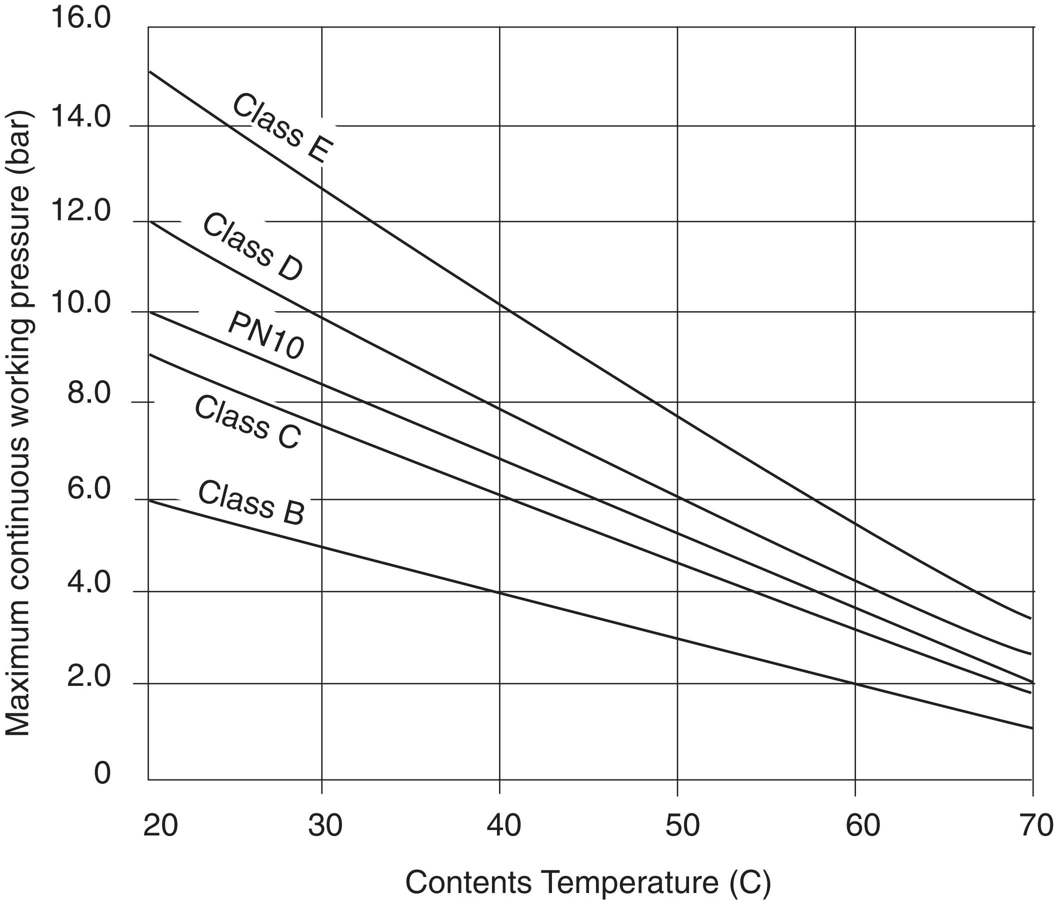
Technical Information

Maximum pressure/temperature relationship

When temperature of contents exceeds 20ºC the working pressure of the system must be reduced accordingly (see table below).



Flow calculations

Pressure drop due to friction in pipes conveying water can be determined using the Flow Nomogram on page 9.

The pressure drop at a given flow rate can be determined as follows:

1. Obtain the internal diameter of the pipe to be used by referring to the dimension table right:
2. Mark this diameter on Scale A.
3. Mark the required flow rate in litres per second on Scale B.
4. Draw a straight line connecting the points on Scales A and B and extend this to Scales C and D.
5. The velocity of flow in metres per second is determined from the intersection with Scale C.
6. The frictional head loss in metres per 100 metres of pipe can then be read off Scale D.

Table of Pipe Internal Diameters

Classes C to E in accordance with BS 5391 Part 1

Size	OD	Class B	Class C	Class D	Class E	Class T
3/8"	17.1				13.7	10.1
1/2"	21.4				17.4	14.2
3/4"	26.7				21.7	19.5
1"	33.6		29.6		27.4	25.0
1 1/4"	42.2		37.2		34.4	31.6
1 1/2"	48.3		42.7		39.3	36.3
2"	60.3		53.1		49.1	45.9
2 1/2"	75.2		65.0			
3"	88.9		78.5		72.3	
4"	114.3		101.1		93.1	
5"	140.2		121.8			
6"	168.3		148.5	142.7		
8"	219.1		193.7			
10"	273.1	250.9				
12"	323.9	297.7				

Note: Dimensions are given for guidance only, please contact our Technical Support Department for accurate information.

In accordance with ISO 161

Size	PN10
16	13.0
20	16.8
25	21.2
32	27.8
40	34.6
50	43.2
63	54.6
75	65.0
90	78.0
110	95.4
125	108.6
140	121.6
160	139.0
200	173.6
225	195.4
250	217.8
315*	273.4

*315mm is PN8 rated.

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Flow nomogram

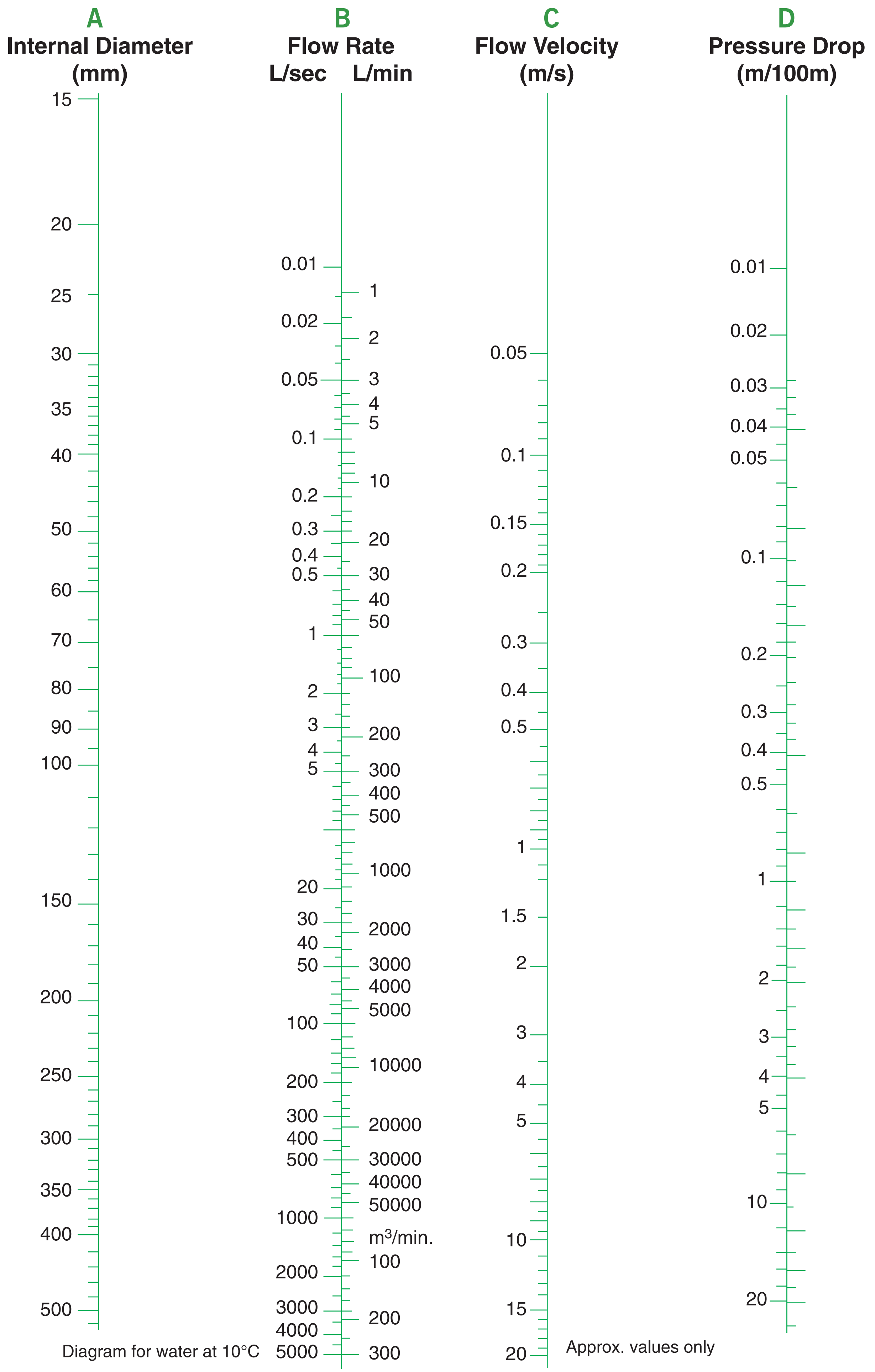

Diagram for water at 10°C

Approx. values only

Fittings

The calculation of pressure drop in fittings is more complex but calculations can be made for equivalent lengths of straight pipe using the formula E=F x D where:

E = equivalent pipe length (metres)
F = fittings constant (see table below)
D = fitting internal diameter (mm)

To calculate the total pressure drop in the system, the equivalent straight pipe lengths for fittings is then added to the total straight pipe length to obtain the total drop.

Fittings constant

90º elbow	0.03
45º elbow	0.01
90º tee - straight through	0.01
90º tee - side branch	0.06
90º bend	0.01
45º bend	0.01
Reducing bush (per size reduction)	0.015
Butterfly valves	0.13
Diaphragm valves	0.23
Check valves	0.05

The values are included as a guide to aid calculation of overall system performance and should not be used in isolation.

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Pipe routing

Systems installed above ground should be designed such that there are sufficient changes in direction to accommodate expansion or contraction. The support method described below will ensure that the pipework can move axially, without snaking. Utilise all available pipe flexibility. Do not place clips too close to changes in direction.

Calculating expansion and contraction

Temperature variations in a pipework system will increase or decrease the length of each pipe. This is the result of temperature changes in the fluid carried and also from ambient temperature variations.

The rate of expansion or contraction of pipework is dependent on its length, its coefficient of expansion and the temperature difference.

Increase/decrease in pipe length is given by the formula:

$$\text{Expansion} = L \times \alpha \times \Delta T$$

where:
- L = length (mm)
- α = coefficient of linear expansion
- ΔT = temperature difference of the pipe (°C)

The coefficient of linear expansion for ABS: 10×10^{-5} per °C

Rule of thumb: ABS expands/contracts 1mm/metre/10 °C temperature change:

Example:

What is the expansion/contraction of an insulated, 30m long, ABS Condenser water main, installed at 15°C, operating at a maximum temperature of 35°C and a minimum temperature of 5°C?

Expansion:

L = 30,000 mm
α = 10×10^{-5}
ΔT = 35 - 15 = 20°C

Expansion = $30{,}000 \times 10 \times 10^{-5} \times 20$°C
= <u>60mm</u>

Contraction:

L = 30,000 mm
α = 10×10^{-5}
ΔT = 15 - 5 = 10°C

Contraction = 30,000mm $\times 10 \times 10^{-5} \times 10$°C
= <u>30mm</u>

Hence the system must be designed, using expansion loops, the natural flexibility of pipe, or expansion bellows, to cater for a differential movement, with an expansion of 60mm and a contraction of 30mm.

The system should be designed to cater for the greater amount of movement of either expansion or contraction.

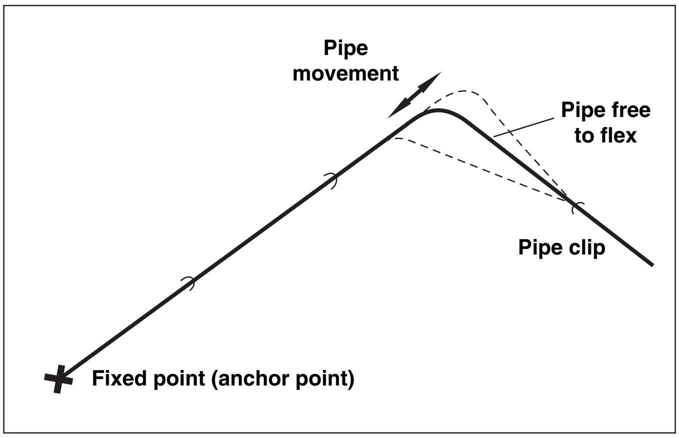
Catering for pipe movement

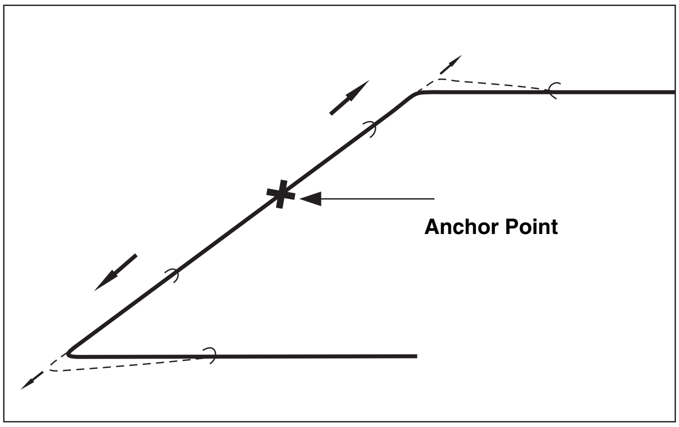
Systems installed above ground should be designed to ensure that there are sufficient changes in direction to accommodate expansion and contraction. The support method described later will ensure that the pipework can move axially without snaking.

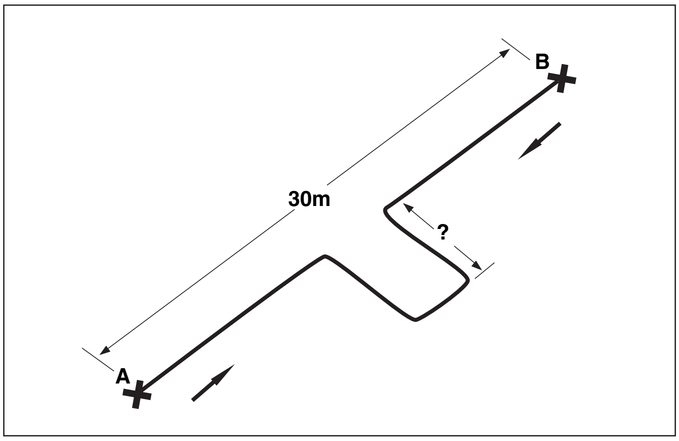
If sufficient changes in direction are not available within the design of the system, alternative methods of catering for pipe movement can be considered such as expansion loops or flexible rubber bellows.

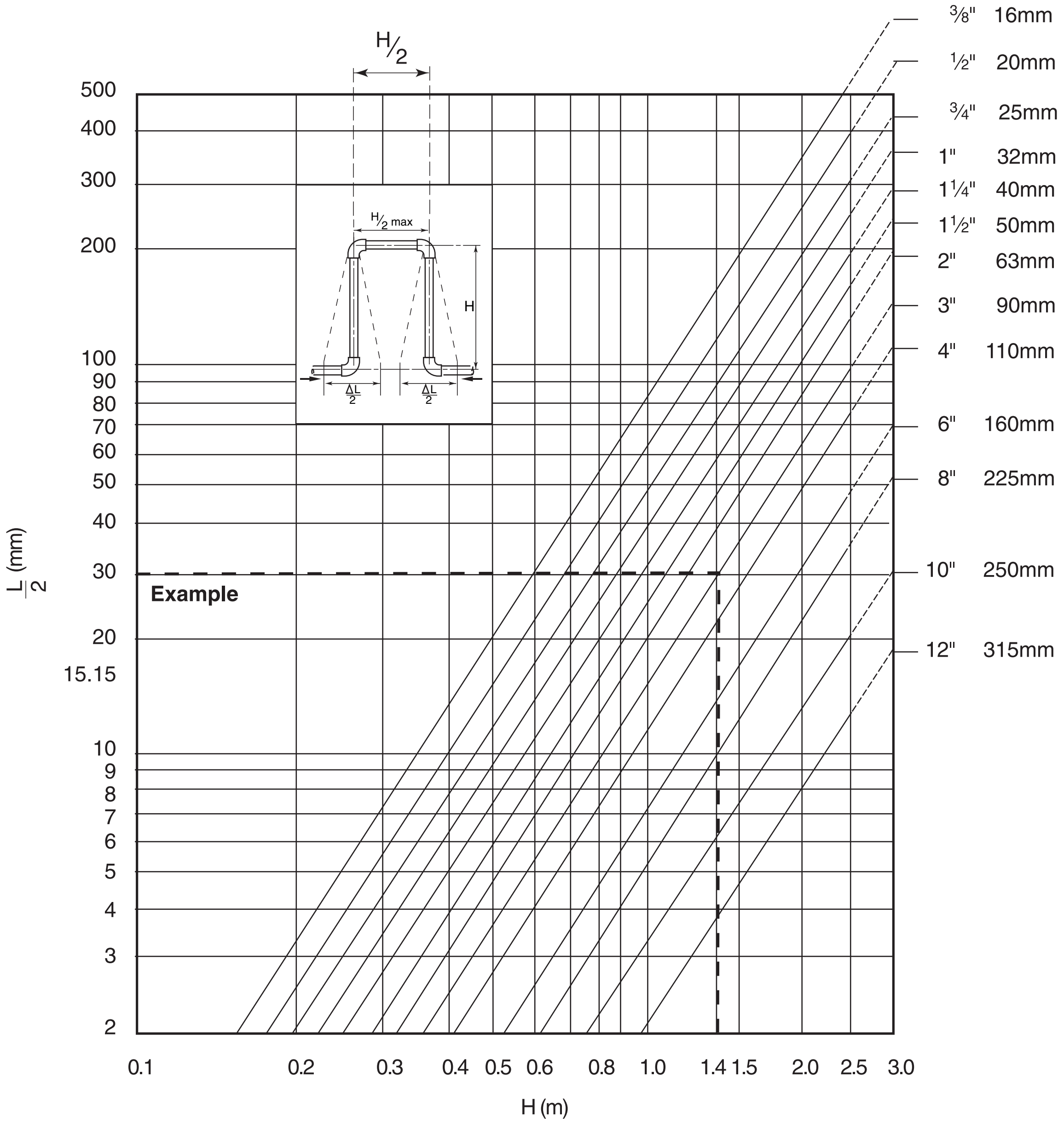
Expansion loops

The length of unrestrained pipe (free leg length) required to accommodate expansion can be calculated from the graph overleaf.









Example:

Calculate the size of expansion loop required for a 90mm diameter pipe expanding 60mm and contracting 30mm:

Based on the worst case ie. 60mm expansion, $\frac{\Delta L}{2} = 30\text{mm}$

Draw a horizontal line from the vertical section to meet the 90mm pipe gradient line.

Drop a perpendicular from the intersection point to the horizontal scale. The figure obtained is the free leg length of the loop required.

Hence, in this instance a loop measuring 1400mm long x 700mm wide will cater for ±60mm movement i.e. the loop will cater for both the expansion and contraction of the pipe.

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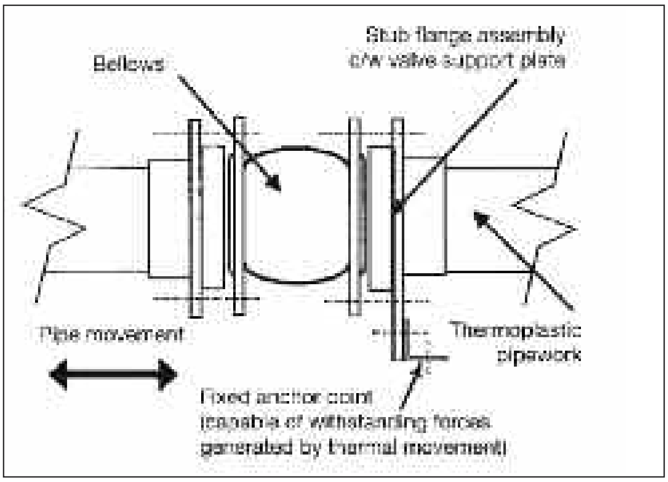
Expansion bellows

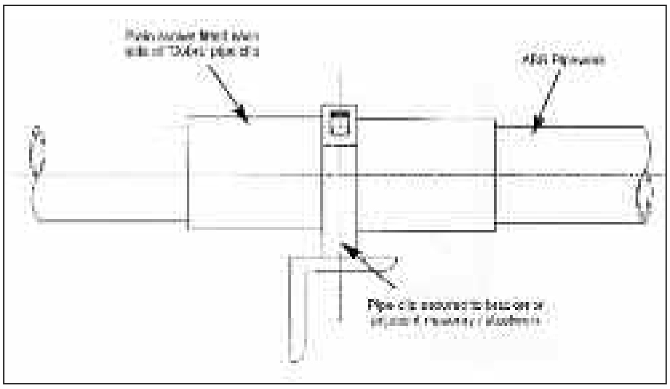
Bellows may also be used in place of or in conjunction with the natural flexibility of the ABS. These must be approved for use by the bellow manufacturers for use with thermoplastic pipework. Bellows must be installed in accordance with manufacturer's recommendations.



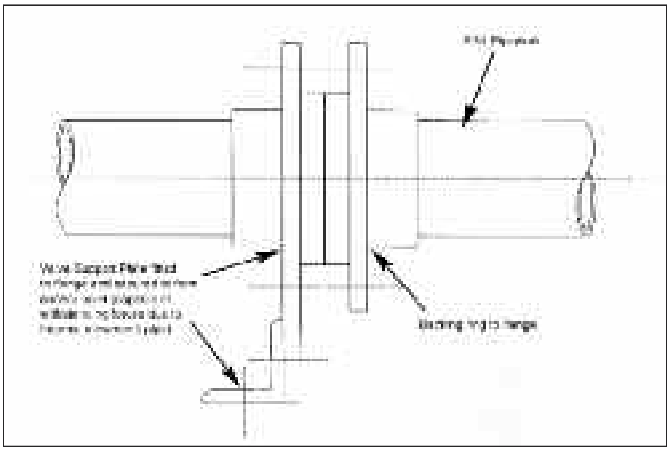
Anchor points

The direction of pipe movement can be controlled by the use of anchor points at strategic positions. There are a number of methods of securely anchoring plastic pipes, some of which are detailed below. However it should be noted that tight fitting pipe supports should not be used since damage to the pipe could occur.
Note: See above for advice on anchoring of bellows.

Construction of typical anchor points



1. Small Bore (up to 4" Pipework)



2. Larger pipe (above 4" Pipework)

Pipe supports and clips

Pipe supports and clips should provide lateral restraint and allow free, unrestricted, axial pipe movement. Standard 'drop rods' may not provide sufficient lateral restraint and the ABS pipe could start to 'snake'.
Durapipe Cobra clips are designed to meet these requirements.
A suitable alternative would be mild steel saddle clips designed with a clearance between the pipe and the clip. All steel brackets in contact with the plastic pipe should be free of sharp edges to avoid damaging the pipe.

Support centres

The recommended distance between supports for ABS pipes filled with water is given in the table below. This table is based on the thinnest wall pipe in each size. For sizes 1", 1 1/4", 1 1/2", 2", 3" and 4" the support distance can be increased by 10% for class E pipes. Where the contents have a specific gravity greater than 1, the distance must be decreased by dividing the recommended centre distances by the specific gravity. The details shown are for horizontal pipes. For vertical pipes, support centres may be increased by 50%.

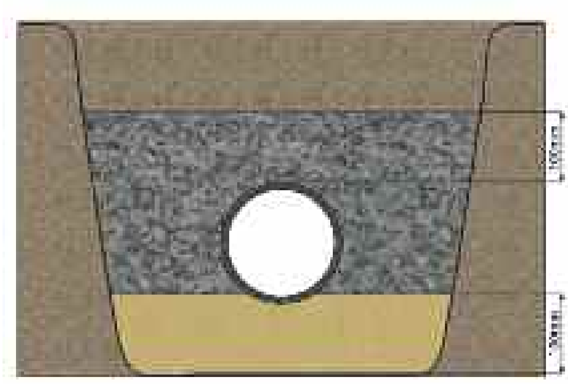
Pipe trays are available for sizes 16mm, 20mm, 25mm and 32mm (see page 69). These allow support distances to be increased to 2.0 metres.

Size mm/imperial	Support distance (m) at 20°C	Support distance (m) at 50°C	Support distance (m) at 70°C
16mm / 3/8"	0.8	0.5	0.4
20mm / 1/2"	0.9	0.6	0.5
25mm / 3/4"	1.0	0.7	0.6
32mm / 1"	1.1	0.8	0.7
40mm / 1 1/4"	1.2	0.9	0.7
50mm / 1 1/2"	1.3	1.0	0.7
63mm / 2"	1.4	1.1	0.8
75mm / 2 1/2"	1.5	1.2	0.8
90mm / 3"	1.6	1.2	0.9
110mm / 4"	1.8	1.3	1.0
125mm	1.9	1.4	1.0
140mm / 5"	2.0	1.5	1.1
160mm / 6"	2.1	1.6	1.2
200mm	2.2	1.7	1.3
225mm / 8"	2.3	1.8	1.5
250mm	2.5	2.0	1.7
10"	2.7	2.2	1.9
315mm / 12"	2.9	2.4	2.1

Support of heavy equipment

Large valves, strainers and other heavy equipment should always be independently supported to prevent undue loading onto the ABS system. Durapipe valve support plates have been designed for this purpose and may be used in place of flange backing rings.

Buried pipes



Recommendations covering essential requirements for installations below ground may be summarised as follows:
In general, trenches should not be less than a metre deep.
Trenches should be straight sided, approximately 300mm wider than the pipe diameter to allow proper consolidation of packing materials.
Trench bottoms should be as level as is practical.
Large pieces of rock, debris and sharp objects should be removed.
Alternatively gravel can be laid approximately 100mm deep on the floor of the trench. (Sand may be used but subterranean water is liable to wash sand away and leave the pipe unsupported.)
If pipes are jointed above ground, they should remain undisturbed for 2 hours before being lowered into the trench.
After laying, pipes should be covered with gravel or similar material to a depth of 100mm above the crown of the pipe. The gravel should be extended sideways to both trench walls and compacted.
This should be done prior to testing, with joints left exposed.
Care should be taken to ensure that sharp objects, stones, etc, are prevented from falling into the trench before covering the pipe.
After pressure testing, joints should be covered with gravel or similar material, and back filling completed.
A section of pipe installed below ground to the above recommendations is shown in the illustration.

Anchor blocks

For wholly solvent welded systems the pipework is pressure balanced and anchor thrust blocks are not required.
When rubber ring joints are used it is necessary to provide concrete anchor blocks at all sudden changes in direction such as elbows, bends, tees etc. This is necessary to withstand the forces generated by system pressurisation.
For greater detail, users in the U.K. are recommended to study the Code of Practice CP 312 published by the Pipe and Fittings Group of the British Standards Institute covering installations above and below ground.

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Additional Important Information

Thermal insulation

Some insulation products can contain substances capable of having a detrimental effect on thermoplastic pipework eg. certain types of foam rubber insulations can cause pipes to fail where the ABS is conveying liquids at temperatures above 30°C.

Recommended insulation - a list of some of the common types of insulation materials known to be suitable with ABS pipework are as follows:
Fibre wool, such as 'Rockwool'
Armaflex Class 1 HT
Koolphen K Phenolic foam
Polystyrene
Note - the above list is not exhaustive – please contact our Technical Support Department if further assistance is required.

Some adhesives can also be detrimental. Do not bond insulation to ABS. (This comment also applies to any tapes, adhesives, or other substances used to secure the heating tape to the pipework.)

Trace heating tapes

The selection of heating tapes with silicone rubber, woven wire or woven polyester outer sheaths will eliminate the risk of plasticiser migration. These tapes are therefore preferred for use on thermoplastic systems.

Pipe contents identification

Do not put self-adhesive labels directly on to pipe surfaces as this may be detrimental to pipe performance. It is recommended that some sort of barrier, such as aluminium foil, is placed between pipe and identification label.

Intumescent mastic and mastic sealants

Certain mastic sealants are formulated with phthalates. Phthalates are known to be extremely aggressive toward ABS materials, and therefore confirmation of the suitability of any mastic sealant should be determined before being used in conjunction with ABS pipework.

Pipe clips

It is important that the composition of pipe clips and their linings do not include substances which might have a detrimental effect upon the ABS pipe. Please check for suitability before use.
We strongly recommend the use of Durapipe Cobra clips for pipe sizes up to and including 160mm OD / 6"NB, wherever circumstances allow.

Pneumatic testing

Pneumatic testing is not recommended because of the risk to personnel or property if, for example, a joint has been temporarily assembled without solvent cement and has then been mistakenly left in that condition. Such joints could separate suddenly and violently during the test.
Also, leak detection sprays designed to detect air leaks on steel pipework can damage thermoplastics.

Contact with synthetic oils

Some synthetic oils are unsuitable for use with thermoplastic pipe systems. The main types of synthetic oils identified as being incompatible with thermoplastic pipe systems includes Esters, Polyalkylene Glycols and Organic Phosphates.

Freezing conditions

Precautions should be taken to prevent contents freezing, as this can cause pipework to split.

Mono-ethylene glycol can be added to the system to lower the freezing point. See opposite for advice on insulation and trace heating.

Contact with fluxes

Some fluxes can be detrimental to ABS. Care should be taken when soldering copper pipework directly above, or close to, ABS pipework.

Buried pipes

Do not lay ABS in contaminated ground eg. 'brown-field' sites.
Do not lay ABS in ground where spillages of chemicals may occur.

Thread sealants

Some thread sealants can damage ABS. PTFE tape should be used when making threaded connections. See page 21 for further information.

Resistance to U.V. (sunlight)

Care should be taken to avoid exposure to U.V. light, e.g. sunlight, particularly during storage. This will cause discoloration and deterioration of the ABS material. Whilst this is a surface effect only it is recommended that precautions be taken to prevent this happening. If stored outdoors pipe should be covered with opaque sheeting. If installed outdoors it can be protected from the effects of U.V. by insulating or painting.

Pressure surges

Durapipe ABS pipework can withstand pressure surges within the limitations detailed within CP312 Part 2:1973 and its amendment dated 1977.
On no account should pressure surges be allowed to exceed the maximum continuous working pressure calculated using the graph on page 8.