter	A	B	C	D
HX44/10	10	14	19	10	7
HX44/15	15	20	22	15	9
HX44/22	22	26	23	22	10
HX44/28	28	32	30	28	11

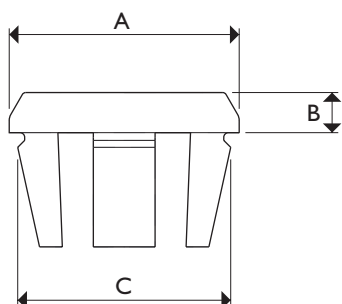
Wedge Removal Tool - Demountable Fittings



Code	Nominal Diameter	A	B	C
HX79/10	10	10	60	77
HX79/15	15	15	60	75
HX79/22	22	22	60	73
HX79/28	28	28	60	71

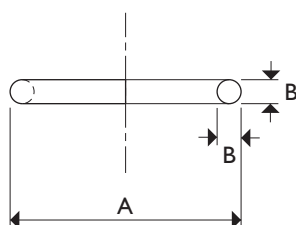
Hep₂O® Ancillary Items

Copper Pipe Cut End Protector



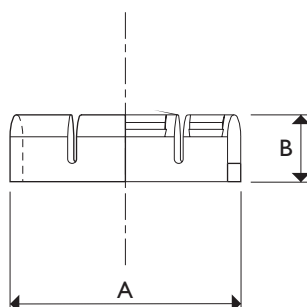
Code	Nominal Diameter	A	B	C
HX61/15	15	15	3	14
HX61/22	22	22	4	20

'O' Ring Seal



Code	Nominal Diameter	A	B
HX51/10	10	9	3
HX51/15	15	14	4
HX51/22	22	21	3
HX51/28	28	27	3

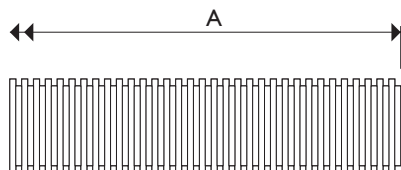
Grab Wedge



Code	Nominal Diameter	A	B
HX46/10	10	14	5
HX46/15	15	20	7
HX46/22	22	26	8
HX46/28	28	32	13

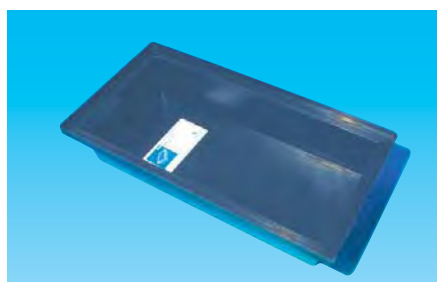
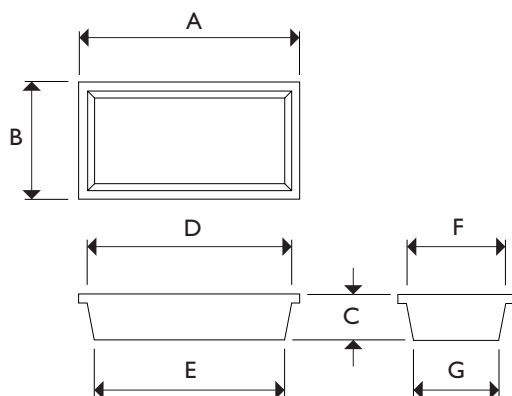
Hep₂O[®] Conduit System

Conduit Pipe



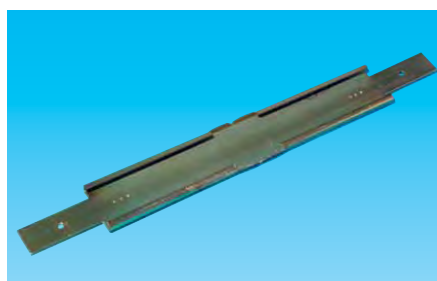
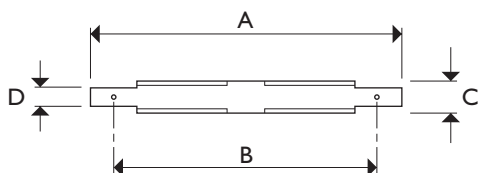
Code	Nominal Diameter	A
HXC25/15	15	25m
HXC50/15	15	50m
HXC25/22	22	25m
HXC50/22	22	50m

Conduit Junction Box & Lid



Code	A	B	C	D	E	F	G
HX100 (box)	377	202	75	340	322	165	150
HX104 (lid)	372	197	-	-	-	-	-

Terminal Back Plate

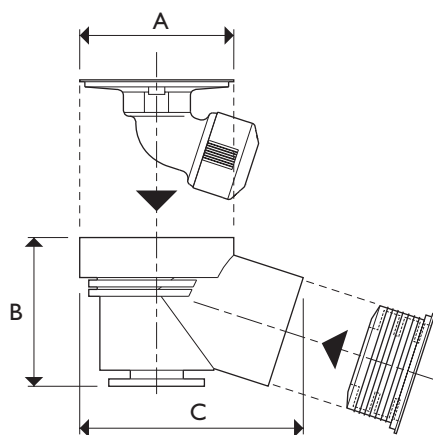


Code	A	B	C	D
HX103	360	280	46	20

- This product is for use with HX6/15, HX6/22 and HX101/15

Hep₂O® Conduit System

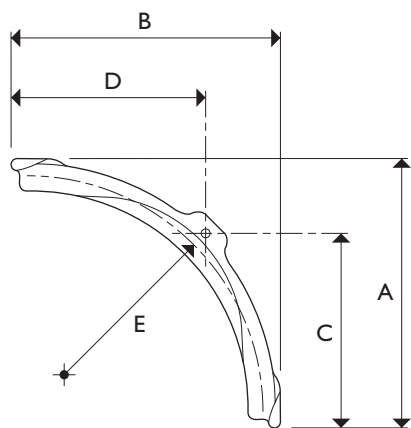
Conduit Terminal



Code	Nominal Diameter	A	B	C
HX101/15	15	58	58	86

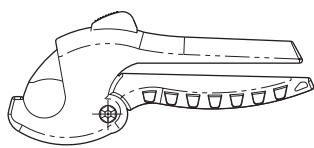
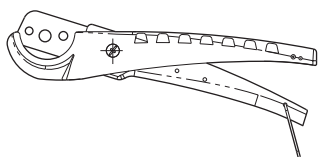
Hep₂O[®] Accessories

Cold Forming Bend Fixture



Code	Nominal Diameter	A	B	C	D	E
HX75/15	15	160	160	126	126	120
HX75/22	22	258	258	206	206	176

Pipe Cutters



Standard cutter HD74 (metal)



Procutter HD75 (plastic)



Ratchet cutter HD78

Code	Type	For Pipe Diameter
HD74	Standard	28 max
HD75	Procutter	28 max
HD77	Ratchet	42 max
HD78	Ratchet	28 max

Hep₂O® Accessories

Hep₂O® Central Heating & Water Services Calculator



Code	Description
HX80	Complete with protective case

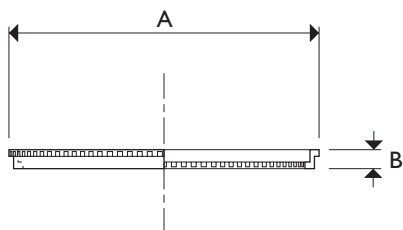
Hep₂O® Joint Test Kit



Code	Description
HX81	Robust metal construction
HX81A	Replacement seals

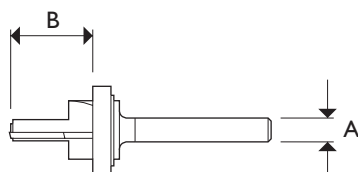
Hep₂O[®] Routabout System

Routabout Spacer Ring



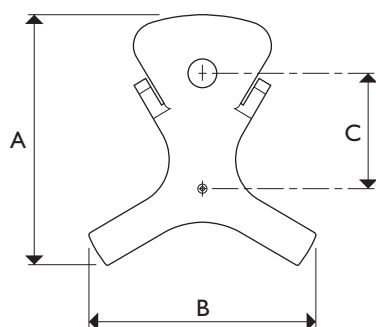
Code	A	B
HX404	250	18
HX405	250	22

Routabout Cutter



Code	A	B
HX406	1/4"	18
HX407	1/2"	18
HX408	1/4"	22
HX409	1/2"	22

Routabout Rotating Template



Code	A	B	C
HX410	266	244	122



Strength and Durability

Pull-out resistance

BS 7291: Part 2: 2001 provides a test procedure for assessing the pull-out strengths of pipes from fittings.

Hep₂O[®] pipes and fittings have been tested and offer resistances in excess of these requirements.

The levels required by BS 7291: 2001 are shown in Table 1.

Hydrostatic pressure resistance and life expectancy

The ability of a pipe to resist water pressure depends upon the tensile strength of the material, which varies with temperature.

Hep₂O[®] pipe has been tested to resist various pressures at various temperatures representing normal operating life cycles. Refer to Table 2.

Hep₂O[®] pipes and fittings conform to the long term hydrostatic strength tests as detailed in BS 7291: Part 1: 2001, Clause 6.3.

A life expectancy of not less than 50 years can be extrapolated from this data, and is based on the range of intermittent flow temperatures that these systems would normally experience, ranging between 12 bar 20°C and 6 bar 90°C.

Short exposure to temperatures up to 100°C resulting from thermostat/system malfunction will not cause failure, but may shorten the long term design life of the system.

Thermal cycling

Thermal cycling - the rise and fall in water temperature during normal operation - also induces different and additional stresses on pipes and joints.

Hep₂O[®] conforms to the requirements of a thermal cycling test schedule, to prove the strengths of a plumbing system, as detailed in BS 7291: Part 1: 2001. The schedule is set out in Table 3.

Effects of Fire

Flammability and burning

In common with most other organic polymers and materials used in the manufacturing and construction industries, polybutylene will burn. It is difficult to ignite, however, and is defined as combustible but not highly flammable.

Fire protection

Polybutylene pipe, less than 50mm in diameter, does not need to be sleeved in intumescent material when passing through a fire resistant wall.

Table 1 BS 7291: 2001 Pull-Out Force Requirements

Nominal outside pipe diameter	BS safe maximum pull-out force
10mm	380N *
15mm	705N *
22mm	1190N *
28mm	1960N *

*From BS 7291: Part 2: 2001, Table C1

Table 2 Operating Temperatures and Pressures

Safe pressures	Peak life cycle operating temperatures								Short malfunction at 100°C
	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	
Bar	12	11.5	11	10.5	9	8	7	6	3.5
psi	174	167	160	152	131	116	102	87	51
Head of water (m)	120	115	110	105	90	80	70	60	35

Table 3 Thermal Cycling

Hot water		Cold water		Min pressure			No. of cycles
Inlet temp	Duration	Inlet temp	Duration	Bar	psi	m/head	
83 ± 2°C	20 mins	15 ± 5°C	10 mins	3.5	88.2	60	5000
114 ± 2°C	20 mins	15 ± 5°C	10 mins	6	88.2	60	1000
105 ± 2°C	20 mins	15 ± 5°C	10 mins	3.5	88.2	60	5000

Flexibility

Modulus of elasticity

Modulus of elasticity is a measure of the ability of a material to cope with stresses.

The modulus of elasticity of polybutylene is 400-450N/mm². Compared to other materials, including other plastics, this value is very low. For example, for PVC it is 2410N/mm² and for copper 129800N/mm².

This means that polybutylene is not difficult to bend and expansion stresses are low. However, polybutylene is unusual in combining flexibility with toughness even at elevated temperatures and pressures, ensuring that Hep₂O[®] meets the demands of modern heating installations.

Manipulation of pipework

Hep₂O[®] pipe can be bent manually without heating for unsupported bends to a minimum radius of eight times the pipe's outside diameter. This removes the need to insert a 90° elbow fitting and results in a reduction in loss of head (i.e. a 15mm elbow equates to an extra 0.5m on the pipe run).

The durability of Hep₂O[®] pipe and its ability to stretch without damage, allows the minimum bend to be made cold, without causing 'kinking' on the inside, nor collapse on the outside of a bend. A reduction of the bore is thereby minimised. Refer to Figure 1 and Table 4.

Where support bends are needed for 15mm and 22mm outside diameter pipes, the use of a Cold Forming Bend Fixture (HX75) will give a radius of eight times the pipe diameter, again minimising the loss of head in a system. Refer to Figure 2 and Table 5.

Dependent on its diameter, pipe is available in coils of up to 100 metres (see Product Range section, page 12), which facilitates handling and transportation.

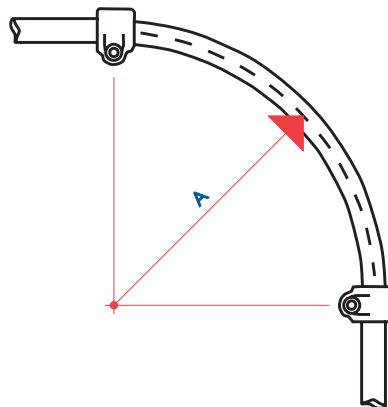


Figure 1
Minimum unsupported cold-bend radii

Table 4 Minimum Unsupported Cold-Bend Radii

Nominal dia (mm)	10	15	22	28
A (mm)	80	120	176	224

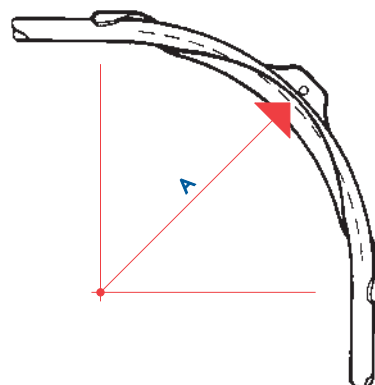


Figure 2
Cold form bend radii

Table 5 Cold Form Bend Radii

Nominal dia (mm)	15	22
A (mm)	120	176

Site handling is also made easier as this flexibility enables the pipe to be bent around corners and within confined spaces.

Hep₂O[®] pipes will not suffer fatigue stress damage through normal vibration.

Weight

Hep₂O[®] pipe is approximately 1/4 the weight of copper pipe per metre as indicated in Table 6.

Table 6 Hep₂O[®] and Copper Pipe Weight Comparison

Nominal dia (mm)	10	15	22	28
	Weight (g/m)			
Hep ₂ O	41	75	126	210
Copper	183	281	534	683

Thermal expansion

Hep₂O[®] pipes expand when the temperature is raised.

The flexibility of the pipe means that the expansion is spread evenly along a pipe run eliminating damaging movement at a critical fixed point in the system.

When hot, the pipe's expansion creates undulations, though its former length is resumed after the temperature has dropped.

Exposed pipe runs should therefore be boxed in to avoid unsightly temporary distortion.

The coefficient of thermal expansion of polybutylene is $1.3 \times 10^{-4}/m/^{\circ}C$. This means that the pipe expands by 1.3mm per metre of pipe for every 10°C temperature rise.

Example:

Calculate the amount of expansion of a 2.4 metre pipe installed at 20°C when running at 80°C.

$$0.00013 \times 2400 \times 60 = 18.72\text{mm}$$

Where the pipe is totally restrained in a concrete floor (e.g. as underfloor heating), the stresses are so low that they are absorbed by the material.



Thermal Characteristics

Thermal conductivity

The thermal conductivity (k) of polybutylene is 0.22W/mK which is low relative to copper. This property, coupled with the approximately 2mm thick pipe walls of Hep2O®, means that:

- the pipe is safe to touch even when conveying water at 60°C.
- the pipe does not radiate heat quickly, and so will not cool quickly, thereby delivering hot water.

Melting point

The melting point of polybutylene is 125°C, and as a result, blow lamps must never be played on Hep2O® pipes and fittings.

However, the Vicat softening point, at 116-117°C, is well above the boiling point of water and is also greater than the overheat control of gas and oil boilers (approximately 95°C).

Connections to boilers

Where boilers incorporate a copper heat exchanger and the connections are made outside the casing, Hep2O® can be connected directly to the boiler via the compression nut, if this is located more than 350mm from the heat source. Typically, these boilers contain high limit cut-out thermostats and generally have a low water content. See page 51.

Special installation procedures only apply for solid fuel boilers, other cast iron heat exchange boilers, or where the first connection is made inside the boiler casing. In these instances, where the heat output may be uncontrolled, a 1 metre run of copper pipe should be used between the boiler and the start of the Hep2O® system. See page 51.

All boiler connections should be made in accordance with the requirements of BS 5955: Part 8.

Solder joints

When soldering HX42/10 (a brass double spigot reducer in the Demountable range), ensure that the solder joint is completed first and has fully cooled before making the push-fit connection.

Freezing temperatures

Hep2O® maintains its flexibility in temperatures down to -15°C. This property significantly reduces the likelihood of bursts, even at sub-zero temperatures, when the pipework has frozen and the water has expanded in volume by becoming ice.

Hep2O® pipe accepts this expansion without fracturing, and resumes its original size after a thaw.

Thermal Insulation

Thermal diffusivity

Thermal diffusivity is the rate of heat diffusion throughout a material. The greater the value the greater the heat diffusion. The thermal diffusivity of a material depends on its thermal conductivity, density and specific heat.

Although Hep2O® has a lower diffusivity than copper, its insulation requirements are the same as those of copper and should comply with BS 6700, BS 5422 and the Water Regulations.

Table 7 Frost Protection

Pipe diameter (mm)	Indoor (k)			Outdoor (k)		
	0.035	0.04	0.055	0.035	0.04	0.055
	Insulation (mm)			Insulation (mm)		
15	22	32	50	27	38	63
22	22	32	50	27	38	63
28	22	32	50	27	38	63

Table 8 Central Heating Installations Insulation Thicknesses

Pipe diameter (mm)	0.04 (k)	0.055 (k)	0.07 (k)
	Insulation (mm)		
15	19	25	25
22	25	25	25
28	25	25	25

Frost protection

The minimum thicknesses of insulation to delay freezing are given in Table 7.

Pipework that is potentially exposed to freezing conditions and therefore requires insulation would typically be found in the following areas:

- unheated roof spaces.
- unheated cellars.
- unheated outbuildings.
- near windows, airbricks, ventilators, etc.
- in chases or ducts formed in outside walls.

Central heating installations

Minimum thicknesses of insulation for central heating installations are given in Table 8. The figures are based on the temperature differential of 75°C hot face to 20°C ambient air.

Gas and oil fired domestic hot water installations

The recommended minimum thicknesses of insulation for domestic hot water pipework is given in Table 9. The figures are based on the temperature differential of 60°C hot face to 20°C ambient air.

Table 9 Gas & Oil Fired Domestic Hot Water Installations Insulation Thicknesses

Pipe diameter (mm)	0.04 (k)	0.055 (k)	0.07 (k)
	Insulation (mm)		
15	25	32	32
22	25	32	32
28	25	32	32

Corrosion and Chemical Effects

Corrosion and oxygen diffusion

Corrosion of metals is a hazard in installations, therefore it is essential that the water oxygen content is kept to an absolute minimum.

Oxygen will almost always be present in any system as it can enter through a variety of points, such as open header tanks, threaded joints, valves and pumps. However, Hep₂O[®] Barrier Pipe will ensure that oxygen ingress through the pipe wall is kept to a minimum.

All heating circuits, whatever the type of pipe used, should be protected by an inhibitor, and then any oxygen entering the system will have no adverse effects.

Hep₂O[®] pipe is unaffected by both acidic (soft) water or alkaline (hard) water, the most common reasons for copper pipe corrosion in all-metal pipework.

Contact with chemicals

Hep₂O[®] is not damaged by *short term* contact with other chemicals commonly found in a domestic environment. These chemicals include: paraffin, diesel oil, carbon tetrachloride, bleaches, detergents, turpentine, linseed oil, white spirit, water purification softeners, common adhesives, paints, varnishes, sealers, cement, quick lime.

High sustained concentrations of chlorine will have an adverse effect on all plastics pipe. However, such concentrations are not usually experienced within the UK water supply which are very low (less than 0.5 ppm). At these levels, under normal operating conditions there will be no adverse effect on the life expectancy of the Hep₂O[®] system. Short term chlorination for disinfection will not have an adverse effect on the system.

However, Hep₂O[®] should not be used in installations where sustained above average chlorine levels can be anticipated such as swimming pools.

If long term contact is suspected, the Hepworth Plumbing Products Technical Advisory Service should be consulted on 01709 856406.

Scale resistance

Hep₂O[®] pipe is unaffected by both acidic (soft) water or alkaline (hard) water, the most common reasons for copper pipe scale build-up in all-metal pipework.

In hard water areas, scale or fur build-up inside Hep₂O[®] pipes is resisted by the exceptionally smooth finish and cleanly abutting surfaces within joints. The bore of the pipework will therefore be maintained almost indefinitely, as the scale will not adhere to it.

Hep₂O[®] pipe and fittings have been tested by the Water Research Centre and have been found to comply with the requirements of the Water Regulations. The pipes and fittings will not waste nor impart taint, taste or odour to water.

Biological

Organic growth

Hep₂O[®] does not encourage the growth of micro-organisms, as listed in the Water Fittings and Materials Directory 0112066. Polybutylene satisfies the requirements of BS 6920.

Rodent attack

Hep₂O[®] does not specifically attract rodents. However, if the installation is in an area where there is a high risk of rodent attack, Hep₂O[®] like other piping and electrical cables should be ducted to ensure no damage can be caused.

Ultra-violet Light

External Hep₂O[®] installations must be adequately covered to avoid long exposure to sunlight.

Hep₂O[®] pipe is delivered in SmartPack™ protective wrapping that should not be opened until the pipe is ready for installation.

Opacity

Hep₂O[®] materials conform with the opacity requirements of BS 7291: Part 1: 2001, Clause 6.7, ensuring that insufficient light passes through the pipe walls to allow the growth of algae.

Acoustic

Problems with noise are frequently experienced with systems incorporating rigid pipes. Hep₂O[®] pipe does not transmit noise and with careful installation to reduce the source of noise to a minimum, Hep₂O[®] can be installed to run almost silently. For example:

- the flexible nature of Hep₂O[®] pipe prevents high contact forces between pipes and supports, significantly reducing the 'creaking' commonly associated with the thermal expansion of rigid pipes.
- noise can be caused by pipes knocking together or knocking on hard surfaces in close proximity. Unlike rigid pipes, the inherent elasticity of Hep₂O[®] cushions the impact causing less impact noise and absorbing vibrations, preventing the transmission of any sound along the pipes.
- similarly, noise from 'water hammer' resulting from abrupt stoppage of water flow (typically by closure of quarter turn valves, solenoids and reverberating ball valves) is normally absorbed by Hep₂O[®] and not transmitted along the pipes.
- noise generated by central heating pumps is rapidly absorbed by Hep₂O[®] pipes and can be significantly reduced when compared with rigid systems.

Electrical Safety

Hep₂O[®] piping does not conduct electricity.

However, if **Hep₂O[®]** forms a break in the continuity of metal pipework that is being used for earthing or bonding, then the break should be re-bonded to both sections of the existing pipe when cutting and after installation.

Main, supplementary and equipotential bonding

Installers should be aware of the main and supplementary bonding of electrical installations where plumbing is carried out with plastics piping.

1. This guidance is given on the basis that the following conditions apply. If they do not then the installation must be considered on an individual basis:

- the gas pipe to the boiler is metallic.
- the hot and cold water services are carried out in **Hep₂O[®]**.
- the central heating pipes are **Hep₂O[®]**.
- the waste pipes from the bath, hand basin, WC, bidet and kitchen sink are plastics.

2. There is no requirement to supplementary bond the following:

- the bath even if it is metal.
- the kitchen sink.
- central heating radiators.
- bathroom radiators and towel rails heated by a wet central heating system unless there is less than a 2 metre run of plastics pipe between them and the boiler, or between them and any metallic pipe from the boiler to which the radiator plastics pipe is connected.

3. There is no requirement in the above circumstances to bond a steel sink but it is not incorrect to bond a steel sink to the earth terminal of an adjacent socket.

4. If all the conditions in 1 apply then the following precautions must be undertaken.

Items to be mainbonded:

- the consumer's gas pipe at the service entry.
- any other services that are metallic, e.g. heating oil pipes.
- structural steel should be bonded to the main earth terminal.

Items to be supplementary bonded (in the bathroom):

- the earth terminal of the lighting point (rose, luminaire support coupling, luminaire).
- the earth terminal of the electric radiant heater (if any).
- the earth terminal of the electric shower water heater (if any).
- the earth terminal of any other appliance.

There is no need to connect the supplementary bonding conductor to the main earth bar.

Supplementary bonding in a bathroom when **Hep₂O[®]** and plastics soil and waste pipes have been installed

(Refer to Figure 3)

There is no requirement to supplementary bond:

- **Hep₂O[®]** pipes.
- plastic soil and waste pipes.
- visible copper pipes less than 0.5m long.
- metal taps.
- metal baths not connected to extraneous conductive parts (i.e. structural steelwork).

However, metal (Class I) items of equipment in a bathroom or shower room (e.g. electric heaters, showers and luminaires) will require supplementary bonding if simultaneously accessible.

Supplementary bonds must be connected to the protective conductors of each circuit at the accessory point.

Supplementary bonding in a bathroom when metallic service pipes, soil pipes and waste pipes have been installed

(Refer to Figure 4)

Supplementary bonding will be a requirement for:

- all simultaneously accessible metal (Class I) equipment (e.g. electric heaters and showers).
- central heating pipes.
- hot and cold water pipes.
- waste and soil pipes.

Pipe connections should be made with BS 951 clamps, complete with a 'safety electrical connection' label.

However, metal baths not connected to a metal building structure do not require supplementary bonding if all metal pipes connected to them have been bonded.

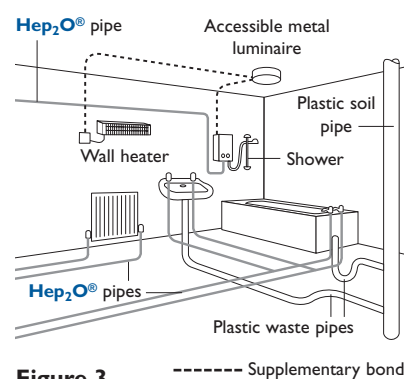


Figure 3

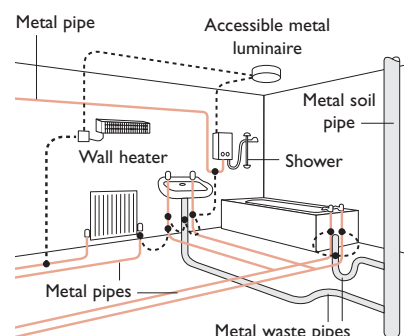


Figure 4

Connection to Metric Copper Pipe

Hep₂O[®] fittings have been designed to form reliable joints with metric copper tube which conforms to BS EN 1057 - R520. Copper pipes should be cut with a wheel cutter. Before jointing, copper pipe ends should be inspected to ensure they are free from burrs or swarf (which could damage the 'O' ring).

It is also possible to connect 10mm BS EN 1057 - R220 copper tube into Hep₂O[®] fittings providing the tube end is carefully prepared. R220 copper tube is 'soft' and therefore susceptible to becoming mis-shaped or dented if it is not handled with care on site. Therefore the R220 tube end should be inspected for any signs of damage prior to jointing, as deformity of the tube could damage the 'O' ring whilst jointing, or otherwise affect the joint seal.

R220 tube should be cut with a mini wheel cutter, and then a chamfer should be filed on the pipe. Rinse away the remainder of any copper filings and dry off.

Connection to Imperial Copper Pipe

When connecting to 3/4" imperial copper Hep₂O[®] offers a special Straight Adaptor (HX3A/22) which accepts 22mm pipe at one end and 3/4" imperial at the other end.

See also fitting detachment procedure in System Modification & Maintenance (page 52).

Standard Hep₂O[®] fittings can be used to connect 3/8", 1/2" and 1" imperial pipes.



Cut copper pipe using a wheel cutter



Inspect ends to ensure they are free from burrs or swarf



Straight Adaptor HX3A/22



Insert copper end protector (HX61)



Mark joint depth on copper pipe before jointing



Push pipe firmly into fitting



Tug back on the pipe to ensure grab wedge engages properly



Connection to Compression Fittings

Hep₂O[®] pipe is suitable for connecting to compression fittings complying with BS EN 1254.

Cut the Hep₂O[®] pipe with the recommended cutters and proceed as shown below.



Insert support sleeve into pipe



Apply PTFE if required



Ensure pipe is fully inserted



Tightening nut

Connections Adjacent to Capillary Joints

When using Hep₂O[®] pipe or fittings adjacent to capillary joints it is preferable to carry out the soldering work before the Hep₂O[®] is installed.

If it is not possible to undertake the work in this sequence then the following precautions should be observed:

- do keep flame or soldering irons away from Hep₂O[®].
- do not allow flux to run onto Hep₂O[®]. Flux runs inside pipe may occur during soldering. This effect can be reduced by not using excessive amounts of flux and by applying flux to copper tube end only.
- do not allow hot solder to come into contact with Hep₂O[®].
- to prevent overheating of Hep₂O[®] by conduction of heat along copper pipe, where necessary, wrap a damp cloth around copper pipe to minimise this effect.
- systems should be flushed with water to remove any internal flux residues.

Connection to Chrome Plated Copper or Stainless Steel Pipe

Hep₂O[®] fittings cannot be connected directly to chrome plated copper or stainless steel, because of the relative surface hardness of these materials. Therefore compression fittings should be used.

Connection to Brass Spigots

The only brass spigots which are suitable for jointing into Hep₂O[®] fittings are those within the Hep₂O[®] range. Brass spigots designed for compression or capillary joints do not have the necessary joint grooves and are too short.

Connection to Acorn[®]

Hep₂O[®] is fully compatible with its predecessor, Acorn[®] system previously manufactured by Bartol, a Hepworth company.

Pre-1984 Acorn[®] 22mm pipe was manufactured with a thicker wall and requires a different support sleeve. If carrying out remedial work on such an Acorn[®] system please contact our Technical Advisory Service.

Internal components of current Hep₂O[®] fittings (Cap, BiTite Grab Wedge, Wedge Support Ring and 'O' Ring) are not in any way compatible with original Hep₂O[®] fitting components (Cap, 'O' Ring, Spacer Washer and Grab Ring) and therefore bodies and components must not be mixed.

However, Hep₂O[®] Pipe (Standard or Barrier) is fully compatible with all versions of Hep₂O[®] fittings.

For further advice and information contact Hepworth Plumbing Products' Technical Advisory Service.

Connection to Plastic Pipes

Hep₂O[®] should not be used in conjunction with other manufacturers' plastics pipe and fittings as dimensional tolerances and quality control cannot be guaranteed by Hepworth Plumbing Products.

Connection to Incoming Service Pipes

Water may enter a property through a variety of pipe materials. In recently developed properties the water is typically brought to a residence in blue MDPE (medium density polyethylene) pipe. However, in renovation of older properties this pipe may well be made of one of a number of metals. The method of converting from the service pipe to Hep₂O® differs depending on the material of the service pipe.

The following guidance is applicable to blue MDPE pipe to BS 6572.

For 20mm MDPE use:

- a polyethylene 20 x 1/2" BSP male adaptor (code 20PEAM05).
- a MDPE pipe liner (code 20PELIN).
- Hep₂O® female adaptor (code HX30/15).
- Hep₂O® stopcock (code HX36/15).

Refer to Figure 5.

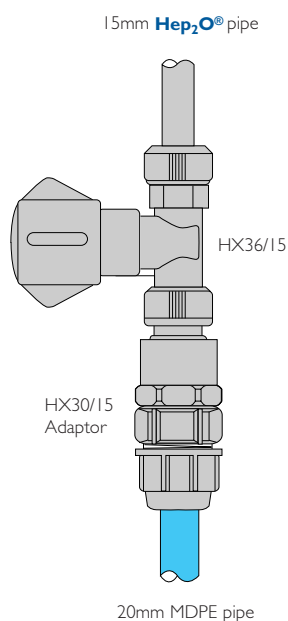


Figure 5
Rotatable stopcock

For 25mm MDPE use:

- a Hep₂O® x MDPE stopcock (code HX43/22).
- a MDPE pipe liner (code 25PELIN).

Refer to Figure 6.

Alternatively if you wish to take advantage of the rotatability of Hep₂O® joints by turning the stopcock towards the wall when not in use, then use:

- a polyethylene 25 x 3/4" BSP male adaptor (code 25PEAM07).
- a MDPE pipe liner (code 25PELIN).
- Hep₂O® female adaptor (code HX30/22).
- Hep₂O® stopcock (code HX36/22).

Refer to Figure 7.

Details of MDPE pipe, fittings and jointing instructions are contained in separate literature which can be obtained by contacting our Literature Service Hotline Tel: 01709 856408 Fax: 01709 856409.

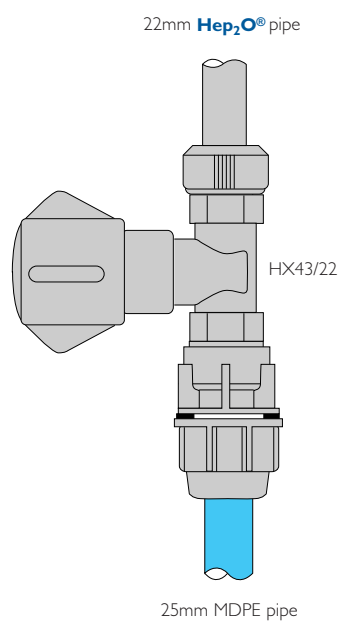


Figure 6
Non-rotatable stopcock

Consideration should also be made of the following:

- where a common supply pipe serves two or more dwellings a double check valve (code HX72) is required directly after the stopcock in each dwelling to comply with Water Byelaws.
- a drain-cock (code HX32) should be fitted immediately after the stopcock or after a double check valve where provided to comply with Water Regulations.
- for sealing screwed joints on adaptors apply PTFE to threads.

Alternatively a PE (polyethylene) to copper compression stopcock can be used. The information on using compression fittings on Hep₂O® pipe should be carefully noted. See page 47.

For metal pipes an appropriate stopcock should be used with a compression outlet to 15 or 22mm copper. Hep₂O® can then be fitted directly to these outlets carefully noting details in Connection to Compression Fittings. See page 47.

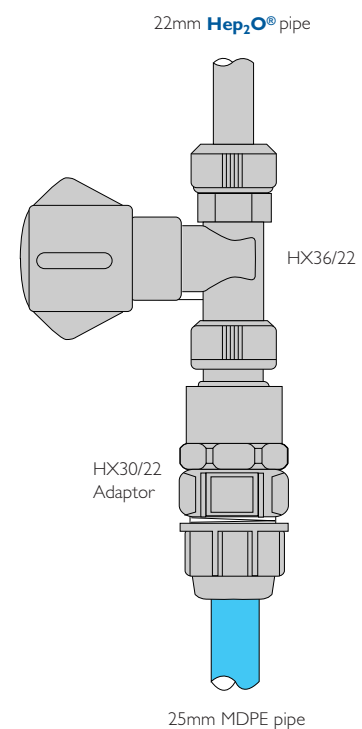


Figure 7
Rotatable stopcock

Connection to Steel Pipes and Threaded Bosses

In order to facilitate connection to male and female iron threads, four adaptors (HX28/HX29 Socket Adaptors, HX31/HX30 Spigot Adaptors) are available in the **Hep₂O**® range. This enables connection to a wide range of different materials.



HX28



HX29



HX30



HX31

Connection to Appliances

When connecting to appliances and dishwashers always use **Hep₂O**® appliance valves (HX38C/15, HX38H/15). The **Hep₂O**® pipework used to service these appliances should be clipped in accordance with the recommended clipping distances using screw-type clips (HX85). Refer to page 66.



Pipe Clip - Screw type HX85



Appliance valve HX38 (Cold or Hot)



Connecting appliance valves

Connection to Draw-off Taps

When connecting to draw-off taps having a male threaded 'tail' use either the Demountable or SlimLine **Hep₂O**® tap connector. Do not use any jointing compound on the jointing shoulder, use only the washer provided. When using the wall plate elbow or the 1/2" x 3/8" BSP adaptor the threads should be sealed by applying PTFE tape to the male threads.



Demountable fitting HD25



Demountable fitting HD27



SlimLine fitting HX25



SlimLine fitting HX27



Wall Plate Elbow (auxiliary fitting HX6)
(tap not supplied)

Connection to Ancillaries (Pumps, Valves, etc.)

When connecting Hep₂O® to ancillaries it is important to follow the guidance in the section 'Connection to Compression Fittings' (Page 47). Due to the flexibility of Hep₂O® the pipework must be clipped adjacent to the outlets of the pumps and valves using Hep₂O® screw pipe clips (code HX85). This ensures adequate support and reduces vibration in the majority of cases.

Where it is felt that the weight of the pump merits extra support, metal brackets should be used.

Where the size of the pump and/or valve requires fixing at a greater distance from the wall than can be accommodated by the pipe clip alone, then this can be augmented with a pipe spacer (code HX86), which will allow a greater 'stand-off' distance whilst maintaining security.



Connection to pump

Connection to Storage Vessels and Radiators

When connecting Hep₂O® pipe to cylinders, radiators etc., it is always recommended that Hep₂O® fittings are used wherever possible.

The Hep₂O® range of fittings includes thermostatic, wheel head and lockshield radiator valves, double check valves, tank connectors, gate valves, stopcocks and cylinder connectors.

If the use of compression fittings is unavoidable then the jointing instructions outlined in the section, 'Connection to Compression Fittings' (page 47) should be carefully followed.

Do not use jointing compound on the jointing shoulder of the cylinder connector; use only PTFE tape.

Do not use any jointing compound when fitting tank connectors, use only sealing washers (not provided).

Refer to 'Design Considerations', page 70, for information on cylinder cupboard requirements.



Tank connector



Cylinder connector



Radiator or Lockshield Valve (HX73)



Thermostatic Radiator Valve (HX71)



Radiator or Lockshield Valve (HX73)
+
Straight Radiator Connector (HX77)
+
Radiator Draincock (HX23)

Connection to Boilers and Heaters

Where boilers incorporate a high limit cut out thermostat, pump overrun device, and have connections outside the boiler casing 350mm from the heat source, direct connection can be made to Hep₂O®. Typically these boilers contain a copper heat exchanger and are low water content boilers. See Figure 8.

Where any one of the above criteria for direct connection to a boiler cannot be met a minimum one metre run of copper pipe should be installed between the boiler and the start of the Hep₂O® system. See Figure 9.

In all cases (including instantaneous water heaters, caravan heaters etc.) care should be taken to ensure that appliances have the appropriate thermostatic controls and cut outs to ensure that operating conditions do not exceed the temperature and pressure limits laid down for Class S pipe (see Table 2, page 41). For any type of back boiler all water connections should be extended from the appliance to the outside of the fireplace opening in copper tube.

In these instances, where the heat output may be uncontrolled, a minimum one metre run of copper pipe should be used between the boiler and the start of the Hep₂O® system.

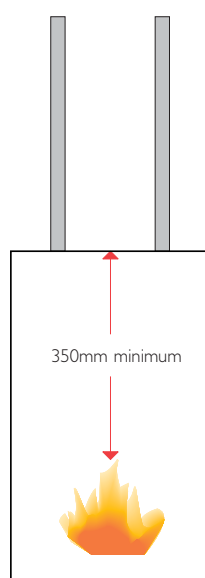
Any gravity circuit of a solid fuel boiler should always be installed in copper.

Regulations require that metal pipe be used as discharge pipe from temperature/pressure relief valves on unvented water heaters, to or from a tundish or from safety valves on sealed central heating systems. On sealed systems where the safety valve is not provided within the boiler casing, the pipe between the safety valve and the boiler should be in copper.

All boiler connections should be made in accordance with the requirements of BS 5955: Part 8.

On heating systems where normal circulation may be drastically reduced (eg. thermostatic radiator valves fitted throughout), then a bypass should be fitted to the circulation pipework preferably controlled by an automatic differential pressure bypass valve.

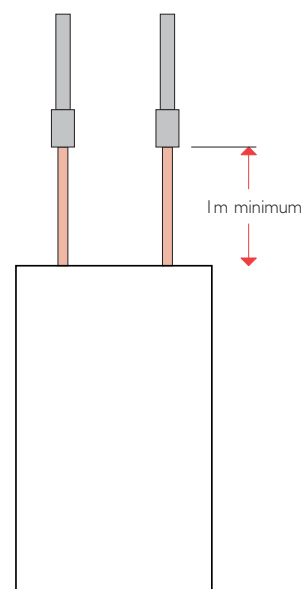
During commissioning it is important to ensure that all trapped air is purged from the heating system before the boiler is operated. 'Pockets' of air can affect proper circulation and impair the correct operation of boiler temperature controls that could cause severe overheating.



Boiler with:

- high limit stat.
- pump over-run.
- connections outside casing.
- connections 350mm from heat source.

Figure 8
Direct connection to Hep₂O®



Boiler with:

- uncontrolled temperature (i.e. solid fuel).
- connections within casing (cast iron heat exchanger).

Figure 9
Connection via copper pipe

Re-using a Hep₂O[®] Demountable Fitting

Dismantling a Hep₂O[®] joint (stages 1 to 4)



Unscrew the retaining cap and pull the pipe clear of the fitting.



Remove the 'O' ring and wedge support ring (if applicable) from the pipe.



Using the wedge removal tool, slide the grab wedge from the pipe. Provided it is undamaged it can be re-used.



All components fully dismantled. To re-assemble, see above.

Re-assembling a Hep₂O[®] joint

To re-assemble the fitting:

- If demounting a fitting, start with a fresh piece of pipe. Cut off pipe at next full 'V' mark from end.
- Check each component for damage. Replacement components are available. See Hepworth Plumbing Products Price List.
- Ensure all components are clean.
- Apply a small amount of **Hep₂O[®] Silicone Lubricant** (code HX200) to the 'O' ring before insertion of fitting.
- Insert the 'O' ring into the fitting body until it rests on the ledge at the bottom of the socket.
- Place the wedge support ring so it sits above the 'O' ring.
- Insert the grab wedge into the wedge support with the flat face of the grab wedge facing down.
- Replace the retaining cap and hand tighten, ready for use.

Alterations to Hep₂O[®] Demountable and SlimLine Fittings

Blanking a Hep₂O[®] Demountable fitting (stages 1 and 2)

Remove the cap and grab wedge from the fitting. Push the open end of the blanking peg (HX44) into the 'O' ring. Replace the cap hand tight.

When ready to continue extending the system, remove the cap and blanking peg, re-insert the 'O' ring and wedge support ring (if applicable) - check the grab wedge is undamaged.

Insert the grab wedge into the fitting with the flat face against the wedge support ring. Replace the cap hand tight.

If the 'O' ring pre-lubrication has been removed by handling, it should be replaced with **Hep₂O[®] Silicone Lubricant** (code HX200)

Blanking a Hep₂O[®] SlimLine fitting

Insert a blanking plug (HX41) directly into the fitting.

When ready to continue extending the system, drain the system, cut off the top of the blanking plug where indicated and attach the next fitting.



Demountable **Hep₂O[®]**



Demountable **Hep₂O[®]**



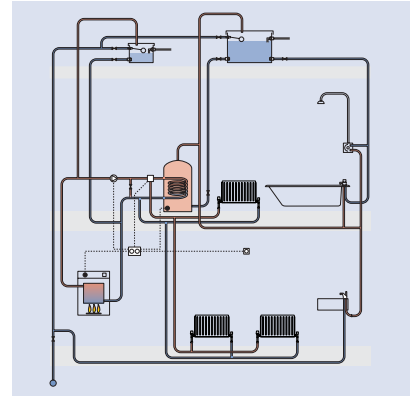
SlimLine **Hep₂O[®]**



Introduction

'Design Considerations' is intended to provide architects, designers and professional installers with an understanding of the wide range of options available to them when specifying Hep₂O[®], including the correct usage of the components and procedures to be adopted.

To ensure the successful and efficient performance of Hep₂O[®] plumbing installations, 'Design Considerations' is therefore divided into 3 sub-sections.



1. Systems Planning (pp 54-70)

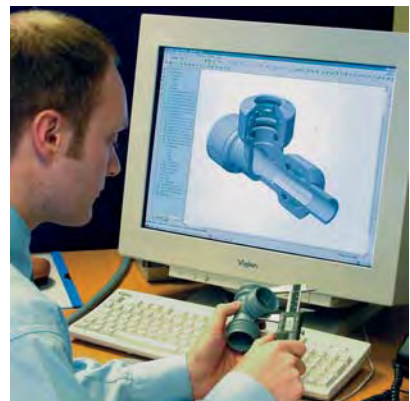
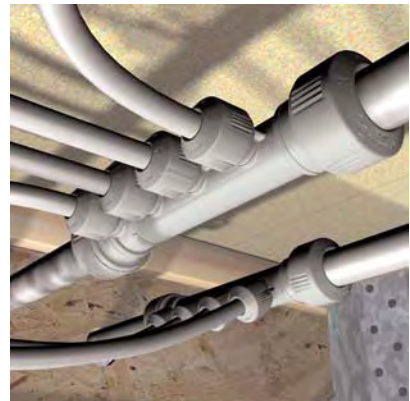
- Typical domestic plumbing arrangements
- Hep₂O[®] underfloor heating
- Temperatures and pressures
- System sizing procedures and calculation examples
- Cabling Hep₂O[®] and drilling through joists
- Pipe supports
- Manifolds and microbore plumbing
- Access to pipes and joints
- General locations of pipes
- Cylinder cupboard layouts

2. Construction Types & Water Distribution (pp 71-80)

- Domestic timber floors
- Floor screeds
- European construction
- Internal drywall systems
- Timber and steel framed buildings
- Drylined walls

3. Regulations & Guidance (p 81)

- A synopsis of the advice and legislation affecting the design and installation of plumbing layouts



Typical Domestic Plumbing Arrangements

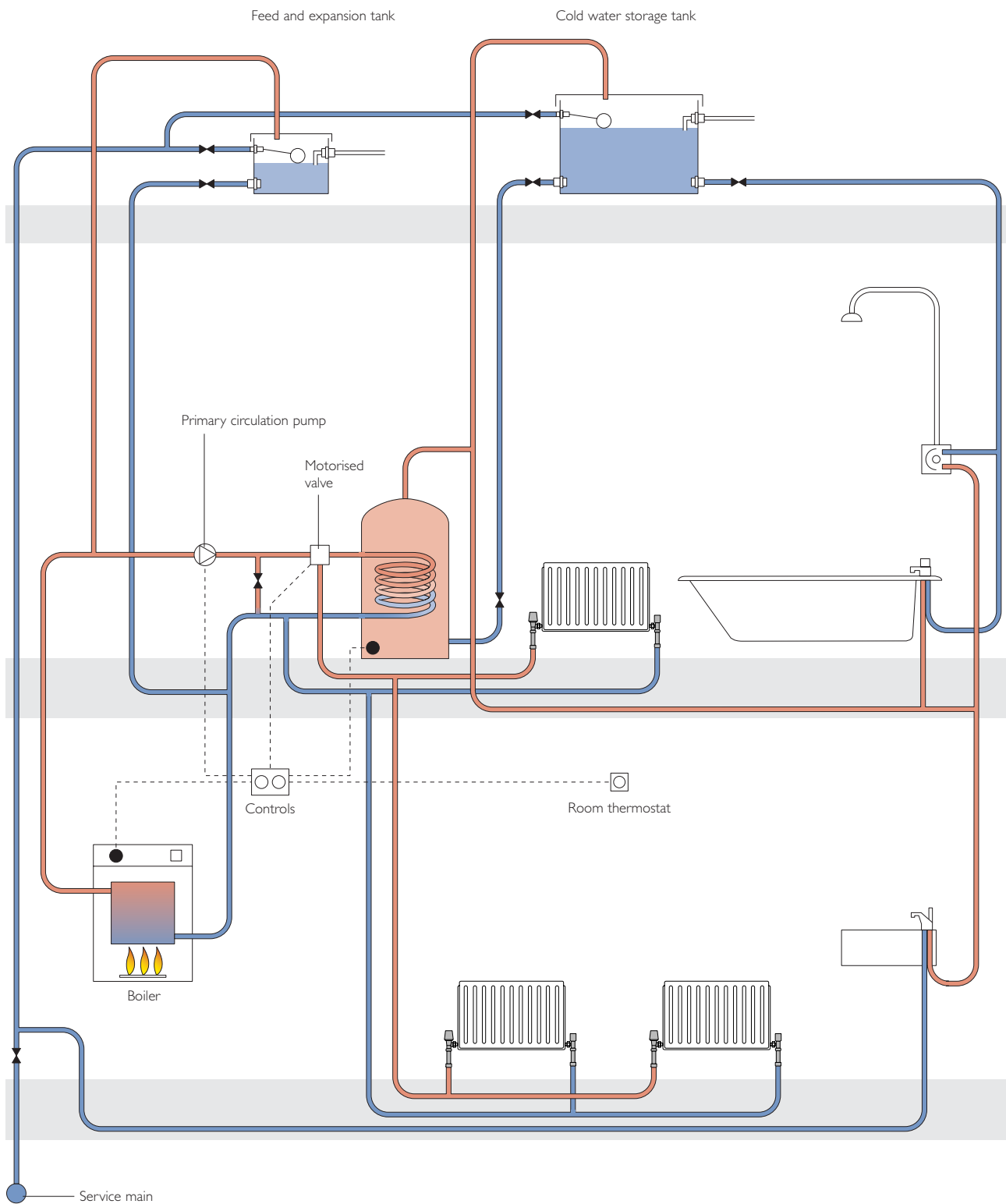


Figure 10
Indirect and vented system



Typical Domestic Plumbing Arrangements

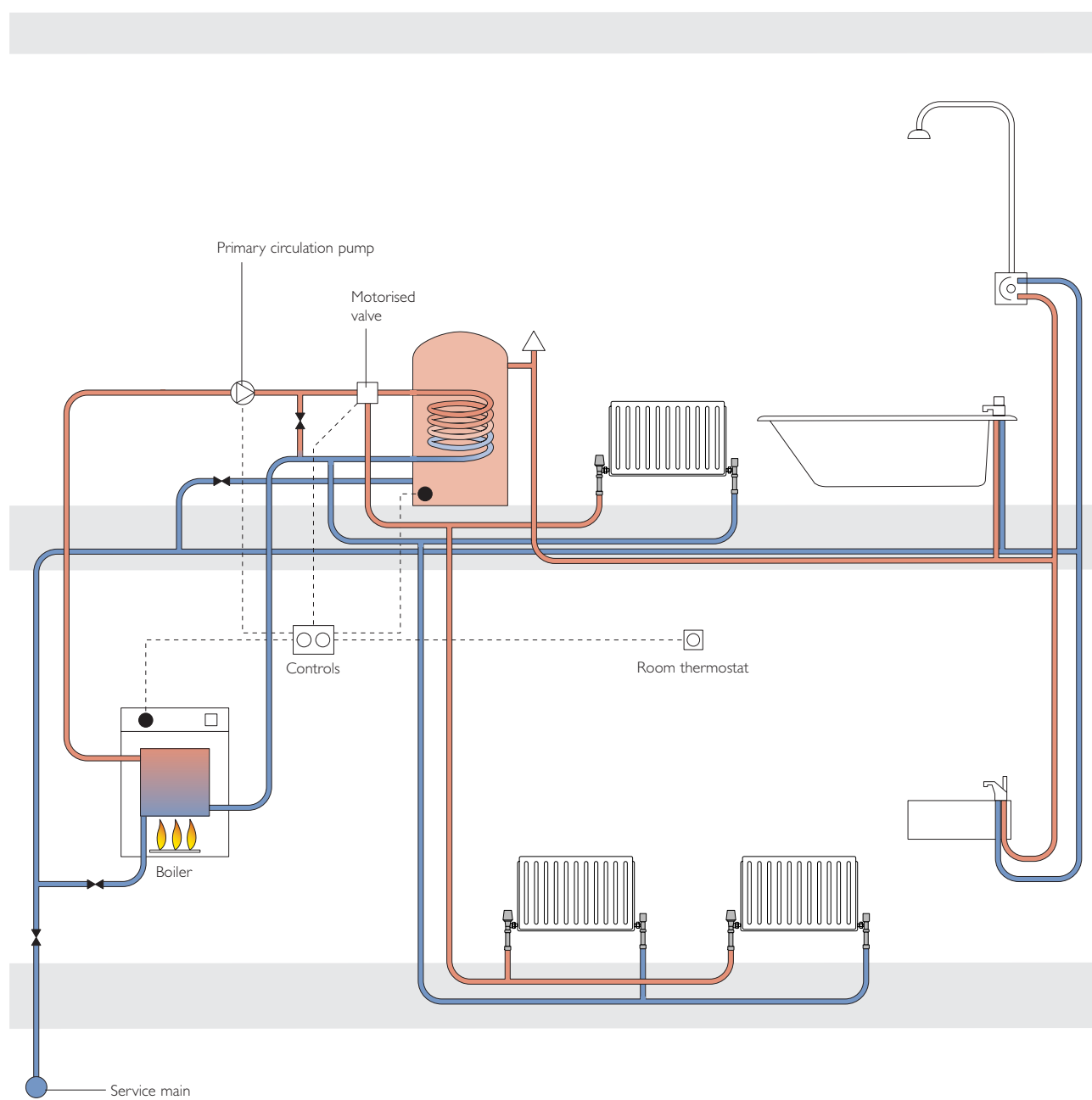


Figure 11
Direct and sealed (unvented) system

Typical Domestic Plumbing Arrangements

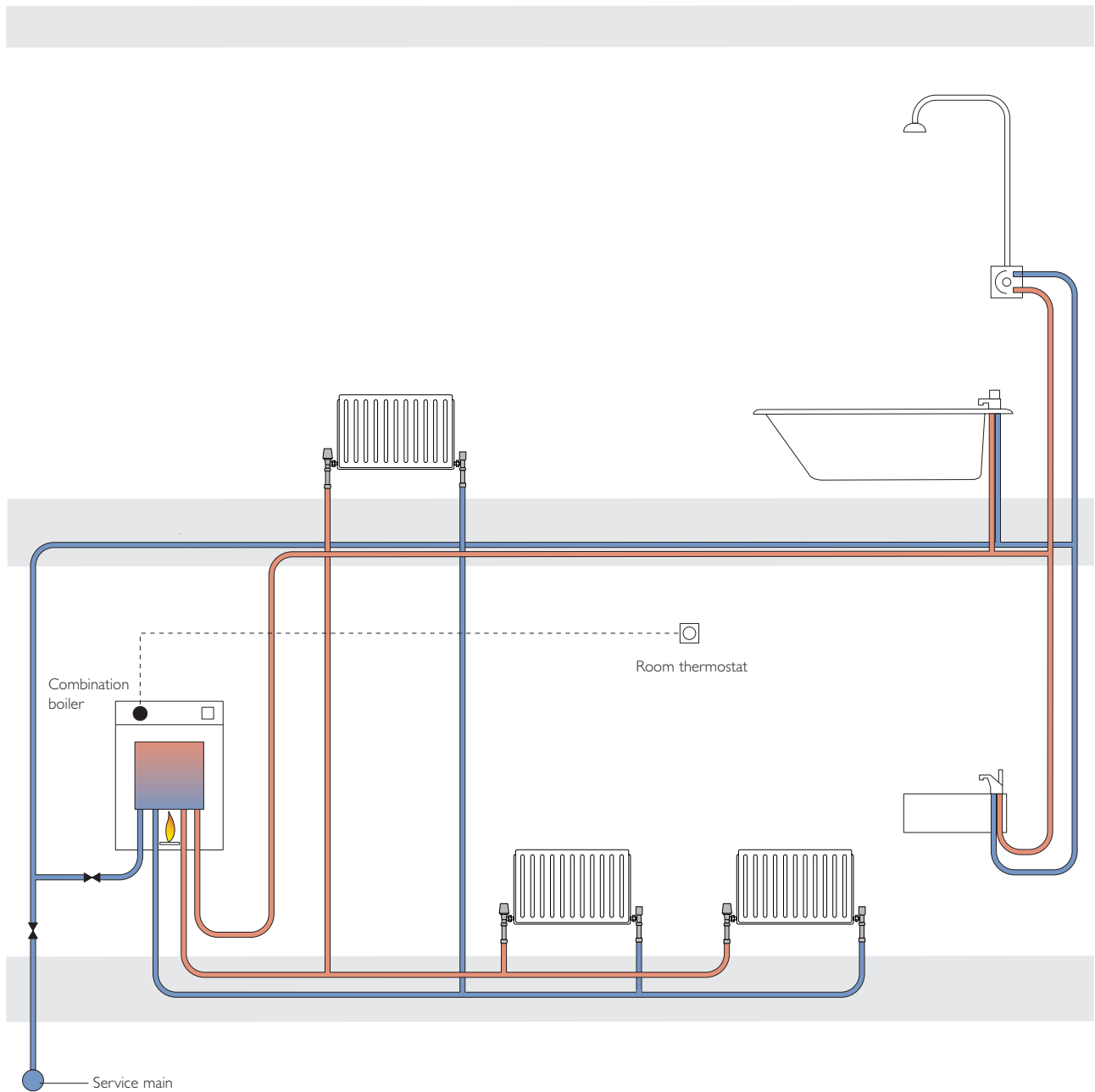


Figure 12
Direct and sealed (unvented) system using combination boiler



Hep₂O[®]

UNDERFLOOR HEATING

Introduction

Underfloor heating provides a comfortable, highly energy efficient type of heating. It delivers an invisible warmth, with no unsightly heat emitters compromising the building layout. Allowing maximum usable area within the building, it is ideal for both renovation and new build methods of construction. This may include the heating of a conservatory, a one room extension, domestic or commercial applications. It is also ideally suited for the high-ceilinged spaces encountered in churches and atriums.

A modern underfloor heating system consists of continuous plastic pipe circuits buried in a concrete screed or run below a timber floor system, either floating or suspended. The Hep₂O[®] underfloor heating system utilises low temperature hot water, typically 40-55°C, unlike conventional heating methods such as radiators or convectors.

See Figure 13 for a typical domestic underfloor heating layout.

Benefits

The major benefit of an underfloor heating system to the end user is the comfort level provided. Underfloor heating gives an even warmth across the entire room from the floor upwards. Optimum, individual comfort in these conditions is achieved when the feet are a few degrees warmer than the head.

Hep₂O[®] Underfloor Heating Pipe is designed for use in underfloor central heating systems. It is supplied with an oxygen diffusion barrier offering maximum protection against oxygen ingress.

The design of the barrier within the wall of the pipe offers significant advantages over underfloor pipes with an external coating.

Material

Hep₂O[®] Underfloor Heating Pipe is manufactured principally from polybutylene (PB), a high quality engineering polymer, designed specifically for use as a flexible plumbing material. The highly flexible nature of polybutylene means it is the ideal material for an underfloor heating installation, allowing the installer to form pipe circuits with ease, without the need for preliminary tempering or pre-warming as with other materials.

Hep₂O[®] Underfloor Heating Pipe is supplied in 16mm and 20mm diameter Straight Coils, and a variety of lengths, enabling the installation of long continuous circuits with minimal pipe wastage.

Hep₂O[®] Underfloor Heating Pipe is corrosion resistant and unaffected by corrosion inhibitors when used in accordance with manufacturer's recommendations.

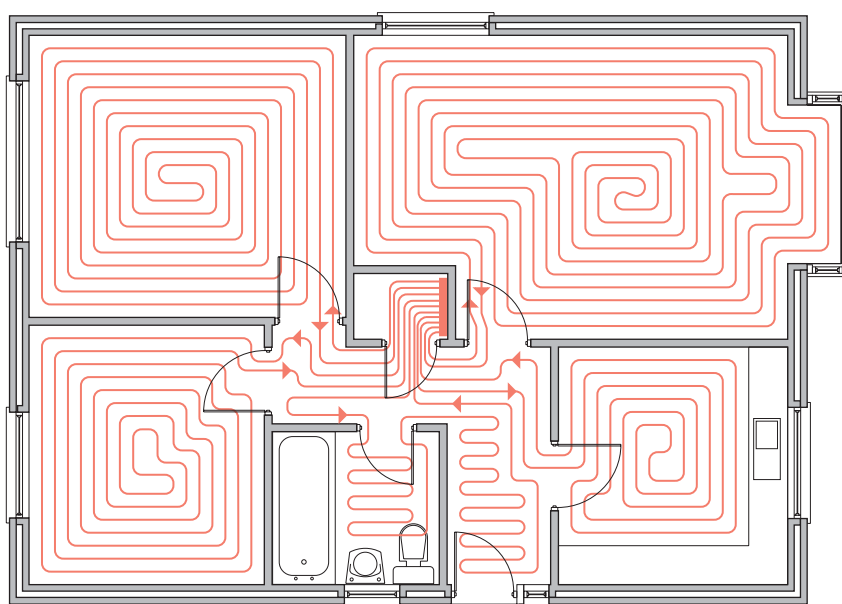


Figure 13
Typical domestic underfloor heating layout



Hep₂O[®] underfloor heating manifold



Laying Hep₂O[®] pipe

Temperatures and Pressures

This section covers the maximum temperatures and pressures associated with hot, cold and central heating systems.

Table 10 relates to plumbing and heating systems generally and shows the type of service, the temperature at which it operates and the pressure usually associated with these.

Cold water systems

The normal working pressure for cold water systems is 3 to 4 bar although in some areas this may rise to 7 bar during the night.

Hot water systems

These are usually tank fed with a maximum of 1 bar. Unvented systems operate at about 2 to 2.5 bar. A safety device prevents the system operating over 3 bar or 100°C. The maximum safe temperature is 60°C.

Combination boilers operate between 1 and 1.5 bar only: a safety device prevents the boiler operating above 3 bar.

Note that 1 bar = 14.5 pounds per square inch = 100,000 Pascals = 10 metres of static head.

Recommended service temperatures and pressures for Hep₂O[®] pipework

Hep₂O[®] has a minimum design life expectancy of 50 years provided the system is installed in accordance with the manufacturer's recommendations. These recommendations include service temperatures and pressures.

Service temperatures are defined as the maximum temperature that can occur during normal operation.

The malfunction temperature is defined as the maximum temperature applied to the system in the event of control thermostat failure or malfunction. The system could remain intact at this temperature and pressure for 3 to 4 months.

Table 11 shows the recommended service temperatures and pressures.

Flow rates

Although the bore of Hep₂O[®] pipe is less than its copper equivalent actual system flow rates are not significantly lower. This is due to four reasons:

- the system requires fewer fittings, i.e. elbows - a 15mm copper elbow reduces the flow of a system by being equivalent to adding 0.5m to the pipe run.
- the smooth bore does not allow corrosion or scale to build up and reduce the flow of a system.
- the method of cutting and jointing ensures there are no burrs or protrusions of solder to impede the rate of flow.
- by using the flexibility of the pipe the course of the water takes fewer sharp bends and the flow is impeded less.

Table 10 Maximum Temperatures and Pressures

Service	Temperature	Pressure
Cold water	10°C to 20°C	up to 7 bar
Hot water	up to 60°C	1 bar for vented systems 3 bar for unvented systems
Central heating	82°C	1 bar for vented systems 3 bar for pressurised and combination systems

Table 11 Recommended Service Temperatures and Pressures

Temperature (°C)	20	30	40	50	60	70	80	90	114
Pressure (Bar)	12.0	11.5	11.0	10.5	9.0	8.0	7.0	6.0	3.0

Note that 114°C = malfunction

System Sizing

For pipe sizing **Hep2O**® in domestic cold and hot water systems, nomograms 1 and 2 on pages 61 and 62 respectively, may be used, as appropriate.

For pipe sizing **Hep2O**® in central heating systems, nomogram 3 on page 63 may be used.

The nomograms indicate head loss due to friction for varying flows in **Hep2O**® piping. Water velocity can also be determined.

Alternatively, pipe sizing can be achieved by using the **Hep2O**® calculator (code HX80). This is a Mears 'wheel' type calculator that can also be used for heat loss calculations. The effect of frictional losses caused by pipe fittings can be made by either adding an allowance to every pipe length (e.g. 25%) or by using equivalent length values for each fitting. The latter method is recommended for greater accuracy, and notional values are shown in Table 12 on page 60. For example, an elbow fitted to a 15mm pipe run will be equivalent to increasing the pipe length by a further 0.5m.

The system sizing calculation examples on page 60 show how the nomograms and Table 12 may be used.

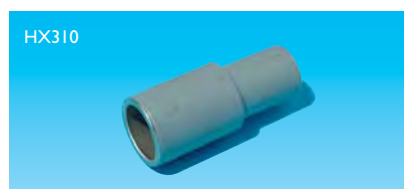
For further explanation of pipe sizing please refer to BS 6700 of the Institute of Plumbing Engineering Services Design Guide.

Pipe diameter reduction

Diameter reduction can be achieved by using any of the reducing fittings shown on this page.

Hep2O® Double spigot reducer

(see page 15)



Hep2O® Socket reducers (see pages 14 & 19)



Hep2O® Reducing tees (see pages 16-17 & 20-21)



Hep2O® Manifolds (see pages 29-30)



System Sizing Calculation Examples

Domestic cold water pipe sizing

Question: What is the effect on the tap head when 22mm Hep₂O[®] is used as the distribution pipe from storage cistern?

System information assumptions

Design flow at tap	0.3 l/s
Frictional loss at tap	0.8m head
Proposed Hep ₂ O [®] size	22mm

Calculation (read with Figure 14 and Table 12)

Measured pipe length (ML): 0.5 + 3 + 5 + 0.5	=	9.0m
Equivalent pipe length (EL): 3 elbows x 0.8	=	2.4m
Total equivalent pipe length (TEL)		11.4m
Head available at tap: 3 – (0.5 + 0.8)	=	1.7m head
Available head loss per 100m: $100 \times \frac{1.7}{11.4}$	=	14.9m

Using Nomogram 1 (page 61), plot a line from 14.9m on head loss scale through 0.3 l/s on flow scale and extend over to pipe size scale (shown by dash line on nomogram). This indicates that proposed 22mm pipe size would be suitable. To check what the actual head loss is for this size, plot a line from 22mm on pipe size scale through 0.3 l/s on flow scale, and extend over to head loss scale (shown by dotted line on nomogram).

This indicates that head loss is 11m per 100m (0.11m per m).

Actual head loss through pipework: 11.4m x 0.11 = 1.254m

Actual flow rate at tap would therefore be slightly higher than design flow.

1m head loss = 9.8l kN/m²

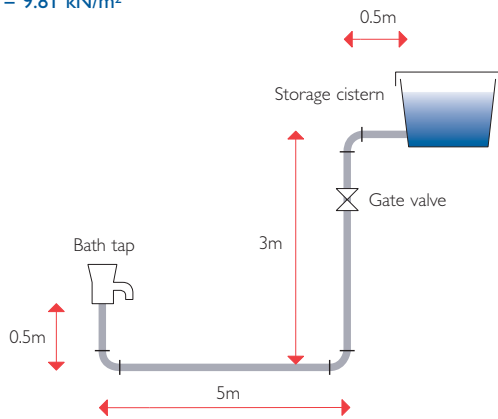


Figure 14

Table 12 Equivalent Pipe Lengths for Pipe Sizing

Hep ₂ O [®] diameter (mm)	Elbow (m)	Tee (m)	Stopcock (m)
10	0.2	0.3	–
15	0.5	0.6	4.0
22	0.8	1.0	7.0
28	1.0	1.5	10.0

Notes:

- This table is appropriate for pipeline water velocities not exceeding 1.5m/s. Refer also to Table 15 on page 72.
- Frictional loss through tees occur on a change of direction only.
- Frictional loss through fully open gate valves can be ignored.
- Frictional loss through cold formed bends can be ignored.

Domestic hot water pipe sizing

Given sufficient system information for domestic hot water layouts, pipe sizes may be ascertained with nomogram 2 (page 62) and the calculation method used for domestic cold water pipe sizing.

Central heating pipe sizing

Question: What is the effect on the pump head when 10mm Hep₂O[®] is used for radiator connections?

System information assumptions

Length of radiator flow pipe	4m
Length of radiator return pipe	5.5m
Flow and return design temperatures	80°C and 70°C
Allowance for unusable pipe heat loss	5%
Specific heat capacity of water	4.2
Design output of 'index' radiator	1.2 kW

Calculation (read with Figure 15 and Table 12)

Heat load: 1.2 kW + 5%	=	1.26 kW
Flow rate: $\frac{1.26}{4.2 \times (80-70)}$	=	0.03 l/s

Using Nomogram 3 (page 63), plot a line from 10mm diameter on pipe size scale through 0.03 l/s on flow scale and extend over to head loss scale, (shown by dash line on nomogram). read head loss value as 14m per 100m, i.e. 0.14m per m run.

Measured pipe length (ML): 4 + 5.5	=	9.5m
Equivalent pipe length (EL): 4 elbows x 0.2	=	0.8m
2 tees x 0.3	=	0.6m
Total equivalent pipe length (TEL):		10.9m
Pipework head loss: 0.14 x 10.9	=	1.526m head
		or 15 kPa

This head must be added to frictional loss of all other circuits on 'index run', together with allowances for radiator valves, control valves, boiler, etc., in order to determine minimum pump head required.

Like copper 'microbore' systems, the use of 10mm Hep₂O[®] will require slightly more pump head than systems using 15mm radiator circuits.

As a general precaution, 10mm Hep₂O[®] should not be used for a radiator output in excess of 1.5 kW (approximately 5,000Btu) unless proven by calculation.

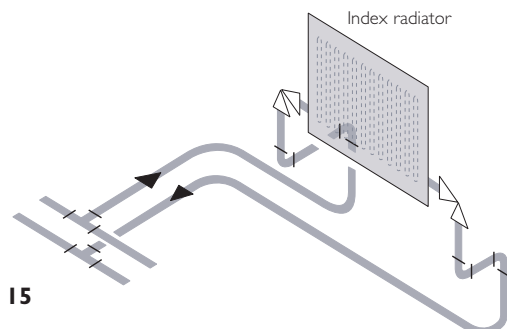
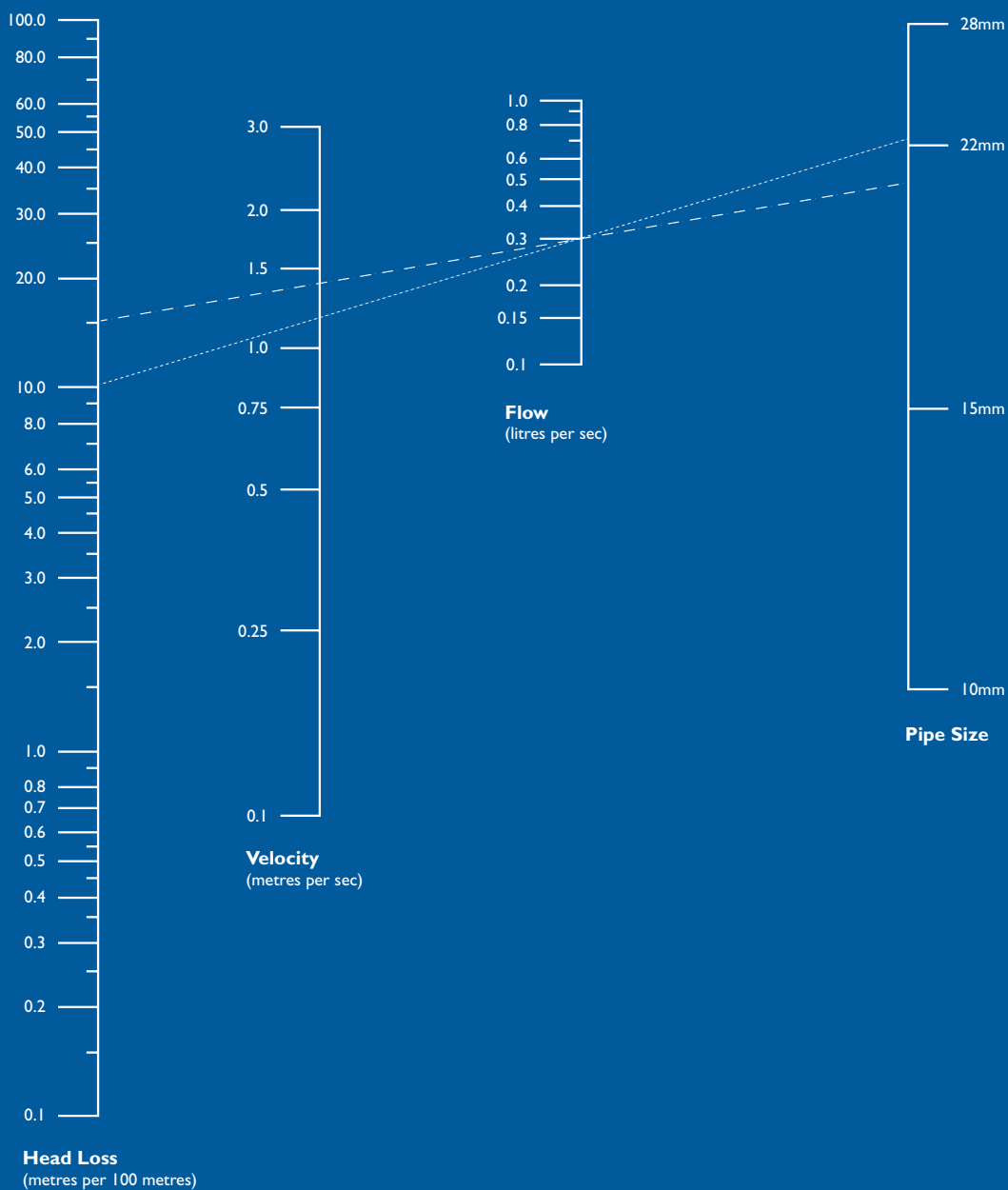


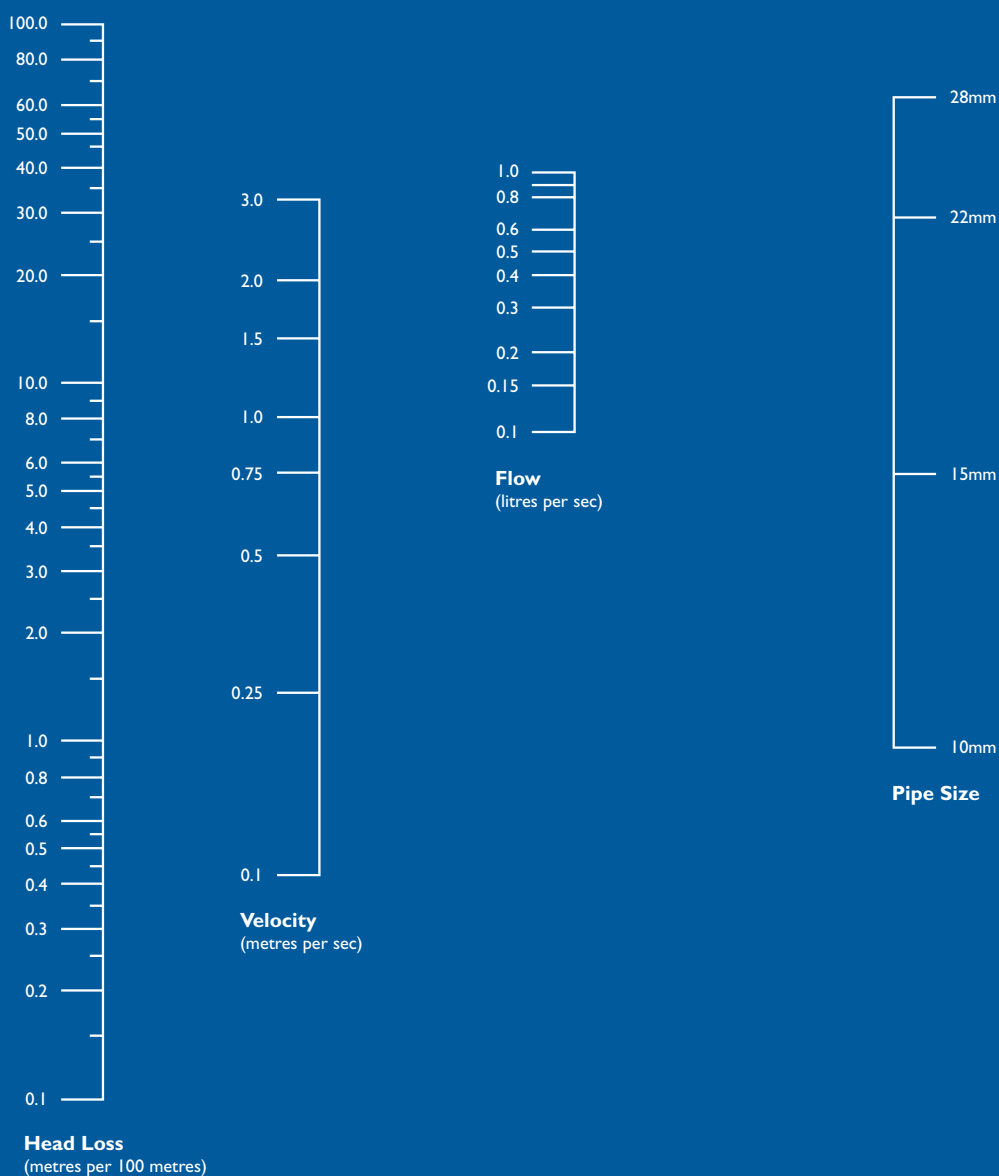
Figure 15



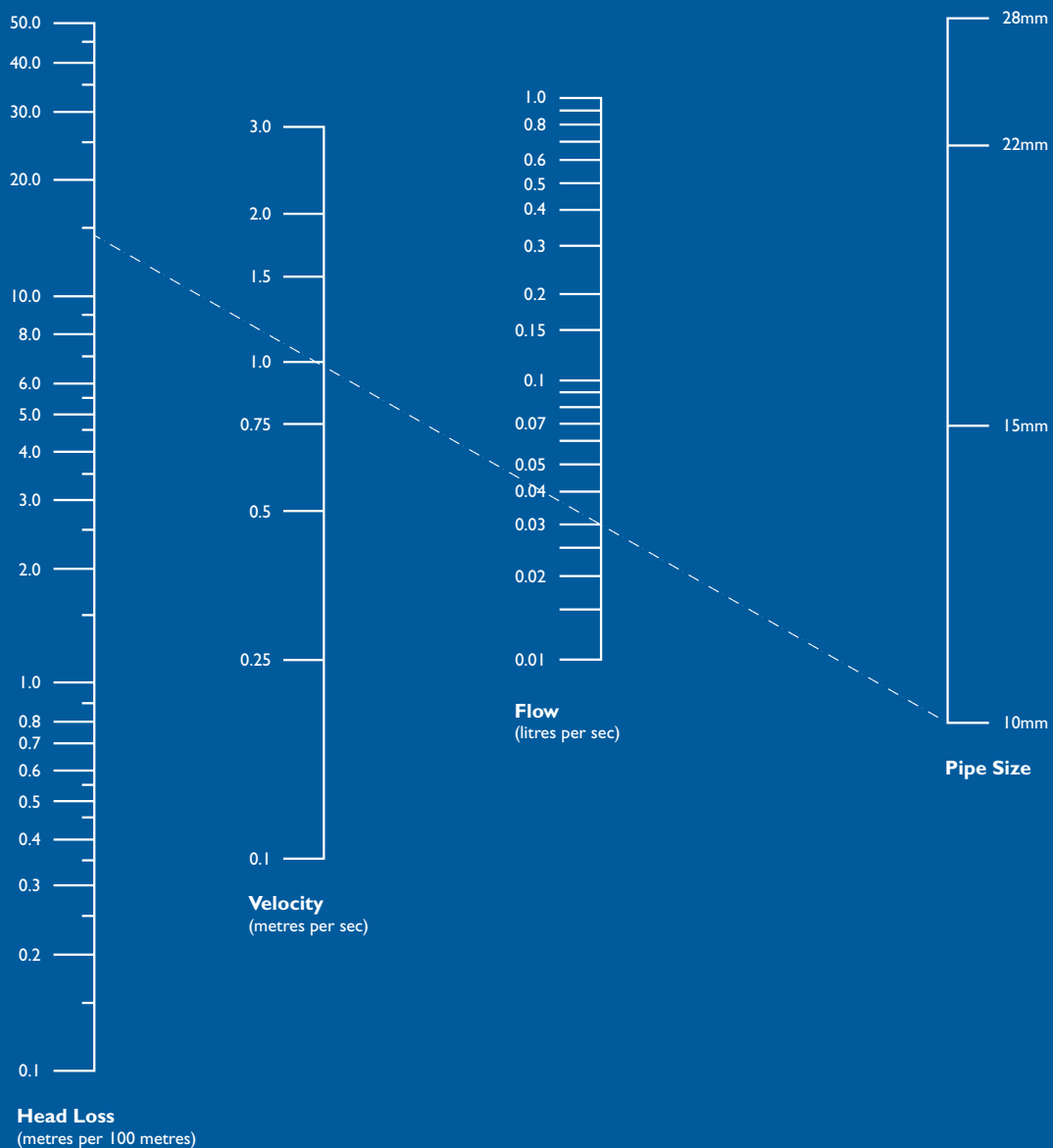
The dashed line and dotted line refer to the worked example on page 60

Nomogram I Determination of pipe diameter for cold water services

System Sizing Calculation Examples



Nomogram 2 Determination of pipe diameter for hot water services



The dashed line refers to the worked example on page 60

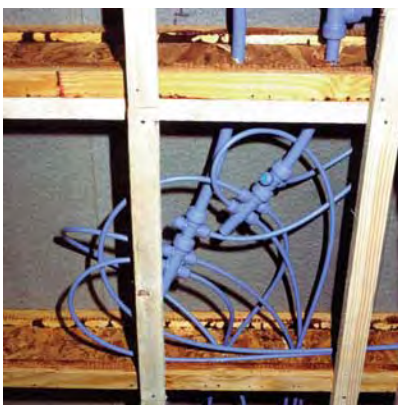
Nomogram 3 Determination of pipe diameter for central heating

Cabling Through Joists

The 1992 Building Regulations Approved Document A allows for pipework to be installed within joists by one of two methods, notching or drilling. Traditionally joists have been notched and the pipework laid in because the rigidity of the pipe does not easily allow for any other method of installation. This means that the pipework must be installed before flooring boards are laid.

Rigid pipework has a number of disadvantages:

- the plumber has to work on open joists increasing risk of accident or injury.
- the plumber will have to return after floors are laid to connect radiators, etc.
- the plumber often finds that the tails originally installed have been moved by other tradesmen thereby causing extra work to reposition pipework correctly for radiators.



Flexible pipework

Hep₂O[®] flexible pipework cabled through joists means that it can be installed by working from below allowing exact positioning of 'tails' through floor boarding.

As flooring can be laid prior to the plumber carcassing from below this will progress the building schedule as other trades can work on the floor above e.g. to form studwork, etc. Carcassing at a later stage in the construction programme is also more pleasant as the building is likely to be weatherproof.

Flexible pipework also has further advantages:

- cabled pipework can more easily utilise continuous runs of pipework.
- dry runs are not necessary as the pipe can be cut and joints made in situ.
- there is less possibility of puncturing the pipe with nails used for fixing the flooring boards, and there is no need to use protective devices such as 'joist clips'.
- **Hep₂O[®]** can be trimmed to length and the natural flexibility used to overcome any mis-alignment.
- when **Hep₂O[®]** is cabled through joists it can be easily positioned to allow for the installation of thermal insulation if required.

Pumps and valves

Where **Hep₂O[®]** is connected to pumps, valves and similar devices consideration should be given to adequately supporting the item in question (bearing in mind the rotatability of the **Hep₂O[®]** joint). Equipment should therefore not be suspended from the pipe without adequate support.

Enhanced site safety and less risk to health

Installing the plumbing system below a completed floor means that site safety is enhanced and the plumber is not exposed to the danger of falling or the discomfort of kneeling on open joists. Other trades also working below are protected from falling tools, molten solder, gas bottles etc.

The unique **Hep₂O[®]** fittings ensure effective, high performance pipe jointing without the use of a naked flame.

Safety from fire, especially in restricted spaces, is therefore greatly increased and the working environment is improved.

As there is no need for flux and solder, any potential contamination of water supplies is eliminated.

Push-fit jointing also has further safety advantages:

- no naked flame means that precautions such as obtaining a 'hot work' permit, having a fire extinguisher readily available, and remaining on site for a while after jointing are not necessary.
- no risk of infringement of Health and Safety recommendations applicable to some brands of flux, such as the means to control exposure to noxious fumes when working in a confined space, or the use of eye protection (where appropriate).
- after jointing the fitting is clean and safe to touch, whereas after soldering, the joint is hot and flux traces have to be removed.
- as no solvents are used in jointing, the system can be tested as soon as the installation is finished.

Parameters for Drilling Through Traditional Joists

The Building Regulations 1992 Approved Document A gives exact instructions on the drilling of floor joists.

The requirements of the regulations are detailed below:

- hole diameters should be no greater than 0.25 of the depth of the joist and should be drilled at the neutral axis.
- they should be not less than 3 diameters (centre to centre) apart and should be located between 0.25 and 0.4 times the span from the support.

and illustrated in Figure 16.

The value 0.25 is obviously one quarter and can easily be calculated on site. The value 0.4 is less obvious and can be obtained from the graph (Figure 17).

Reading in conjunction with Figure 16, the following example illustrates the use of the graph:

Joist span is 4.5m.

Find value on horizontal scale and read-up to sloping line.

Transfer point of intersection to the vertical scale and read 1.8m.

Parameters for Drilling Through Engineered Joists

Hep₂O® is ideal in buildings incorporating timber 'I' joists. Piping can be properly installed through holes in the web section without damaging flange members (e.g. TJI Joist system, Trus Joist MacMillan Ltd.) even where the pre-formed holes do not align on the plan.

Refer to Figure 18.

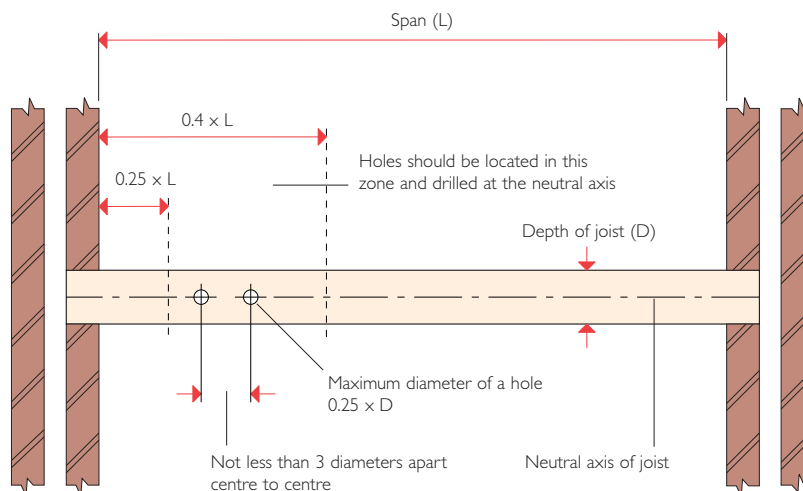


Figure 16
Drilling requirements for traditional joists

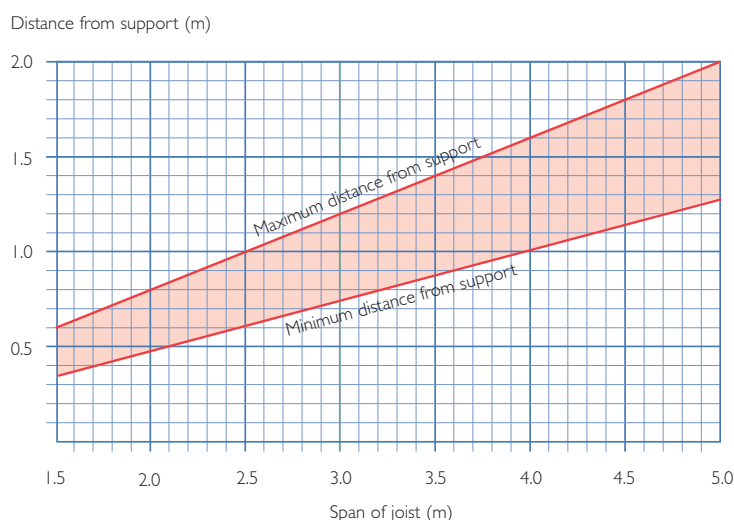


Figure 17
Joist drilling zone from support

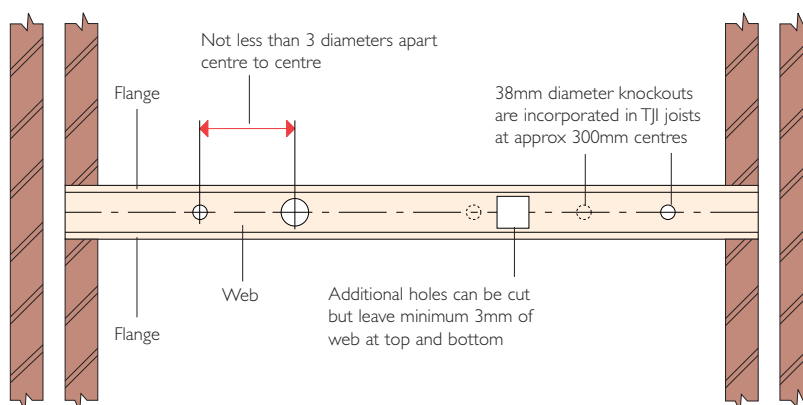


Figure 18
Drilling requirements for engineered joists

Hep₂O[®] Pipe Supports

The Hep₂O[®] system includes two types of pipe clip, the screw fix type (HX85) and the nail type (HX65). The nail type is primarily designed for use on concealed pipework, and allows for rapid fixing to timber. The screw type may be used together with a spacer (HX86) which allows a greater spacing between the pipe and the fixing background. The spacer therefore allows different pipe fixing centres which can be used to facilitate pipe cross-overs or the installation of thermal insulation to the pipe (see Figure 19 and Table 13).

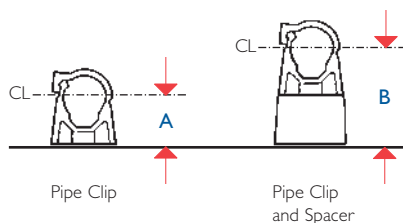


Figure 19
Pipe fixing centres

Table 13 Pipe Fixing Centres

Nominal dia (mm)	15	22	28
A (mm)	17	21	24
B (mm)	40	43	46

A cold forming bend fixture (HX75) is available to allow the formation of a bend on 15mm and 22mm pipes for situations where secure fixing and neatness are important. Refer to Performance Data page 42 for the minimum radii that can be achieved.

The recommended support distances for general purpose use are shown in Table 14.

Table 14 Recommended Clipping Distances

Nominal dia (mm)	10	15	22	28
Horizontal runs (m)	0.3	0.3	0.5	0.8
Vertical runs (m)	0.5	0.5	0.8	1.0

Where piping is adequately supported or is run within concealed spaces (eg. through suspended timber floors) clips can be reduced or omitted provided that:

- the pipe does not form part of an open vent provided for safe operation of heat source
- the pipe does not form a distribution pipe or circuit where effective air venting might be impaired by poor pipe alignment
- the hot pipe will not touch a cold pipe or vice versa
- there is no risk that pipes or fittings will come in contact with sharp, abrasive or other potentially damaging surfaces
- there is no risk the pipe will come in contact with materials which may suffer damage or discoloration from transmitted heat.

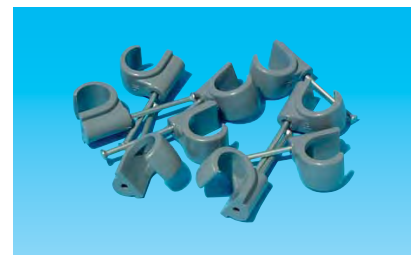
For improved visual appearance support distances of 300mm are suggested for Hep₂O[®] in exposed locations.

Where the pipe is concealed, clipping may not be considered necessary. Cable ties may be used for restraint.

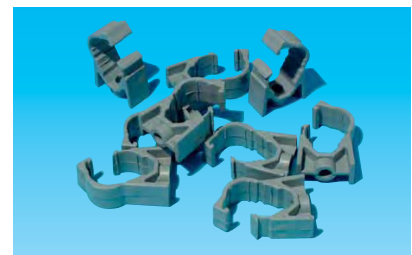
The cabling ability of Hep₂O[®] enables easy installation through noggins, studs etc., and in internal plasterboard/studding walls. Simply carried out, with tails left exposed prior to the plasterboard being installed, this is especially useful for 'microbore' plumbing (see page 67).

Partition systems on the market have the built-in facility for cabling electrical wiring and this can be utilised for Hep₂O[®] pipework.

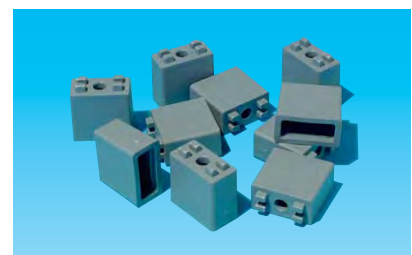
Hep₂O[®] pipe can be easily manipulated by hand to form unsupported bends of any angle. In order to prevent any long term detrimental effect on the material, the curvature of Hep₂O[®] pipe should be not less than the minimum radii shown in Performance Data page 42.



Pipe Clip - Nail Type (cable)



Pipe Clip - Screw Type



Pipe Clip Spacer

Hep₂O[®] Manifolds and Microbore Plumbing

Microbore plumbing systems are those that employ 10mm diameter Hep₂O[®] pipes.

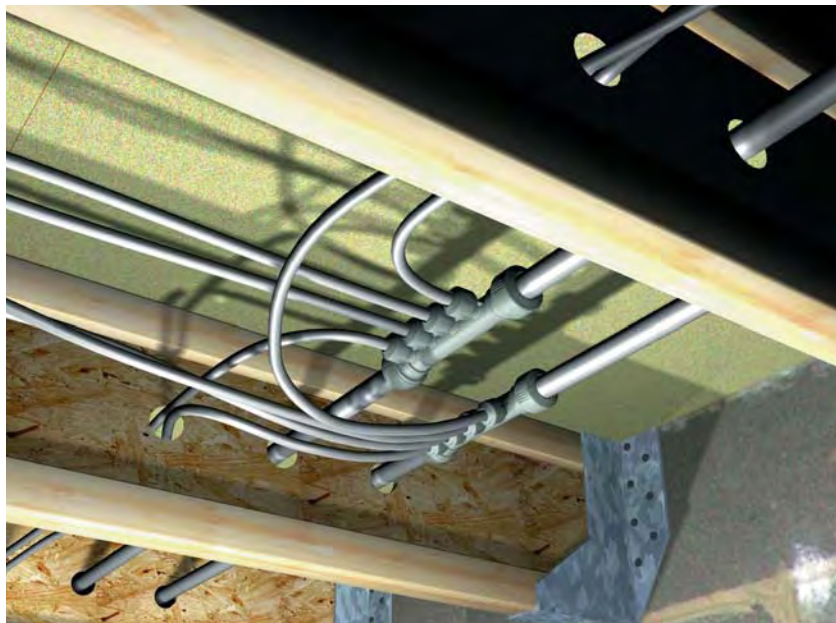
Hep₂O[®] Manifolds are designed for use on microbore central heating systems and can also be used for hot and cold water.

The Hep₂O[®] Manifold, in one fitting, brings together multiple 10mm pipe connections on the flow and return pipework to one area of a building, enabling easy access when used in conjunction with the Hep₂O[®] Routabout system (see page 68). This system provides instant access below sheet flooring installations for future system modifications or extensions.

A comprehensive range of Hep₂O[®] Manifolds is available that can be connected in series allowing any number of outlets.

Hep₂O[®] Manifolds offer a number of installation and performance benefits:

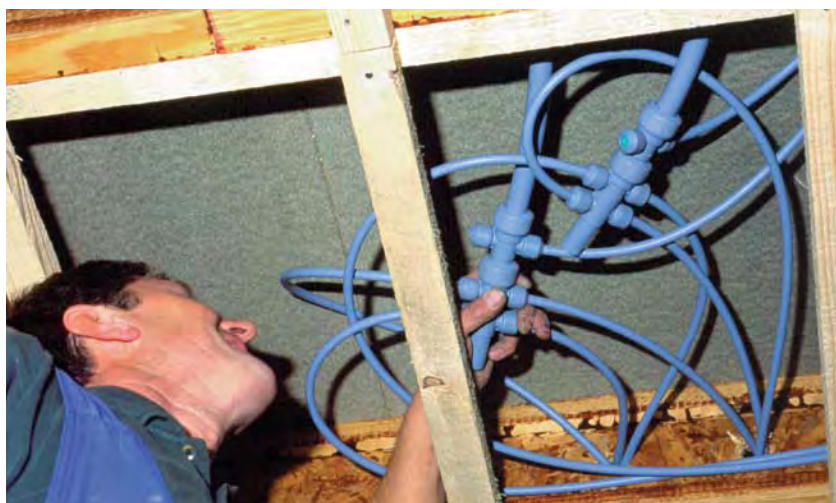
- the Hep₂O[®] Two Port and Four Port Manifolds provide a cost effective way of connecting 22mm pipe to 10mm pipe as they reduce the number of fittings required.
- fewer fittings reduces installation time.
- one of the main advantages of the Hep₂O[®] Manifolds is that they are manufactured from polybutylene, an extremely robust yet lightweight material and are therefore, much easier to install.
- the lightweight Hep₂O[®] polybutylene manifolds enable the pipe to be suspended between joists without fear of dragging the pipe down.
- blanking pegs can be used to close off any unused sockets, then removed as and when required to extend the system.



Hep₂O[®] manifolds and microbore plumbing with engineered joist construction



Hep₂O[®] manifold range



Installation of Hep₂O[®] manifolds

Access to Pipes and Joints

The Hep₂O[®] Routabout System

Hep₂O[®] Routabout Hole Cutter is a unique system that solves the problem of underfloor access found by all builders, plumbers and other trades. A 250mm diameter opening can be cut and made good in minutes. Designed for use in new or existing 18mm and 22mm chipboard or similar floors, the Routabout cuts only the thickness of the board, thus leaving no waste, and the piece cut out is used to make good the floor.

The Routabout starter kit contains:

- 1 x Routabout Rotating Template.
- 1 x Routabout Tungsten Cutter.
- 4 x Routabout Spacer Rings. (Additional rings are available separately)
- 1 x 25mm x No. 8 chipboard screw.

Refer to Product Range page 40.

Also needed, but not supplied:

- A medium sized plunging type router (750 watts min).
- 1 x 1/4" or 1/2" collet to fit router.
- 1 x 30mm (outside dia) guide bush fitted to the router.

Forming an access point to underfloor services (stages 1 to 4)

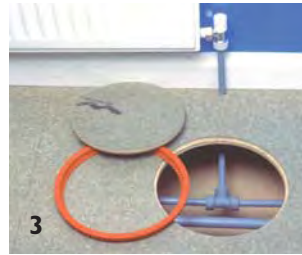


The equipment:

- Plunging type router.
- Routabout Tungsten Cutter.
- Routabout Rotating Template.
- Routabout Spacer Ring.



Routing the flooring sheet using the Routabout Rotating Template.



The Routabout Spacer Ring provides access in the floor sheet to the pipework.



The chipboard cut-out fits snugly into the Routabout Spacer Ring, leaving a neat access.

The Hep₂O[®] Conduit System

The **Hep₂O[®]** Conduit System allows pipe and fittings to be installed directly into concrete floors or walls whilst complying with the requirements of the Water Regulations.

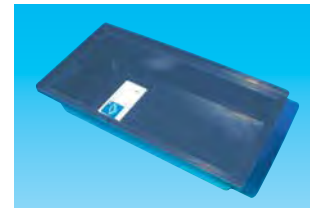
The flexible conduit allows **Hep₂O[®]** to be withdrawn for inspection, and junction boxes allow maximum accessibility to fittings for inspection and possible removal.

To replace or terminate pipework easily, use only Demountable fittings within the junction boxes. Spigot tees in 22 x 15mm and 15 x 10mm sizes are available to build up manifold configurations.

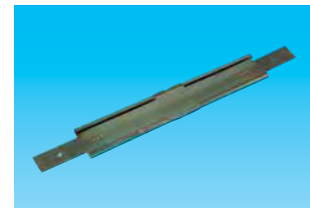
If any bent sections of conduit pipe are formed in an installation then future replacement of the **Hep₂O[®]** is likely to require the use of a 'draw cable'. In this event the draw cable should be attached to one end of the **Hep₂O[®]** before it is pulled out from the other end. Replacement of a new section of **Hep₂O[®]** pipe may require two operatives; one pulling the draw cable which is attached to the pipe end and the other person feeding-in the new length from the opposite end. Replacement will be easier if conduit bends are kept to a minimum and any radius kept as large as practicable.

The system consists of two sizes of flexible conduit, junction boxes with lids and terminal fittings. Holes can be cut in the sides of the junction box at the appropriate position to accommodate the conduit which simply clicks into position.

Refer to Product Range pages 36 and 37. For the use of the Conduit System in floor screeds see pages 74 and 75.



Conduit Junction Box



Terminal Back Plate



Conduit Terminal components

The Hep₂O[®] Pipe in Pipe System

Hep₂O[®] Pipe in Pipe System incorporates **Hep₂O[®]** Barrier Pipe in a pre-sheathed conduit ready for underscreed installation, thus allowing the installer to save time and effort whilst complying with current regulations. Refer to Product Range page 13.

Pipes in Concealed Locations

Hep₂O® pipework can easily be installed in concealed locations in floors, roof spaces etc. Any expansion which may occur will have little mechanical effect, this being absorbed within the pipe length as undulation which may be ignored. Undulation of **Hep₂O**® pipe which may occur naturally as a result of expansion, or installation through joists, will not lead to airlocks. Installation in difficult locations is aided by the cabling ability of **Hep₂O**® pipe. If adequately supported, **Hep₂O**® in concealed locations needs only to be clipped for system alignment e.g. at changes in direction.

Where convenient, cable ties can be used to restrain pipes for system neatness (care should be taken not to overtighten the tie). The pipe should be able to slide freely through the tie to facilitate thermal movement.



Pipes in Exposed Locations

Hep₂O® pipe expands as temperature increases causing it to undulate along its length. This can be visually unacceptable in the case of long exposed runs. Long runs of exposed pipe are unusual in new build where pipework is generally concealed, but may occur in refurbishment.

If the pipework is exposed there are a number of options open to the installer to ensure that a neat, tidy job is achieved:

- **Hep₂O**® pipework, if exposed, can be boxed in (PVC-U trunking or preformed plywood profiles are generally used).
- Long runs of exposed **Hep₂O**® may be unsightly as a result of expansion and therefore the installer may choose to use copper pipe in this instance.

Pipes Through Walls and Floors

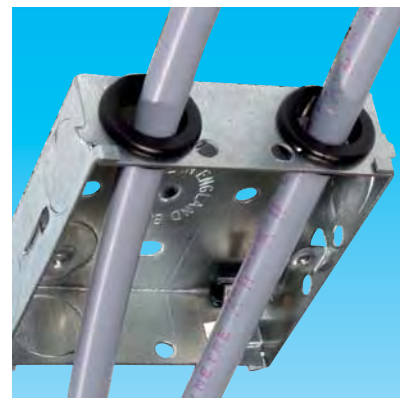
Whenever **Hep₂O**® passes through brickwork, stone or concrete the pipe should be sleeved. The annular gap between the pipe and the sleeve should be filled with a resilient material to provide effective fire stopping and prevention of noise transmission from one room to another.



Pipes Through, and Adjacent to, Metalwork

When running **Hep₂O**® adjacent to or through metalwork, it is important to ensure that the pipe cannot make contact with any sharp edges as this could cause damage during thermal movement. Any of the following preventative measures would be acceptable:

- For a pipe passing through a small hole drilled in metalwork, fix a resilient grommet in hole.
- For a pipe passing through a large hole in metalwork or adjacent to a sharp edge, fix an extruded flexible profile to metalwork.
- Provide sufficient local pipe clipping to prevent contact between pipe and metalwork.
- Run pipe within a conduit.



Cylinder Cupboard Layouts

In order to achieve a neat Hep₂O[®] installation in cylinder cupboards the following recommendations should be observed.

Pipework within the cupboard should preferably come from cut lengths of Hep₂O[®], not coils. See Product Range page 13 for availability of cut lengths.

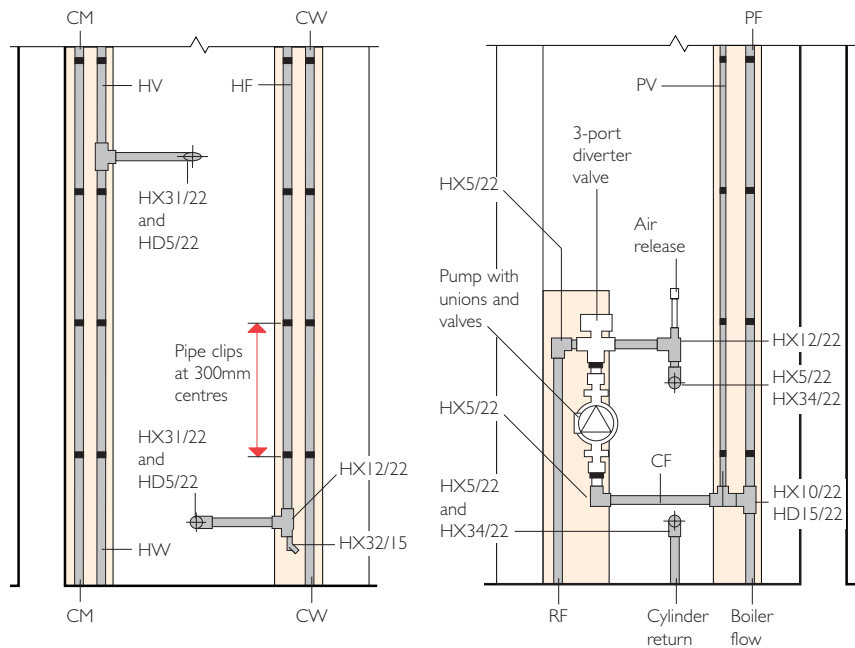
Pipes should be cut exactly to length and clipped at 300mm centres using screw clips (code HX85). For information on insulation requirements in cylinder cupboards, refer to Building Regulations Approved Document L.

To simplify the fixing of pipe clips, boards should be provided at pipe locations. The boards can be surface mounted or fixed within new stud partitions prior to plasterboarding.

New cylinder cupboards often form a restrictive space for the plumbing and a typical layout for a small cupboard is shown in Figure 20. This diagram shows the cylinder primary connections on the left hand side along with the pump, but the whole arrangement could be reversed for right hand installation if required. The cylinder cold feed and the cold down service are located at the front to allow easy access to the gate valves and cylinder drain cock.

Likewise, the pump and diverter valve are located for ease of access. To support the weight of these, one clip should be directly under the diverter valve and a second clip should be directly under the pump inlet connection.

Although space, pipe size and equipment may vary, these layout principles can be used to give satisfactory results.



Section AA

Section BB

Plan

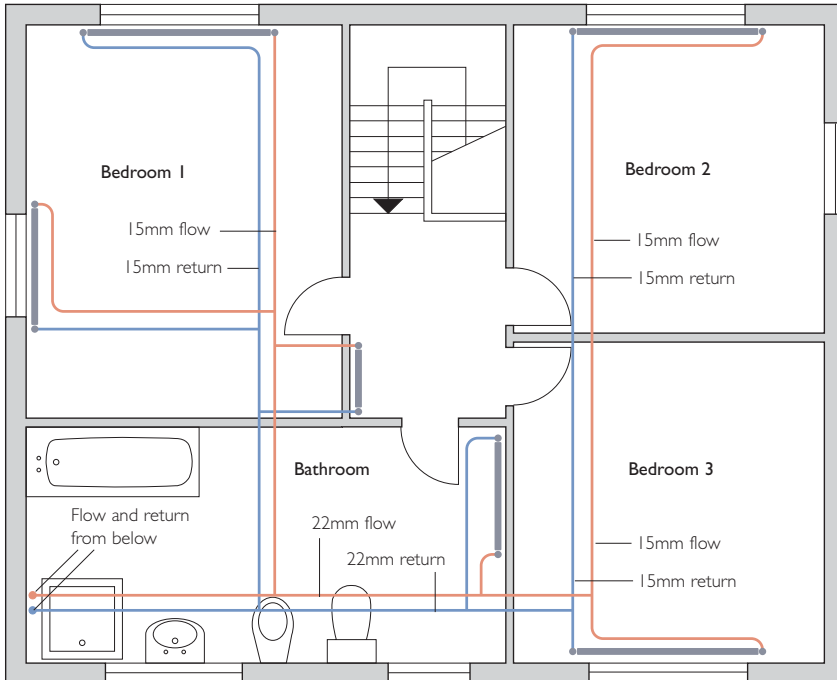
Key

PB	Pipe fixing board (70 x 12mm minimum) full height	HF	Hot water cold feed
CB	Controls fixing board (150 x 12mm minimum) approximately 700mm high	HW	Hot water service
CF	Cylinder flow	HV	Hot water open vent
CM	Cold main	RF	Radiator flow
CW	Cold downservice	PF	Primary feed
		PV	Primary open vent

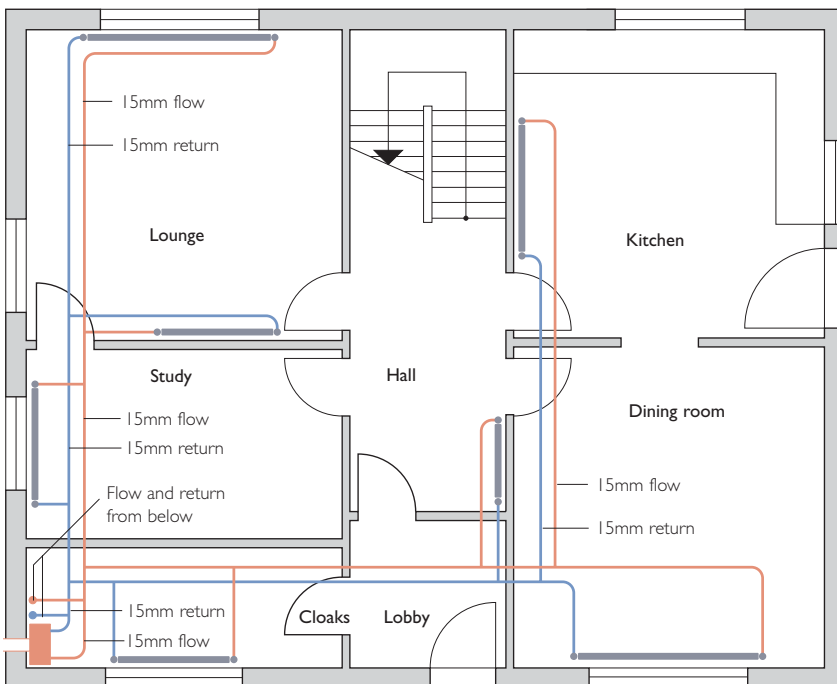
Figure 20 Typical cylinder cupboard layout



Domestic Timber Floors With Traditional Joists or Engineered Joists



First floor



Ground floor

Installation costs are affected by the quality and the type of materials used, and by the time it takes to complete the installation.

A typical central heating system layout incorporating a combination boiler in a 3 bedroom house is shown here.

This layout has a different bill of quantities depending on whether a rigid or flexible system is installed. Refer to Table 15 on page 72 that sets out comparative quantities.

Cabling Hep₂O[®] pipes through traditional or engineered joists allows a more flexible pipe layout to be achieved than would be obtained with rigid piping, particularly within a complex floor plan.

Figure 21 Typical central heating layout

Domestic Timber Floors With Traditional Joists or Engineered Joists

Table 15 Comparative Quantities of Materials for Hep₂O[®] and Copper for a Typical Domestic Central Heating Installation

Hep ₂ O [®] Pipe and Fittings			Copper Pipe and Fittings	
Pipes	Code	Quantity	Pipes	Quantity
15mm Pipe – 100m Coil	HXP100	100m	15mm pipe – 6m lengths	102m
22mm Pipe – 6m Lengths	HXP06	24m	22mm pipe – 6m lengths	24m
SlimLine Fittings			Fittings	
15mm Straight Connectors	HX1/15	3	15mm straight connectors	21
15mm 90° Elbows	HX5/15	3	15mm 90° elbows	19
15mm Equal Tees	HX10/15	16	15mm equal tees	16
Auxiliary Fittings (terminal fittings)			Terminal Fittings	
15mm Draincocks	HX32/15	2	15mm draincocks	2
15mm Radiator Valves	HX73/15	24	15mm radiator valves	24
Ancillary Items			Ancillary Items	
15mm Clips	HX85/15	30	15mm clips	55
15mm Support Sleeves	HX60/15	90	–	–
15mm Cold Forming Bends	HX75/15	2	–	–
Demountable Fittings			22mm Fittings	
22mm Straight Connectors	HD1/22	3	22mm straight connectors	5
22m 90° Elbows	HD5/22	3	22mm 90° elbows	8
22 x 15 x 15mm Tees	HD14/22	4	22 x 15 x 15mm tees	4
22 x 22 x 15mm tees	HD13/22	2	22 x 22 x 15mm tees	2
22mm Equal Tees	HD10/22	2	22mm equal tees	2
Ancillary Items			Ancillary Items	
22mm Clips	HX85/22	10	22mm clips	20
22mm Support Sleeves	HX60/22	30	–	–
22mm Cold Forming Bends	HX75/22	2	–	–

It can be seen that through the use of Hep₂O[®] in the above table, the number of fittings, principally straight connectors and elbows is significantly reduced. Read with Figure 21 on page 71.

Exploiting the characteristics of Hep₂O[®], including its natural flexibility, when designing a plumbing installation will reduce installed cost by between 20-40% in comparison with rigid metal systems.

Domestic Timber Floors With Traditional Joists or Engineered Joists

Comparative radiator details for Hep2O® and copper

In Figure 22, there is clearly a saving in the quantity of fittings needed when using Hep2O®, such as 90° elbows, resulting in a significant reduction in installation time.

The copper installation could have substituted elbows with pipe bending to save materials, but this would significantly increase time costs.

A full comparative bill of quantities is shown in Table 15 on page 72.

Using 10mm Hep2O® for radiators

The use of Hep2O® 'drop' circuits to ground floor radiators will allow systems to be emptied (if required) by rotating the joints and operation of the radiator valves as shown in Figure 23.

Radiator Draincocks (code HX23/15) should still be provided elsewhere to allow the main contents of the system to be drained.

Refer to page 60 for assessing the pipe diameter of central heating circuits.

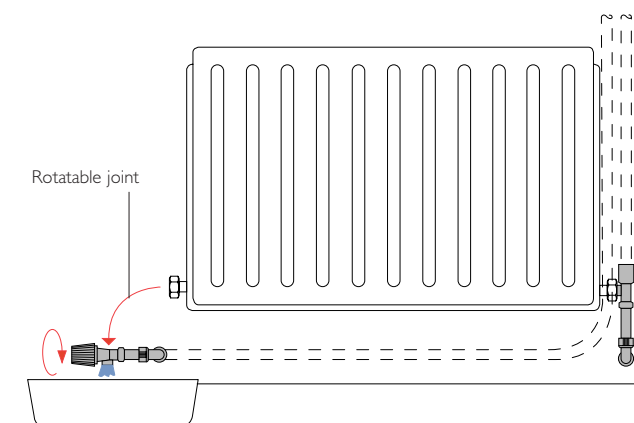


Figure 23
Draining a ground floor radiator

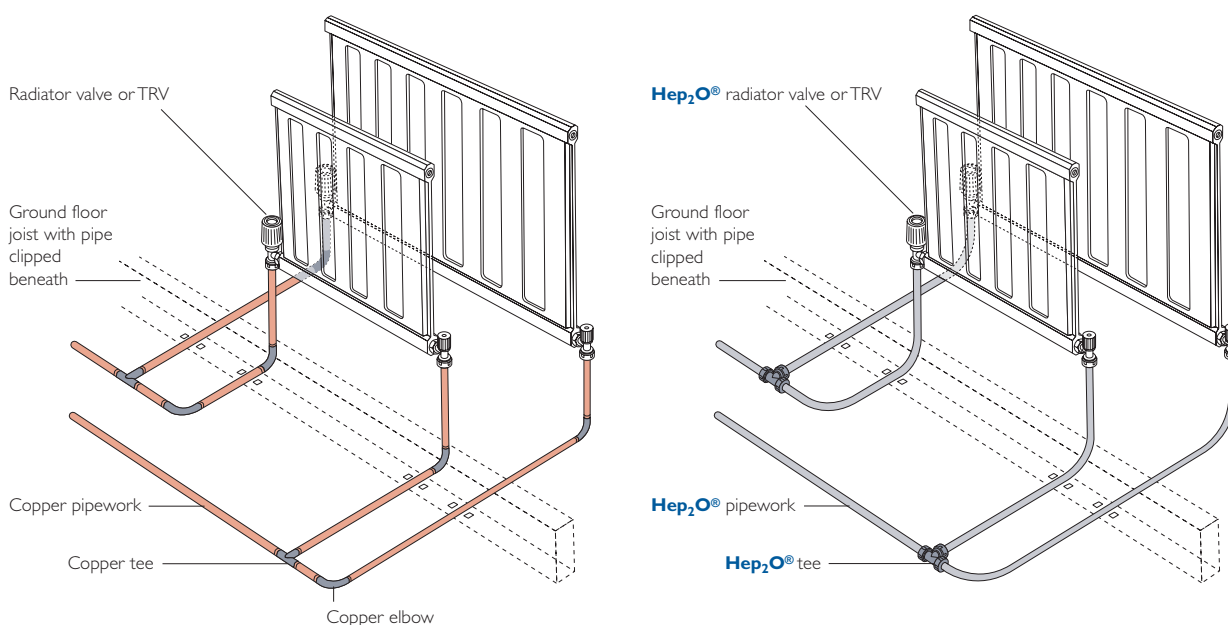


Figure 22
Comparative radiator details for copper and Hep2O®

Hep₂O[®] Within Floor Screeds

The Hep₂O[®] pipe should be fed into the conduit at the same time as the Conduit System is installed i.e. before screeding. The conduit system should not be installed on sub-floors a long time in advance of screeding as damage by site traffic could occur.

The junction box is designed to gain access to pipe fittings, and to allow pipe cross-overs (which are normally undesirable within the floor screed material). For junction box dimensions refer to Product Range pages 36 and 37.

The junction box should be drilled using a hole cutter or spade bit, to allow the conduit to fit snugly and click into position to protrude not less than 5mm inside the box. The correct drill size is shown in Table 16.

It is important that central heating pipework should not be run within the same junction box as cold water pipework unless there is sufficient space to fix adequate thermal insulation, in order to prevent the warming of cold water. The prevention of cold water becoming warm is a Water Regulations requirement. See Figure 24.

No thermal insulation would be necessary where the junction box is used solely for central heating pipes.

If required, the junction box can be cut in half and installed up against a wall as shown in Figure 25.

The junction box should be fixed to the sub-floor (to prevent movement or 'floating' during screeding), and the fixings provided with suitable washers. The junction box should be fixed so that the lid (when fitted) is level with the adjacent floor finish.

For uneven sub-floors or where the screed depth exceeds the junction box height, the box should be provided with suitable packing support under the base.

Table 16 Drill size for conduit box holes

Hep ₂ O [®] diameter (mm)	Conduit code	Drill bit diameter (mm)
10 and 15	HXC25/15 and HXC50/15	26
22	HXC25/22 and HXC50/22	32

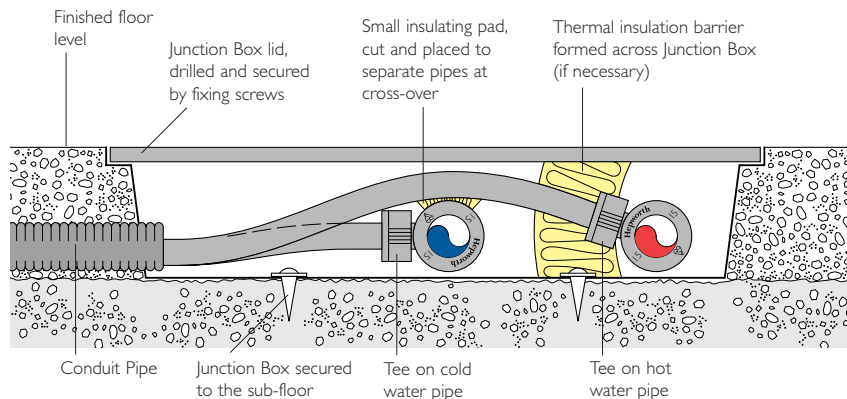


Figure 24
Typical section through Hep₂O[®] Junction Box enclosing hot and cold water distribution pipes with tees

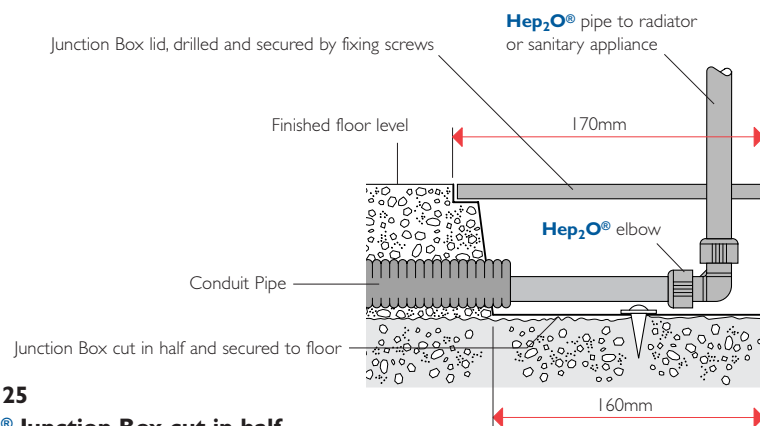


Figure 25
Hep₂O[®] Junction Box cut in half



To facilitate the possible removal and replacement of Hep2O® within the conduit system, conduit pipe should be installed without joints and should ideally run in straight lines between junction boxes. Where bends are unavoidable there should be not more than two changes of direction between adjacent junction boxes. Refer to Figure 26.

Conduits carrying cold water pipes should not touch conduits carrying hot water or central heating pipes.

The recommended gap between conduits run within floor screeds should not be less than 50mm (see Figure 27) in order to prevent the warming of cold water.

The conduit system should not contain unused water pipes which remain connected to water systems. Redundant pipework will result in water stagnation which would pose a risk to health.

Conduit pipes should be fixed to the sub-floor by using suitable straps to prevent movement. Conduit pipes for cold water systems should not be run in floor screeds which incorporate underfloor heating 'loops'.

Refer to pages 76 and 77 for detailed descriptions of conduit pipe termination methods in floors and walls. These methods are used particularly in European construction.

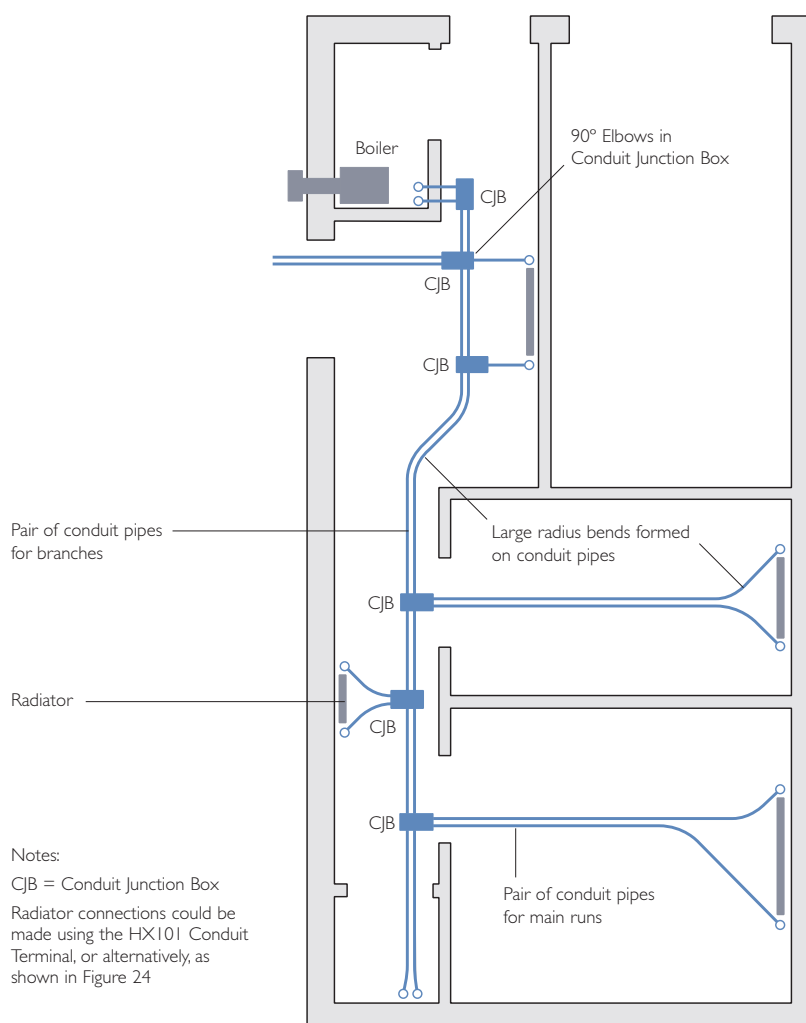


Figure 26
Typical plan using Hep2O® Conduit System for central heating layout

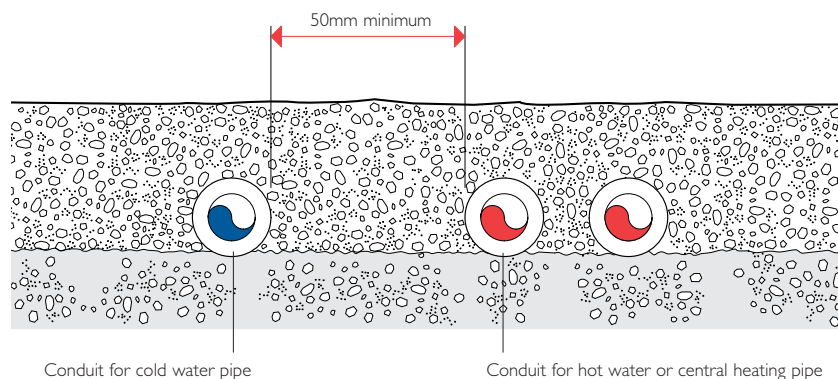


Figure 27
Minimum spacing for cold water conduit in floor screeds

Typical European Construction Using Hep₂O[®] Conduit Systems

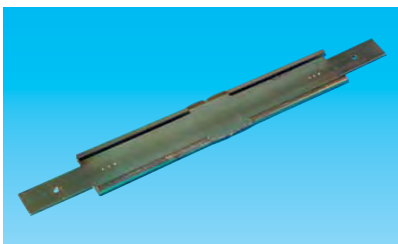
European construction often employs conduit systems to distribute water pipes in floors and walls.

The basic Hep₂O[®] Conduit System has been described on page 68 and pages 74 and 75 for UK construction. In this section, the Conduit System is shown in greater detail on how to deal effectively with **terminations** in walls and floors as encountered in European construction projects.

The conduit terminal fittings that form part of the Hep₂O[®] Conduit System are shown below.



HX101/15 15mm Conduit Terminal



HX103 Terminal Back Plate

Conduit terminations at floor finish level

For terminating the conduit pipe at floor finish level for direct 15mm connections to appliances, a Conduit Terminal Fitting (HX101/15) is available. For floor terminations the plastic housing may be drilled through the base to allow fixing.

The floor termination procedure, stages 1 to 4, is shown below.



Conduit Terminal body fixed to floor. Pipe within conduit then push-fitted into retaining cap of brass connecting plate.



The connecting plate screw fixed to Conduit Terminal body.



Hep₂O[®] adaptor (HX29) screwed to connecting plate.



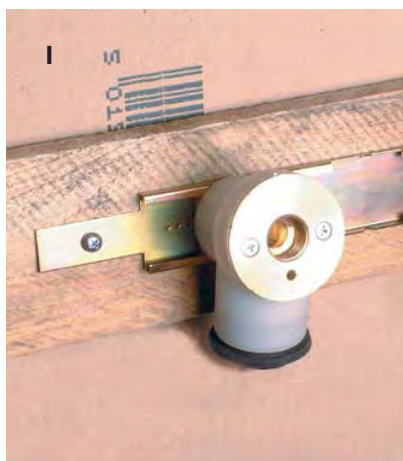
Pipe push-fitted into Hep₂O[®] adaptor.

Conduit terminations at wall surface finish

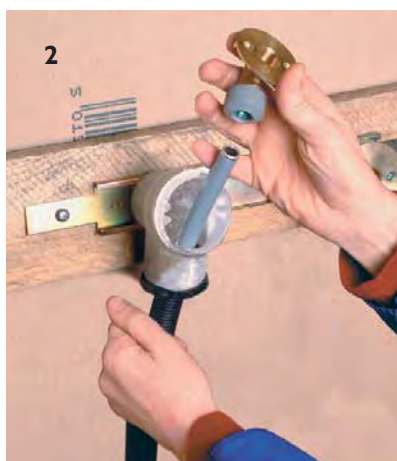
For wall terminations, fixing plate type HX103 Terminal Back Plate is used.

The HX103 Terminal Back Plate can be used to mount two terminals side by side, or it can be easily split to form two single plates. The HX103 Terminal Back Plate can also be used to fix a maximum of four Wall Plate Elbows.

The wall termination procedure for using the HX103 Terminal Back Plate, stages 1 to 4, is shown below.



The Conduit Terminal is fitted to the Terminal Back Plate (showing the brass connecting plate).



The conduit is fitted to the Conduit Terminal body. Pipe within conduit is then push-fitted into retaining cap of brass connecting plate.



The brass connecting plate is screw fixed to Conduit Terminal body, then the plasterboard and finish are made flush.



Hep2O® adaptor (HX31) is screwed to the connecting plate, and the appliance connection made.



Two HX101 Conduit Terminals fitted to the HX103 Terminal Back Plate



Four HX6 Wall Plate Elbows fitted to the HX103 Terminal Back Plate

Hep₂O[®] Within Internal Drywall Systems

Hep₂O[®] can easily be cabled within timber studwork and proprietary wall systems during construction. This method is often used for running feeds to radiators or where concealed plumbing is necessary.

A connection for a radiator can be made using a secured elbow in the wall and fixing a plastic snap-on Escutcheon Plate HX83 to neatly cover the hole in the wall surface.

Alternatively for 10mm Hep₂O[®], a drylining box can be used which gives the advantage of allowing minor alignment adjustment to the 'tail' during 'second-fix' (see Figure 28) and allowing access to the elbow. This solution can also be used where the radiator is fed from below in which case the risers should be located directly under each box.

'First-fix' pipework should follow the good practice advice in 'Hep₂O[®] Within Drylined Walls' on page 80, and also 'Pipes Through, and Adjacent to, Metalwork' on page 69.



Escutcheon Plate HX83

Hep₂O[®] Within Timber Framed and Steel Framed Buildings

Hep₂O[®] is ideal for use within both timber framed and steel framed buildings. For recommendations applicable to internal partition walls refer to 'Hep₂O[®] Within Internal Drywall Systems', on this page.

Running pipework of any material within the external wall of framed buildings should not be done without consideration of the following:

- if a leak occurred on a pipe it should be discovered without delay as seepage within a wall may damage the structural frame and affect the performance of insulating materials.
- Water Regulations require that pipes should not be fixed in a situation where leaks could be undetected for long periods.
- where a pipe passes through a vapour control layer the installation method should allow possible future replacement of pipe without affecting the integrity of this layer.
- pipework should be installed on 'warm' side of thermal insulation layer.

To comply with the foregoing criteria, pipework should be either run within a recessed duct designed by the Architect or run within a conduit system. Whichever method is used it is necessary to consider the detail at the junction between the wall and floor to avoid floor joist problems and to agree pipe penetrations at header rails/bottom rails. For radiator connections, 10mm Hep₂O[®] within conduit pipe may be used (see Figure 29).

The suggested installation sequence is as follows:

1. Prepare sketches showing setting-out dimensions for each drylining box including height and hole size.

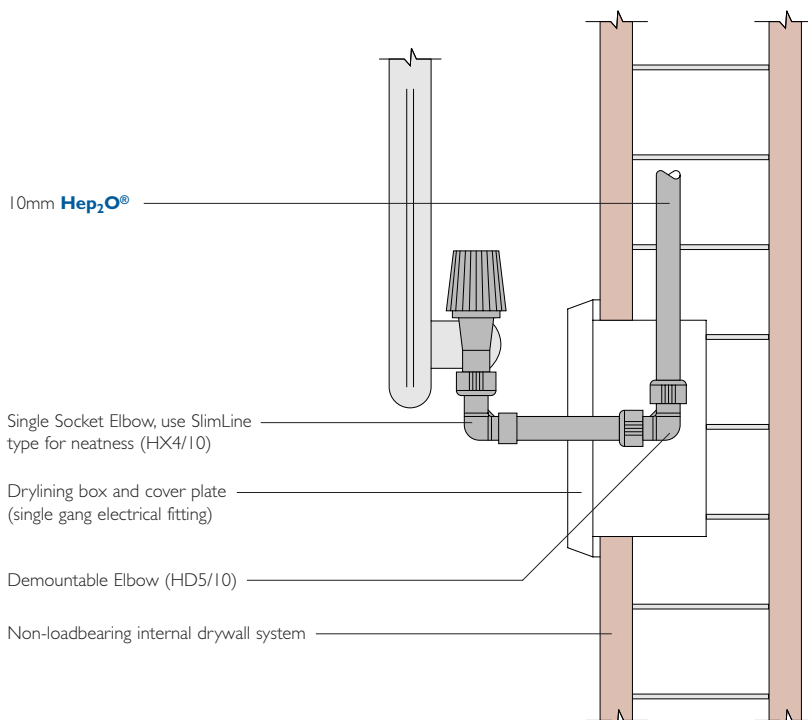


Figure 28
Radiator connection using 10mm Hep₂O[®] and a drylining box within a drywall system

2. Fix each conduit pipe to noggins using suitable straps or cable ties. Fixings at 1m centres are adequate for vertical conduit pipe. Horizontal runs and bends more than 45° should be avoided.
3. To allow future installation of drylining boxes, each conduit pipe end should be left approximately 100mm longer than box position and should not be fixed closer than 600mm to the box.
4. Install the main 'first-fix' pipework leaving joints below floor access covers to allow connection to conduit pipework during 'second fix' work.
5. Using setting-out dimensions on sketches, holes in plasterboard can be cut to allow each conduit pipe to be pulled out through the surface during plasterboard fixing work.
6. During 'second fix' each dry lining box is installed by drilling a 26mm diameter hole for 15mm (nominal) conduit pipe. The conduit can then be inserted through hole in box and should 'click' into position leaving one or two conduit 'ribs' inside box.
7. Slide a length of 10mm Hep₂O® pipe through conduit pipe from the floor access above. Pull out enough Hep₂O® from drylining box to allow a sufficient hand grip for jointing. Connect a demountable elbow to pipe then slide whole assembly through plasterboard hole and secure box into position. Conduit pipe should 'snake' within void to take up slack leaving Hep₂O® protruding out of box.
8. Pull Hep₂O® pipe backwards from floor access panel until elbow is central within dry lining box. Cut pipe to length and connect to Hep₂O® joint left during 'first fix'.

General advice on timber or steel framed buildings

Holes through timber joists should be drilled in accordance with Figures 16 & 17, on page 65. Holes through timber studs should be drilled in accordance with Figure 30.

Within steel framed buildings pipework should be routed through preformed holes in steelwork wherever practicable (and where provided). No holes should be formed in steelwork without the approval of the Architect. Pipework passing through steelwork should be protected from damage. Refer to 'Pipes Through, and Adjacent to, Metalwork' on page 69. Do not lay pipework in areas where plasterboard is likely to be fixed.

Services *within* compartment or party walls should be avoided so as not to impair fire resistance or acoustic properties.

Care should be taken that pipework *passing through* compartment walls or floors does not impair the fire resistance of the property.

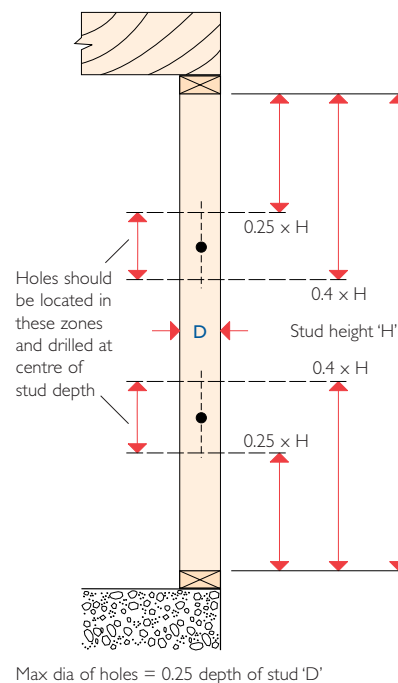


Figure 30
Limitations of drilling studwork

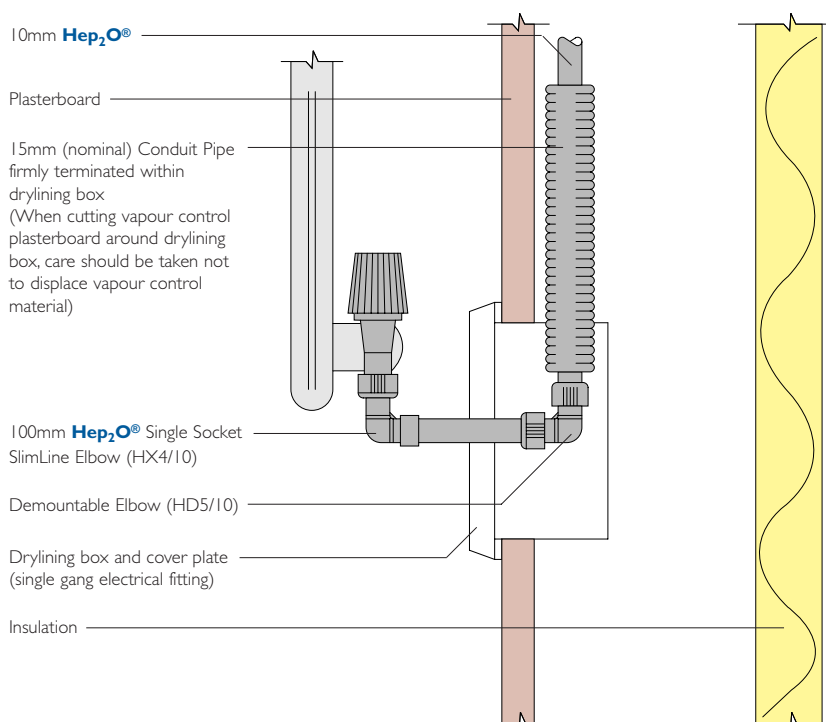


Figure 29
Radiator connection using 10mm Hep₂O® within a timber or steel framed external wall

Hep₂O[®] Within Drylined Walls

Feeds to radiators run in microbore copper can be accommodated behind 'dot and dab' plasterboard to give a pipe-free appearance within the room. Pipes run in 10mm Hep₂O[®] are equally suited to this application but will not be susceptible to damage such as dents or kinks which can be caused on 'soft' copper by following tradesmen. The penetration through the plasterboard for a radiator connection can be achieved by using a 10mm SlimLine Elbow (HX5/10) together with a Fitting Clip (HX84/10) or alternatively a dry lining box can be used. See Figure 28 on page 78.

Another method when using 10mm Hep₂O[®] Pipe is to utilise the HX111 Cover Plate. The HX111 Cover Plate and Back Box (HX109 or HX110) allows for a superior and easy to install method of connecting radiators. The box is fixed in a central position behind the radiator with the 10mm pipes dropping out to the radiator valves. This gives a smart professional finish where little or no pipe is seen and for new build provides an anchor point for the pipe work prior to plastering/boarding.

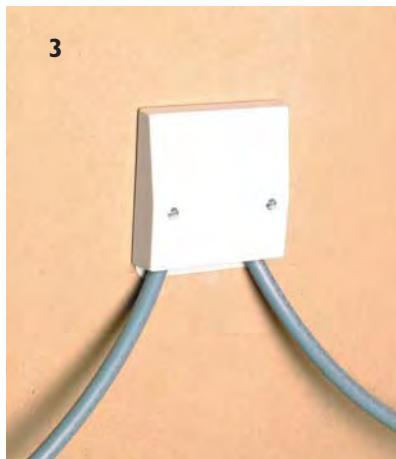
The installation procedure for using the HX111 Cover Plate, stages 1 to 4, is shown below and opposite.



The pipe is looped through the Back Box (HX109 or HX110).



The HX111 Cover Plate is screwed to the back-plate.



The looped pipe is cut and then connected to the radiator valves.



Completed installation.

The following is good practice for 'first-fix' pipework: (see Figure 31)

- radiator 'drops' should be run vertically, side by side, at one end of the radiator position.
- lateral pipes should be run horizontally in line with plasterboard penetrations.
- avoid running pipework along any obvious fixing zone ie. at skirting level.

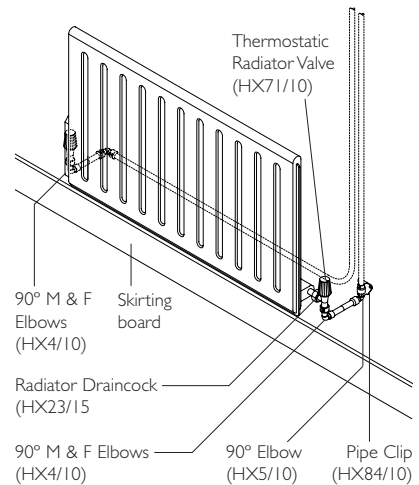


Figure 31
Radiator pipework in 10mm Hep₂O[®]

For fixing pipework to lightweight blockwork the HX65 Pipe Clip Cable Type is not suitable for fixing directly to such walls because of the low pull-out resistance of the nail.

In such circumstances a more secure hold can be achieved by fixing wooden dowels at each clip position. The dowels should be the solid type with a serrated surface and of sufficient size (not less than M8 x 30mm).

Holes should first be drilled in the blockwork using a drill bit size which provides a tight fitting hole for the dowel, taking care not to over-drill the hole depth. After tapping in the dowels the pipe clips can then be fixed by knocking the nail into the centre of each dowel.

Alternatively, use the screw fixed Fitting Clip HX84 shown below.



Two 5mm fixing holes, one each side



Sources of Information

The following list of publications is intended to help specifiers and designers consider in greater detail all aspects of plumbing layout design.

Plumbing Engineering Services Design Guide

(Published by the Institute of Plumbing)

- Section D: Pumps and pumping
- Section F: Fire protection services (sprinklers)
- Section H: Pipework expansion
- Section J: Legionnaires disease
- Section K: Fountain and water display techniques
- Section N: Conversion factors and miscellaneous data

Installation and Equipment Data: Volume B

(Published by the Chartered Institution of Building Services Engineers)

- Section B1: Heating (hot water, vented/sealed heating, underfloor heating)
- Section B4: Water service systems
- Section B5: Fire safety engineering (extinguishing systems)

Polybutene - I Piping Systems in Use

(Published by the Polybutene Piping Systems Association)

Describes the environmental impact of polybutylene during manufacture, installation and use compared to other materials. An extensive extract of this document is given on pages 92 to 94.

Building Regulations Approved Document A

- Loading
(Sizing of certain timber floor, ceiling and roof members in single family houses – limits for notches and holes in floor and roof joists)

Building Regulations Approved Document G

- Provision of sanitary conveniences and washing facilities
- Performance/design of hot water storage systems

Building Regulations Approved Document L1

- Conservation of fuel and power in dwellings

Building Regulations Approved Document L2

- Conservation of fuel and power in buildings other than dwellings

BS 5449

(An installation standard)

- Code of Practice for Central Heating for Domestic Premises

BS 5955: Part 8: 1990

(An installation standard)

- Specification for the installation of thermoplastics pipes and associated fittings for use in domestic hot and cold water services and heating systems

BS 6700

(An installation standard)

- Design, Installation, Testing and Maintenance of services supplying water for domestic use within buildings and their curtilages.

BS 7291: 2001

(A manufacturing standard)

Hep₂O[®] is manufactured and kitemarked to Class S of BS 7291: Parts 1 and 2

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

BS EN ISO 9002

(A manufacturing standard)

Hep₂O[®] is also manufactured within a Quality Management System which satisfies BS EN ISO 9002 requirements.

British Board of Agrément Certificate 92/2823

Hep₂O[®] Barrier Pipe is covered by Agrément Certificate 92/2823 to class 'S' of BS 7291.

Water Byelaws

- Listed in the Water Fittings and Materials Directory, Listing Number 0112066

The Control of Substances Hazardous to Health Regulations 1999 (COSHH)

Pressure Testing

Installers should ensure that all non-Hep₂O[®] products can withstand the test pressure by checking with other relevant manufacturers.

When testing Hep₂O[®] pipework systems, the recommended test pressure is:

- for Hep₂O[®] fittings with grab wedges – 1.5 times working pressure.
- for Hep₂O[®] grab ring and SlimLine fittings – a further test to 18 Bar.

If the system contains **any** grab ring or SlimLine fittings the further test to a maximum of 18 Bar should always be undertaken.

Care should be taken to disconnect any appliances or fittings that will not withstand, or will be damaged by, testing at 18 Bar.

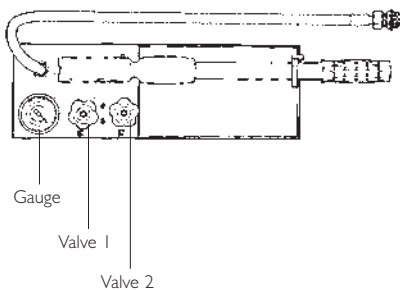


Figure 32
Hep₂O[®] Pressure Testing Kit (HX81)



Setting up the pressure test

The testing procedure is set out below. The duration of the test should be not less than 1 hour in accordance with BS 6700.

Pressure test procedure:

1. Ensure that any non-Hep₂O[®] components in system will withstand test pressure.
2. Blank off all open ends using Hep₂O[®] Blanking Pegs (HX44) or Blanking Plugs (HX41).
3. Connect pressure hose to system at a convenient point using a demountable socket.
4. Close Valve V2 and open Valve V1.
5. Fill system to be tested with water ensuring that the system is **completely full** of water (purge all air).
6. Raise pressure to test pressure and close Valve V1.
7. At end of test duration, gently tap gauge with a finger (to ensure pointer is 'free'). Read pressure on gauge. No appreciable drop in pressure should be noticed to indicate the system is watertight.
8. Release Valve V1 and V2 to release pressure from system. Drain system if necessary.
9. Replace cap and components in socket used for connection to test kit.
10. Re-connect non-Hep₂O[®] parts of the system.

It is important that this pressure testing procedure is **not** used as a substitute for making sure the correct insertion depth of the pipe is made into the fitting. The chevron marks on the pipe or a measured pencil mark should always be used.

See page 6 for the correct method of connecting pipes to fittings.

Painting Hep₂O[®]

Hep₂O[®] can be painted where this is felt to be necessary, e.g. outdoors to protect the pipe from sunlight and the effects of ultra violet light.

It is preferable when painting Hep₂O[®] to use emulsion paint. However, oil based gloss paint can be used in conjunction with undercoat. Cellulose based paints, paint strippers or thinners should not be used.

Before painting, ensure all surfaces are clean, free of grease and dry.

Freezing for Maintenance and System Modification

Hep₂O[®] pipe can be frozen for maintenance or repairs without damage to the system. Freezing equipment manufacturers instructions should be followed. Freeze at a reasonable distance from where pipe is to be cut.

Antifreeze

Antifreezes based on Ethylene Glycol mixtures will not have an adverse effect on Hep₂O[®]. However if there is any doubt as to their suitability please contact the Hepworth Plumbing Products Technical Advisory Service for advice.

Woodworm/Timber Treatment

When treating timber for woodworm or timber rot, water-based solutions are generally accepted. But care should be taken to protect and cover Hep₂O[®] pipe and fittings prior to any spraying.

It is preferable to carry out any spraying prior to Hep₂O[®] installation.

Solvent based treatments should not be used.

For further information contact the Hepworth Plumbing Products Technical Advisory Service.



Use of Corrosion Inhibitors

Corrosion of metals is a hazard in all installations therefore it is essential that possible causes of corrosion are kept to an absolute minimum.

Oxygen will almost always be present in any system as it can enter through a variety of points such as open header tanks, threaded joints, valves, pumps and above the bleed point on a radiator.

To provide maximum system protection independent of pipe material, all heating circuits should be protected by an inhibitor.

Hep₂O[®] Barrier Pipe incorporates an additional oxygen barrier to reduce ingress of oxygen through the pipe wall.

Fernox MBI and GE Betz Sentinel Inhibitors have been tested and are suitable for use with **Hep₂O[®]**.

Handling and Storage

Hep₂O[®] is an extremely tough and durable system. However, as with all materials some care is required to ensure damage is not incurred during storage or installation which may impair its ultimate performance.

Straight lengths of **Hep₂O[®]** pipes may be laid flat or stacked vertically. Coils may be laid on their side or edge. Both are lightweight and easy to carry and handle.

Pipe and fittings wherever possible should be stored in their original packaging until ready for use. This ensures protection from ultra-violet light and will reduce the risk of contamination.

Spare grab wedges and 'O' rings should not be carried loose amongst other fittings or tools where they may be damaged. They should be kept in their original packaging or in a separate container which will protect them.

Hep₂O[®] should be protected from contact with petroleum and oil derivatives, fluxes and other agents that may damage fittings or components.

When carrying or installing **Hep₂O[®]** pipe, care should be taken to avoid dragging the pipe along the ground or damaging the pipe on other surfaces such as walls.

When feeding pipe through holes in walls and brickwork the pipe end should be taped over, or alternatively, the red end cap included in the pipe coil should be used to prevent damage to the jointing surface and debris entering the pipe.

Care should be taken to avoid kinking the pipe during installation.



Hep₂O[®] Straight Coiled pipe is easy to carry and handle



Fed pipe with end cap protection



Hep₂O[®] Straight Coiled pipe compared to standard plastic coiled pipe

Hep₂O[®] Brings New Life to an 1830's Landmark

An 1830's landmark, said to be the most photographed building in Somerset, is being given a new lease of life with a little help from one of today's hi-tech plumbing systems. Hep₂O[®] has been specified by owner Mike Pope as the ideal solution to ease installation in the tiny Turnpike Cottage on the A30 at Chard.

Dating back to 1839, the Grade II listed building is a former toll-collector's cottage. Built from limestone dressings with flint facades and rubblestone returns beneath a thatched roof it is familiar to thousands of tourists as a landmark en route to Cornwall. Occupied until the 1980s, it has more recently fallen into disrepair and was bought by South Somerset District Council in 2000 with a view to finding a buyer willing to renovate it.

Mike Pope, a civil engineer, with a passion for restoring small and quirky buildings is now in the process of faithfully renovating the property which will retain as many as possible of its historic features.

Original plumbing

The original plumbing, however, consisted of a privy at the bottom of the garden so it was determined something a little more modern would now be appropriate. Traditional rigid plumbing would have posed several problems in the confined space of the building, particularly under the thatched roof where using blowtorches would have presented a considerable fire risk.

By contrast the flexible Hep₂O[®] push-fit system can readily be routed around the cottage with the minimum number of joints and is easy to work with, even in parts of the roof where the headroom is no more than a metre.

Comforts

When the restoration is complete, visitors will find the cottage exterior all but indistinguishable from the original. The old cast iron range will once again provide a welcoming focal point to the main downstairs room but 21st century plumbing will provide the additional comforts of hot and cold running water and central heating.



Turnpike Cottage is a familiar landmark on the A30 near Chard



Flexibility and push-fit joints ease installation and ensure safety in the restricted space under the eaves of the thatched roof

Challenge: Fit new plumbing in a Grade II listed building

Location: Chard, Somerset

Installation: Hot and cold water services, central heating

A Flexible Answer for Prestige Apartments

Flexible plumbing systems from Hepworth Plumbing Products have been chosen to supply hot and cold water services to one of Leeds' most prestigious city centre developments. A project by Crosby Homes, it includes some 150 flats and duplexes arranged in three blocks, of, respectively, eight, 12 and 14 storeys. A bar and restaurant are also located on the lower floors.

The M&E package has been undertaken by Vallectric who have used the **Hep₂O**® flexible push-fit plumbing system throughout. A key requirement was to minimise the number of joints as services are located in the ceiling voids and access, once the project has been completed, will be limited.

Pipe runs

Using **Hep₂O**®, it was a simple matter, for example, to complete 12 metre pipe runs between kitchens and bathrooms using a single pipe length. Both 15mm and 22mm **Hep₂O**® pipes, operating at 3 bar, are used.

Hepworth's **Hep_vO**® hygienic self-sealing waste valve has also been used throughout, rather than traditional water seal traps, in order to avoid the need for secondary venting of waste systems.

For details of the **Hep_vO**® range of waste fittings see separate literature.



An artist's impression of the prestigious Leeds development



The availability of pipe in coils up to 100 metres makes it a simple matter to install long runs of pipes with the minimum number of joints

Challenge: Fit new plumbing with a minimum of joints & access points

Location: Leeds, Yorkshire

Installation: Hot and cold water services

Project Location.....

Drawing References.....

Main Contract Preliminaries.....
(Insert as appropriate)

General System Performance Requirements

1. Cold water installation.....

2. Hot water installation.....

3. Low temperature hot water space heating installation (exposed heat emitters).....

4. Underfloor heating installation

Shall be **Hep₂O[®]** UFH Manifold System.

(Brief descriptions of installations 1 to 4 where appropriate)

Associated general building work

(Refurbishment and/or direct plumbing contract)

For example: form openings, chases, duct casings, etc where appropriate.

Associated electrical work

EITHER

(Use the following clause when electrical work is carried out by a separate contractor)

- Electrical work in connection with the plumbing installation is to be in accordance with electrical specification and carried out by the electrical engineer.

OR

(Use the following clause when electrical work is specific to the plumbing contract only)

- Electrical work to be included as part of the plumbing contractor's work, and carried out in accordance with BS 7671 "Requirements for Electrical Installations" - The IEE Wiring Regulations.

Design of installations

EITHER

(Use the following clauses where contractor designs installation. Also delete* as required)

- The (Main)* (Plumbing)* Contractor is to be responsible for the design and installation of the **Hep₂O[®]** systems (1 to 4 below as appropriate) in accordance with Hepworth Building Products instructions, all relevant statutory requirements, standards or codes of practice.

1. Pipeline sizes shall:

- a) Meet anticipated simultaneous water demand for the building type

- b) Provide a water velocity of 2 m/s for cold water, 1.3 m/s for hot water

- c) Provide a minimum discharge rate at each draw-off point (refer to schedule taken from BS 6700)

- d) Ensure a cold water storage cistern filling time of not more than.....hour(s).

2. Hot water storage system shall ensure the:

- a) Storage capacity is sufficient for the building type

- b) Primary heat source is capable of raising the water temperature from 10°C to 60°C in 1 hour

- c) Temperature of stored hot water is 60°C to 65°C.

3. Low temperature hot water space heating system shall ensure:

- a) Exposed heat emitters maintain the required room temperatures

- b) Surface temperature of heat emitters is not greater than.....°C.

4. **Hep₂O[®]** UFH Manifold System shall be installed in accordance with Hepworth Plumbing Products' recommendations.

OR

(Use the following clauses where the plumbing contractor is not to design the plumbing system)

- Pipe sizes to be installed as shown on the drawings and performance schedules/tables.
- The cold water storage cistern filling time in houses up to three bedrooms shall not exceed one hour.

Hep₂O[®] Pipes and Fittings

Pipes for cold and hot water

- Shall be **Hep₂O[®]** Standard Straight Coiled Pipe, Code..... **and/or**

- Shall be **Hep₂O[®]** Standard Cut Length, Code.....

Pipes for central heating

- Shall be **Hep₂O[®]** Barrier Straight Coiled Pipe, Code..... **and/or**

- Shall be **Hep₂O[®]** Barrier Cut Length, Code.....

Conduited pipes for central heating

- Shall be **Hep₂O[®]** Barrier Straight Coiled Pipe, Code..... **and/or**

- Shall be **Hep₂O[®]** Barrier Cut Length, Code.....

- Shall be **Hep₂O[®]** Conduit System comprising:

Conduit Pipe, Code.....

Conduit Junction Box and Lid, Code.....

and if required

Terminal Back Plate, Code HX103



As an alternative to separate Barrier Pipes and separate Conduit Pipes, use pre-sheathed Barrier Pipe in conduit:

- Shall be **Hep₂O[®]** Pipe in Pipe System, Code.....

Underfloor heating

- Shall be **Hep₂O[®]** UFH Manifold System installed in accordance with Hepworth Plumbing Products' recommendations.

Fittings for pipe joints and tap/tank connections (Hep₂O[®]/Hep₂O[®] and/or Hep₂O[®]/copper)

- Shall be **Hep₂O[®]** Demountable Fitting(s), Type(s)..... Code(s)..... **and/or**
- Shall be **Hep₂O[®]** SlimLine Fitting(s), Type(s)..... Code(s).....

Adaptors, equipment/appliance connections

- Shall be **Hep₂O[®]** Auxiliary Fitting(s), Type(s)..... Code(s).....

Supports, washers, seals

- Shall be **Hep₂O[®]** Ancillary Item, Type(s)..... Code(s).....

Hep₂O[®] Cold and Hot Water Installations

Installation generally

- Installation, testing and commissioning of the plumbing installation shall comply with BS 6700, water regulations, the water utility company and Hepworth Plumbing Products' recommendations.
- The whole of the plumbing installation shall be carried out by qualified operatives.
- All plumbing components shall be stored in dry conditions in original packaging.
- **Hep₂O[®]** pipework and fittings shall be protected from prolonged exposure to direct sunlight, preferably in original protective wrappings, until Practical Completion.
- Where components and materials other than the **Hep₂O[®]** system are located in moisture-prone areas, corrosion resistant fittings/fixings shall be used, in addition to suitable washers and gaskets for isolation between dissimilar metals.
- Unless otherwise shown or specified, all equipment, pipework, components, valves and other items requiring maintenance shall be fully accessible.
- Builder's work shall comply with the restrictions set for the cutting of holes, chases and notches within critical construction as described in current Building Regulations.
- All fittings, other than **Hep₂O[®]**, used below ground or

in concealed or inaccessible locations shall be of gunmetal or other material resistant to dezincification.

Hep₂O[®] pipe runs

- Approval shall be obtained before commencing work for routes not accurately shown on drawings.
- Runs shall be straight and parallel or perpendicular to walls, floors or ceilings.
This does not apply to the Conduit System.
- The minimum number of joints, bends and offsets shall be used.
- Hot pipes shall be located above cold pipes where routed together horizontally, and spaced well away from drinking water pipes.
- Pipes shall not be run through electrical enclosures or above switchgear distribution boards.
- Sufficient space around pipes shall be allowed to fit insulation without compression.
- Wherever possible, pipework shall be concealed within floor, ceiling or roof voids.

Hep₂O[®] pipe fixing and supports

- All **Hep₂O[®]** pipes and fittings, and other equipment/materials shall be securely fixed to the structure in the specified locations, ensuring the operation of valves or taps does not strain pipework.
- Pipes passing through walls, floors and other structural elements shall be sleeved and the annular gap filled with.....
- Open ends of pipes shall be temporarily sealed with end caps to prevent damage to the jointing surface and the ingress of dirt, insects or rodents.
- Pipes shall be fixed to falls to avoid trapped air and facilitate purging and draining. Vents shall be fitted at high points, and draining taps fitted at low points.
- Pipes shall be supported true to line and at the following maximum centres:

Pipe diameter (mm)	Horizontal (mm)	Vertical (mm)
Up to 16	300	500
17 to 25	500	800
26 to 32	800	1000

- Additional supports shall be provided as necessary within 150mm of connections, junctions and changes of direction.

Hep₂O[®] pipe bends

- Minimum unsupported cold bend radii for 90° bends shall be to the following dimensions, dependent on pipe diameters.

Pipe diameter (mm)	10	15	22	28
Radius (mm)	80	120	176	224

- Cold Forming Bend Fixture (HX75) shall be used to fully support small radius (eight times pipe diameter) 90° bends.

Hep₂O[®] pipe spacing

- Minimum clearances shall be maintained, measured from pipe face or pipe insulation, for the following conditions:

From floor	150mm
From ceiling	50mm
From wall	15mm
Between pipes	25mm
From electrical conduit, cables, etc	150mm

Hep₂O[®] joints

- Form joints between Hep2O fittings and pipes, and between other compatible materials, in accordance with Hepworth's jointing instructions.

Pipes entering buildings

- Pipes shall be laid not less than 750mm below finished ground level.
- Where pipes rise into building within 750mm of external face of building or pass within a ventilated floor void, insulation shall be fitted to the pipes extending from finished floor level to 600mm beyond external face of building.
- Pipe ducts shall be sealed at both ends with an approved non-hardening, non-cracking, water resistant compound to a depth of not less than 150mm.

External supply pipes

- Pipes less than 750mm below ground shall be insulated.

Insulation to pipes

EITHER

(Use the following clauses to satisfy basic Building Regulation requirements)

- Insulation material shall be preformed flexible closed cell or mineral fibre split tube with a thermal conductivity not exceeding 0.035 W/mK.

- Insulation thicknesses shall be to the following values:

Hot water pipes:

Equal to the outside diameter of the pipe up to 40mm maximum

Cold water pipes:

Located internally, externally or in roof spaces – to be in accordance with the recommendations of BS 5422 referred to in Approved Document L.

- Fire performance of insulation shall be Class I spread of flame when tested to BS 476-7.
- Insulation shall be fitted to cold water pipes in unheated spaces and to potable water pipes.
- Insulation shall be fitted to hot water pipes except short lengths exposed to view adjacent to appliances.
- Insulation shall be fitted in accordance with manufacturer's instructions, ensuring that continuity is maintained over fittings and at supports, leaving no gaps and with the split on 'blind' side of pipes.
- Testing shall be completed prior to fitting of insulation.

OR

(Use the following clauses to satisfy the more onerous requirements of BS 6700)

- Insulation shall be to BS 6700, clause 2.7, Building Regulation Approved Document L1, and BS 5422.
- Insulation material shall be preformed flexible closed cell or mineral fibre split tube, thickness to current Building Regulations.
- Fire performance of insulation shall be Class I spread of flame when tested to BS 476-7.
- Insulation shall be fitted to cold water pipes in unheated spaces and to potable water pipes.
- Insulation shall be fitted to hot water pipes except short lengths exposed to view adjacent to appliances.
- Insulation shall be fitted in accordance with manufacturer's instructions, ensuring that continuity is maintained over fittings and at supports, leaving no gaps and with the split on 'blind' side of pipes.
- The maximum permissible lengths of uninsulated hot water pipes shall be as follows:
 - Up to and including 12mm diameter pipe - 20m
 - Over 12mm, up to and including 22mm diameter pipe - 12m
 - Over 22mm, up to and including 28mm diameter pipe - 8m
- Testing shall be completed prior to fitting of insulation.



Valves

- Valve types shall have appropriate pressure/temperature ratings and be approved for their intended use by the local water utility company.
- Valves shall be provided for isolation and regulation of all equipment and sub-circuits.
- Valves shall be located to ensure they can be readily operated, maintained and adjacent to appliances requiring isolation.
- Valves shall be fitted with handwheels for control purposes and lockshields for isolation or regulation of circuits/appliances.
- Valves shall be fitted with joints to suit pipe material.
- Stop valves and draw-off taps for above ground hot and cold water supplies shall be copper alloy to BS 1010-2, Kitemark certified.
- Stop valves for below ground cold water supplies shall be DZR copper alloy CZ 132 to BS 5433.
- Gate valves for the isolation and regulation of heating circuits shall be copper alloy to BS 5154, Series B, Kitemark certified.
- Double check valve assemblies to prevent backflow contamination of water supplies shall be copper alloy to BS 6282-1 with intervening test cock to BS 2879.

Hep₂O® Low Temperature Hot Water Space Heating Installation

Installation generally

(as cold and hot water installations)

Hep₂O® pipe runs

(as cold and hot water installations)

Hep₂O® pipe fixing and supports

(as cold and hot water installations)

Hep₂O® pipe bends

(as cold and hot water installations)

Hep₂O® pipe spacing

(as cold and hot water installations)

Hep₂O® joints

(as cold and hot water installations)

Insulation to pipes

- Insulation material shall be preformed flexible closed cell or mineral fibre split tube with a thermal conductivity not exceeding 0.035 W/mK.

- Insulation thicknesses shall be to the following values:

Heating and primary pipes:

Equal to the outside diameter of the pipe up to 40mm maximum

Cold water pipes:

Located internally, externally or in roof spaces – to be in accordance with the recommendations of BS 5422 referred to in Approved Document L.

- Fire performance of insulation shall be Class I spread of flame when tested to BS 476-7.
- Insulation shall be fitted to cold water pipes in unheated spaces.
- Insulation shall be fitted to heating pipes except short lengths exposed to view adjacent to appliances.
- Insulation shall be fitted in accordance with manufacturer's instructions, ensuring that continuity is maintained over fittings and at supports, leaving no gaps and with the split on 'blind' side of pipes.
- Testing shall be completed prior to fitting of insulation.

Provisional Sums

- Allow for the following provisional sums:

Service connections

Fuel for testing.

Boats

The flexibility of Hep₂O[®] means it can be cabled around the interior cavities of boats and easily hidden behind bulkheads. Light in weight, Hep₂O[®] will not add unduly to the draft of the vessel.

There are three key problems with traditional plumbing in marine craft:

- prolonged and damaging vibration from the engine and forces of the sea may cause soldered or compression joints to crack or work themselves loose. The flexibility of Hep₂O[®] pipe absorbs these damaging forces, and jointing technology ensures a secure joint will not come loose during its service life.
- electrolytic corrosion may occur as a result of contact established between dissimilar metals in the plumbing system and the boat's construction. This can cause damage to both, but will not occur with Hep₂O[®].
- salt water is itself extremely corrosive to most metal plumbing systems but has no effect on Hep₂O[®] pipe or fittings.

Caravans

Hep₂O[®] is ideal for caravan installation where its lightness and flexibility allows fitting in confined spaces without damage to the fabric of the vehicle, or adding unduly to the kerbside weight. Resistance to corrosion and freezing make Hep₂O[®] an obvious choice for this application.

Agricultural and Horticultural Use

Because of its resistance to damage, corrosion and cold weather, Hep₂O[®] has many applications in agricultural and horticultural environments. Typical installations ideally suited to Hep₂O[®] are the water supply to milking parlours, drinking troughs and horticultural watering systems.



Exhibitions

The temporary nature of most exhibitions combined with the requirement that services be run for considerable distances with multiple take-off points, requires a plumbing system which is not only flexible, but also capable of regular dismantling and remaking to different layouts. Hep₂O[®] combining flexible pipe with demountable joints, offers a unique solution to this problem, giving a positive cost saving (as little waste is incurred) with the opportunity to modify the overall design installation to suit short-term requirements.

Portable Buildings (site cabins, toilets etc.)

Similar in many respects to caravans, portable homes often require connection to more permanent services.

The Hep₂O[®] range includes all the necessary items to ensure compliance with local water byelaws (e.g. double check valves) whilst allowing the building to be moved to another location when required, with the minimum disruption to internal systems. Coupled with the ability to install in difficult spaces and the ability to rotate fittings to allow better access to valves etc. Hep₂O[®] is the ideal choice for these structures.

Air Conditioning Systems

Hep₂O[®] is ideal for the condensate pipes from air conditioning systems and chilling systems, and in many low pressure systems will also be suitable for the primary circulation. If in doubt contact the Hepworth Plumbing Products Technical Advisory Service.



Trouble Free Installation of Hep₂O[®]

Most installers that have worked extensively with Hep₂O[®] will have experienced the odd problem from time to time. Based on customer feedback and over 20 years experience in dealing with such occurrences, the following are simple but effective precautionary steps that when taken will ensure trouble free installation.

Potential joint problems can be divided into two main categories, and can also be used as the basis for appropriate specification clauses.

Pipe derived problems

By far the majority of problems occur because the pipe end inserted into the fitting has been damaged in some way. This can create a leak pathway via the scratch or indent for water to pass. This type of damage can occur at various points along the route to finally commissioning the plumbing system. But in general taking a few precautionary measures can eradicate any such problems:

- take care in how and where the product is stored, retain pipe in protective packaging until it is to be used.
- never use an open bladed knife to remove the pipe packaging.
- always use the attached shielded blade tool to remove packaging and cut on the inside of the coil, thus enabling the pipe to be contained within the packaging until the last metre.
- when threading pipe through holes in stone, brick and block walls always use a pipe sleeve or alternatively a small piece of foam pipe insulation to protect the pipe from the rough surface.
- ensure exposed first fix pipework is protected after initial installation if further connections are to be made to the pipe. By simply pushing a temporary end protector onto the pipe, it ensures that no debris will enter the pipe and furthermore it will protect the pipe end from damage.

Fitting derived problems

Problems can arise for a number of reasons, such as grit or debris ingress into the joint prior to coupling, or sometimes the inadvertent omission of an integral component part of the joint due to past interference by the installer or a possible third party. Again taking a few general precautionary measures can eradicate any such incidents:

- store materials in a secure place free from dust and dirt etc.
- keep fittings in their bags until ready for use.
- when fittings are de-mounted ensure they are correctly re-assembled.
- do not take joint components from new fittings to replace damaged or lost components in other fittings.
- always follow the do and don't guidelines leaflets included with all bags of fittings.



Where Not to Use Hep₂O[®]

The Hep₂O[®] system has been designed and tested to meet the requirements of modern heating and water distribution systems.

Testing has not been carried out to determine suitability for other purposes and therefore **should not** be used for instance, in the following applications:

- conveyance of gas.
- conveyance of fuel oil.
- in areas contaminated by petroleum and oil derivatives.
- compressed air.
- Hep₂O[®] is not suitable for use in systems where the water carried in the pipe contains a high concentration of chlorine e.g. swimming pools or decorative water features.
- Hep₂O[®] will not be affected by those levels of chlorine expected in UK water supply (typically less than 0.5ppm). Short term chlorination for disinfection will not have an adverse effect on the system. See page 44.
- Hep₂O[®] should only be used for the **secondary** circulation of a solar heating system, **not** for a primary circuit as temperature cannot be thermostatically controlled.
- Hep₂O[®] should be protected at all times from exposure to direct sunlight and ultra violet light.
- Hep₂O[®] should not be installed in ringmain installations.

A ringmain is a water-replenished circulating system maintained at a constant high temperature to provide a permanent source of hot water to its distributing pipes.

Typical locations where ringmain systems are used are hospitals or hotels which distribute constant hot water to wards or rooms at a distance from heat source.

This restriction does not apply to domestic systems operating intermittently at temperatures less than 65°C where a design life of 50 years as detailed in BS 7291: 2001 can be expected.

Introduction

Hepworth Plumbing Products is committed to promoting measures for limiting the adverse environmental impact of its operations. With the increasing awareness of environmental issues and growing legislative controls, an environmental policy and cohesive management system has been implemented to co-ordinate, control and continually improve standards of environmental performance. Where possible, the environmental management system (EMS) is integrated with all the manufacturing operations undertaken at Hepworth Plumbing Products' manufacturing plants.

The endorsement of a product for any particular application is increasingly influenced by its potential impact on our environment. The two main factors taken into account in calculating this impact are:

- the period of time for which a product fulfils its intended use before the need for replacement – otherwise known as its 'sustainability'.
- the negative impact a product has on the environment during its manufacture and use, both in terms of its fuel efficiency and environmental damage, and also taking the possibility of recycling.

The following information has been taken from a paper entitled 'Polybutene-I Piping Systems in Use' issued by the Polybutene Piping Systems Association.



Sustainability of Installations

Polybutylene (PB) has been successfully used in pipe applications in Europe for almost thirty years. In Austria and Germany, district heating and underfloor heating schemes of the early 1970's are still offering trouble-free operation.

Perhaps the most noteworthy success to date of polybutylene (PB) as a material for pipework is its use in the Vienna Geothermal Project. Since 1974, very aggressive geothermal water has been utilised as the heating medium and is still operating today at a constant temperature of 54°C and at 10 bar pressure. In the same application, metal pipes had proved totally unsuitable due to rapid corrosion problems.

The sustainability of polybutylene (PB) pipes is therefore proven through long-standing, trouble-free service. Since these first installations, advances in both material technology and production processes, combined with the introduction of stringent standards, has furthered the performance and reliability of polybutylene (PB) piping systems.

International standards now specify a minimum 50 years performance for polybutylene (PB) hot water pipes operating at 70°C and 10 bar pressure.

There are no international standardised requirements for the lifetime performance of metal pipes.

Environmental Impact

The impact which a material has on the environment in terms of, for instance, landscape scarring, emissions into the atmosphere, soil and water, and the potential for recycling is assessed in what is commonly referred to as a 'cradle to grave' study. Such a study was conducted by the Technical University of Berlin on various drinking water pipe installation systems, including both metals (galvanised steel and copper) and plastics, i.e. cross-linked polyethylene (PE-X), polybutylene (PB), polypropylene (PP-R), and chlorinated polyvinylchloride (PVC-C).

The study included the life cycle stages of a product (either of metal or plastics), from extraction of materials through to the end of its useful life, as shown in Table 16.

Each of the life cycle stages listed in Table 16 and their implications for energy use are described on pages 93 and 94.



Table 16 The Life Cycle Stages of a Product

Life cycle stage of product	Material of product	
	Metals	Plastics
Raw material sourcing	Ore mining	Crude oil extraction
Raw material processing	Metal refining	Oil refining/cracking
Pipe material production	Smelting	Polymerisation
Pipe manufacture	Rolling	Extrusion
Fittings manufacture	Casting, re-shaping	Injection moulding
Pipe system installation	Soldering, clamping	Welding, clamping, gluing, push-fit
Installation life expectancy	Not standardised	Minimum 50 years

Raw material sourcing

The mining of metallic ores, which is predominantly open cast mining, results in a lasting scar on the landscape. The fraction of metal extracted from the ore (1 to 2%) exacerbates this problem.

Crude oil in contrast, is extracted via a bore-hole and consequently has much less of a lasting effect on the landscape. Furthermore, almost 100% of crude oil is subsequently converted into useable products, e.g. oils, fuels and chemicals.

Raw material processing and pipe material production

The refining and smelting of metals consumes far more energy than the refining of oil and polymerisation of plastics. The emissions from metals production processes in terms of soil, air and water pollution also far exceed the impact of oil refining and plastics polymerisation.

The emissions into soil from metal refining are increased due to the large fraction of the electrical energy used for smelting being generated by coal combustion. The ore residues, together with the ashes from power production have a considerable polluting effect on the landscape. Emissions from these metal refining processes also have an impact on both water and air pollution due to the generation of sulphur dioxide, carbon dioxide, other gases and airborne particles, plus sulphates and other solid/chemical emissions. In contrast, the oil refining and plastics polymerisation processes generate very little in the way of emissions since they are essentially fully integrated processes.

Pipe and fitting manufacture

For both metals and plastics the production of pipes and fittings involves raising the temperature of the raw materials above their melting/softening points. The temperatures involved, however, are much higher for metals in comparison with plastics, with consequential differences in energy efficiency ratings.

Pipe systems installations

The weight of piping is an important factor in assessing the overall energy efficiency of the piping system. Due to their much lighter weight, plastics materials exhibit a distinct advantage over metal pipes in this respect. The total energy consumption to manufacture metal pipes required for the piping system of, for instance, a 16-family housing complex is significantly higher than for plastic pipes. Figure 33 shows the total energy consumed (total weight account for) in producing the complete piping network in each of the different materials.

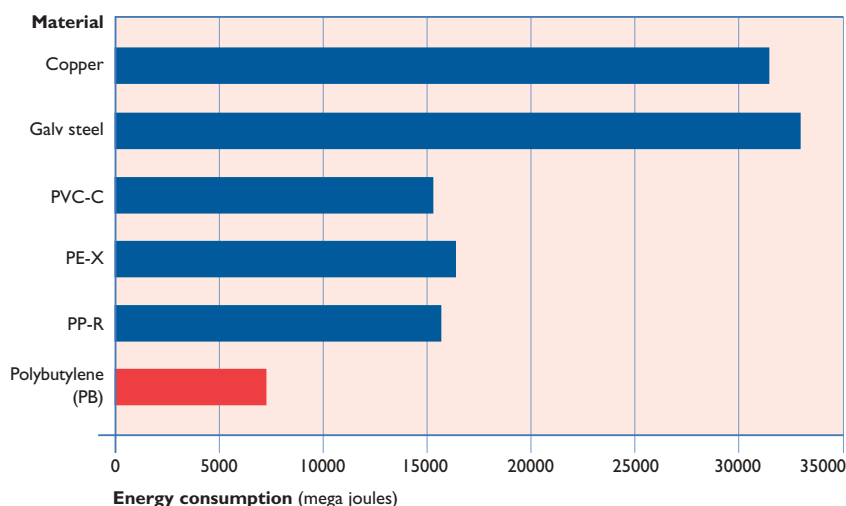
Installation life expectancy

Two considerations should be taken into account with respect to the life expectancy of a piping installation. Firstly, the lifetime of a system delays the need for replacement, and hence reduces the environmental impact on a time-dependent scale. Secondly, when a material has completed its useful applicational life, its environmental impact is reduced if it can be recycled. Both metal and polyolefin thermoplastics, including polybutylene (PB), can be recycled. However, since the plastics piping systems are expected by standards accreditation to provide a service life in excess of 50 years, it is difficult to reliably predict the environmental impact of recycling on such a long timescale.



Hepworth's Doncaster manufacturing plant

Figure 33 Total Energy Consumption (during manufacture/installation/use) of the Complete Piping System for a 16-Family Housing Complex



Quantifying the environmental impact of emissions

To quantify the environmental impact of emissions, the Technical University of Berlin developed a standardised comparison method referred to as VENOB (Vergleichende Normierende Bewertung). This environmental analysis compares the energy consumption in relation to the resulting emissions in air, water and soil during each stage of a product's complete life cycle from raw material sourcing to the installation of the piping system. The University evaluated six different materials used for drinking water pipe installations according to DIN 1988 Part 3 on the basis of the 16-family housing complex with central hot and cold water distribution at 4 bar pressure.

Figures 34, 35 and 36 illustrate the standardised comparison (VENOB) of the various pipe materials' impact on the environment in terms of soil, water and air emissions respectively. The impact factor is a comparative number only. The material with the lowest number will have the least environmental impact.



Figure 34 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Soil

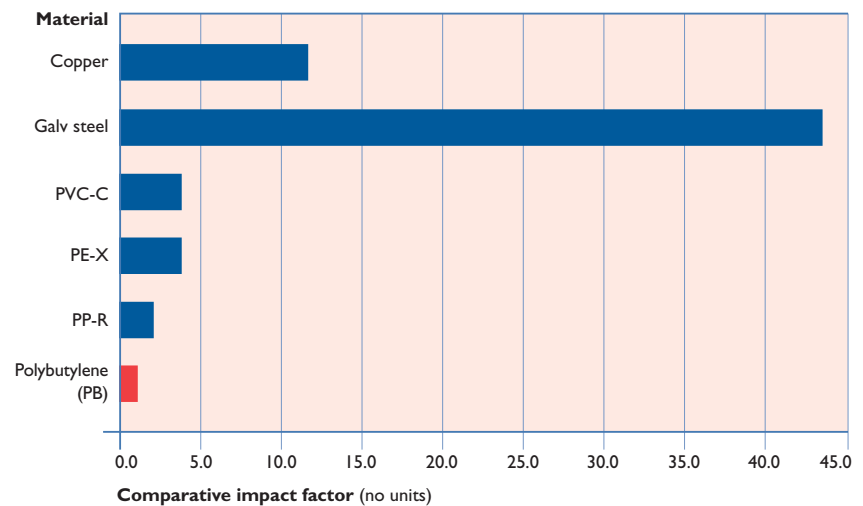


Figure 35 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Water

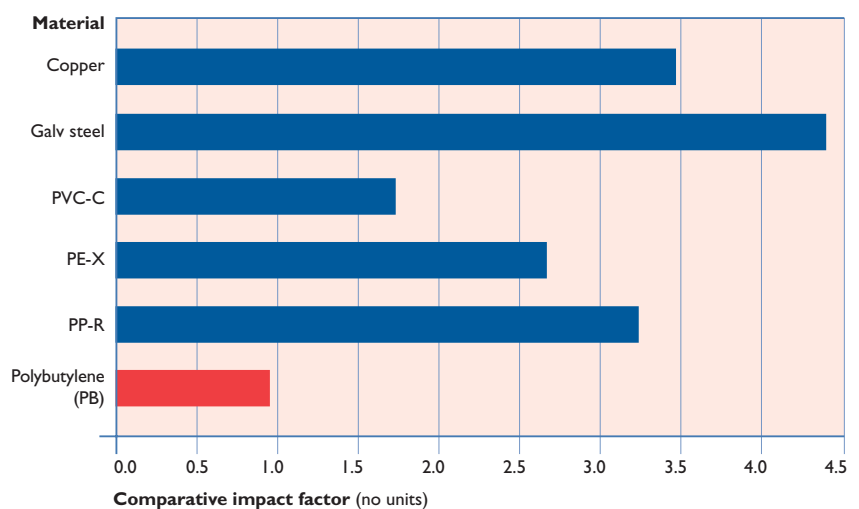
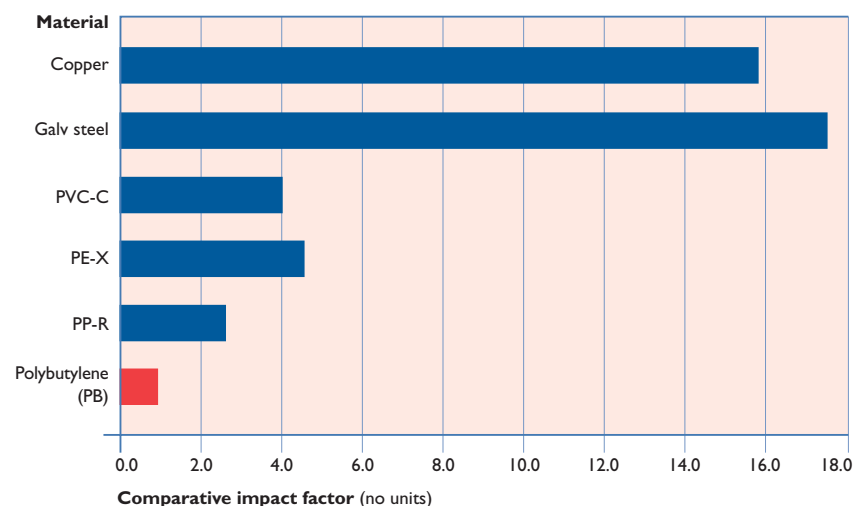


Figure 36 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Air





International standards organisations

The performance characteristics of Hep₂O[®] pipes and fittings have been assessed by the countries listed on this page and shown to meet acceptable standards.

Hep₂O[®] products therefore incorporate their standard organisation's logo, indicating that they comply with the performance requirements of the listed country concerned.

kiwa

Holland

This standard covers the complete range of Hep₂O[®] pipes and fittings (i.e. 10 to 28mm diameter)



Germany

This standard covers the Hep₂O[®] Euro metric range that includes 16, 20 and 25mm diameter pipes and fittings.



Spain

This standard only covers 15, 22, 25 and 28mm diameter pipes and fittings from the Hep₂O[®] range.

ÖVGW

Austria

This standard only covers selected 16, 20 and 28mm pipes and fittings from the Hep₂O[®] range (i.e. 10 to 28mm diameter)



Poland

This standard covers the complete range of Hep₂O[®] pipes and fittings (i.e. 10 to 28mm diameter)



Hungary

This standard only covers 15, 22 and 28mm, including 16 and 20mm diameter pipes and fittings from the Hep₂O[®] range.



Australian Standards
AS2642
Lic.No 1963

This standard covers the complete range of Hep₂O[®] pipes and fittings (i.e. 10 to 28mm diameter)

Australia/New Zealand

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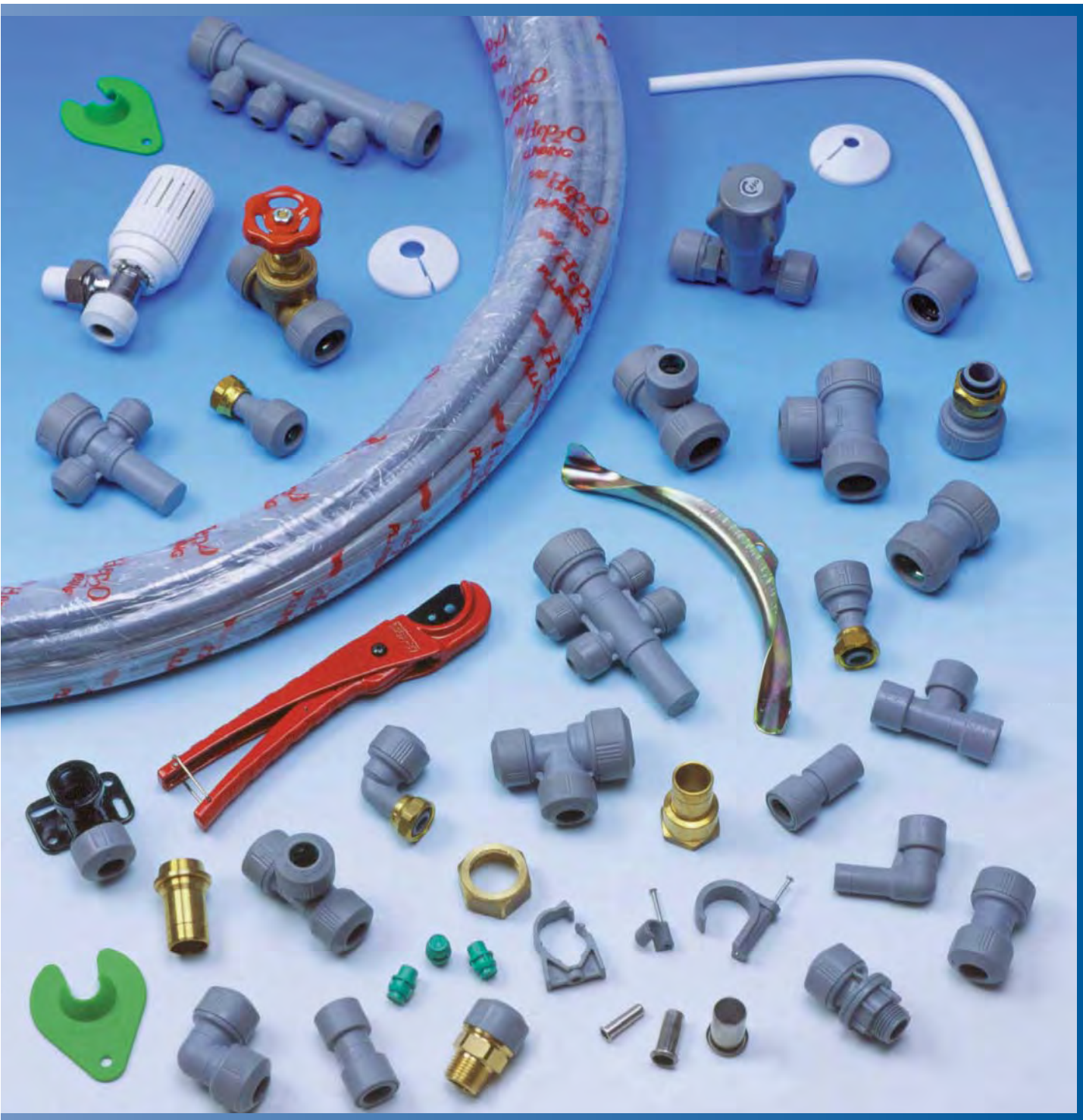
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