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BSI Standards Publication

Plastics piping systems — Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption

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National foreword

This Published Document is the UK implementation of CEN/TR 12108:2012. It supersedes DD ENV 12108:2001, which is withdrawn.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Plastics piping systems - Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption

Systèmes de canalisations plastiques - Guide pour l'installation à l'intérieur de structures de bâtiments de systèmes de canalisations sous pression pour l'eau chaude et l'eau froide destinées à la consommation humaine

Kunststoff-Rohrleitungssyteme - Empfehlungen zum Einbau von Druckrohrleitungssystemen für die Versorgung mit Warm- und Kaltwasser für den menschlichen Gebrauch innerhalb von Gebäuden

This Technical Report was approved by CEN on 25 July 2011. It has been drawn up by the Technical Committee CEN/TC 155.

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Contents

Page

Foreword

This document (CEN/TR 12108:2012) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes ENV 12108:2001.

This document includes the following:

— Annex A (informative), Thermal length variation as a function of the pipe length and temperature difference for pipe materials;

— a bibliography.

At the date of publication of this Technical Report, System Standards for piping systems of hot and cold water applications inside buildings are the following:

— EN ISO 15874 (all parts), *Plastics piping systems for hot and cold water installations — Polypropylene (PP)*;

— EN ISO 15875 (all parts), *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*;

— EN ISO 15876 (all parts), *Plastics piping systems for hot and cold water installations — Polybutylene (PB)*;

— EN ISO 15877 (all parts), *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C)*;

— EN ISO 22391 (all parts), *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT).*

Introduction

This European Technical Report covers the material-related aspects of installation practice. General requirements including design consideration and pipe sizing are given in EN 806 series.

It is essential when dealing with techniques for the installation inside buildings of pressure piping systems to choose the correct type of products for the installation and that a well-established installation technique is used. The system supplier/manufacturer should supply detailed instructions for satisfactory handling, storage and installation.

1 Scope

This European Technical Report recommends practices to be followed in the application and installation of thermoplastics pipes and associated fittings. These fall within the scope of EN 806-1 and, EN ISO 15874, EN ISO 15875, EN ISO 15876, EN ISO 15877 and EN ISO 22391 to be used for hot and/or cold water distribution intended for human consumption inside buildings. This document can also be used for heating installations if applicable, except for under floor heating for which EN 12164 can apply.

Guidance is also given on acceptable methods of jointing polybutylene (PB), crosslinked polyethylene (PE-X), polypropylene (PP), chlorinated poly(vinyl chloride) (PVC-C) and Polyethylene of raised temperature resistance (PE-RT) pipes and associated fittings, together with recommendations for their storage, handling and transportation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 806-1, *Specifications for installations inside buildings conveying water for human consumption — Part 1: General*

3 Terms and definitions

For the purposes of this Technical Report, the terms and definitions given in EN 806-1 apply.

4 Storage, transport and handling

4.1 General

Pipe ends should be covered or protected in such a way that dirt is prevented from entering the pipe.

Pipe with end treatment, such as flanging, forming or pre-assembled fittings, should be stacked or supported so that the ends are free from loading and damage.

When storing, transporting and handling, original packing should be used if possible.

4.2 Storage

The storage chosen should not cause any change to pipe dimensions and the storage area should be such that it does not cause any damage to the pipe surface.

All fittings and accessories should be stored in their original containers, or as recommended by the system supplier/manufacturer.

Storage in direct sunlight should be avoided, as extended exposure to UV light can lead to deterioration.

4.3 Handling

Loading and unloading of pipes should be carried out with care to avoid damage.

Where mechanical handling is employed, the techniques used should ensure that no damage to pipes can occur. Metal slings, hooks and chains should not come into contact with the pipe.

Pipes should not be dragged along rough ground or dropped on a hard surface.

4.4 Transport

Vehicles with a flat bed should be used for transporting pipe. The bed should be free from nails or other projections. Straight lengths should be uniformly supported along their length.

Pipes should be loaded on vehicles in such a way that there is no unnecessary overhang.

5 Design considerations

5.1 Service conditions

The installed pipe work system should be capable of operation at the applicable service conditions in accordance with classes specified in EN ISO 15874, EN ISO 15875, EN ISO 15876 EN ISO 15877 and EN ISO 22391.

5.2 Materials and components

Components for hot and cold water pipes should alternatively conform to EN ISO 15874, EN ISO 15875, EN ISO 15876, EN ISO 15877 and EN ISO 22391.

6 Installation

6.1 Pipe supports - General

Pipe supports should be designed to provide a permanent fixing. Where fittings such as valves and manual controls are used, these should be firmly anchored so as to minimize any moment imparted to the pipe by operation e.g. of hand wheels or levers.

Spacing distances should be in accordance with the system supplier’s/manufacturer's installation instructions. Clamps/brackets to support pipe should be designed in such a way that the function of the piping system is not affected. Where pipes are adequately supported through joists or on boarding, intermediate clips may not be necessary.

6.2 Installation of pipes allowing thermal length variation

6.2.1 General

NOTE Annex A shows the thermal length variation ΔL as function of length of pipe and temperature difference for, PE-X, PP-R, PB, PVC-C and PE-RT.

Pipes are subjected to thermal length variation, which requires consideration to prevent any damage, particularly for rigid pipes. There are different ways to consider this.

Thermal length variation of a thermoplastic pipe can be calculated according to Formula (1):

$$\Delta L = \Delta T \times L \times \alpha \quad (1)$$

where

ΔL is the thermal length variation, in millimetres;

ΔT is the temperature difference, in Kelvin;

L is the length of pipe, in metres;

α is the coefficient of thermal expansion (thermal length variation), in millimetres per metre, per Kelvin.

Reference values for α are given in Table 1.

Table 1 — Reference values of thermal length variation

Material	α mm/m K	Figure
PVC-C	0,07	A.1
PE-X	0,15	A.2
PP-R	0,15	A.2
PB	0,13	A.3
PE-RT	0,19	A4

6.2.2 Positioning of anchor points

The positioning of anchor points can be used to give direction and to limit to the amount of thermal length variation. The anchor points can be positioned in such a way that variations of lengths can be split in different directions. Examples are given in Figures 1 to 3.

This is also valid for header pipes in a basement.

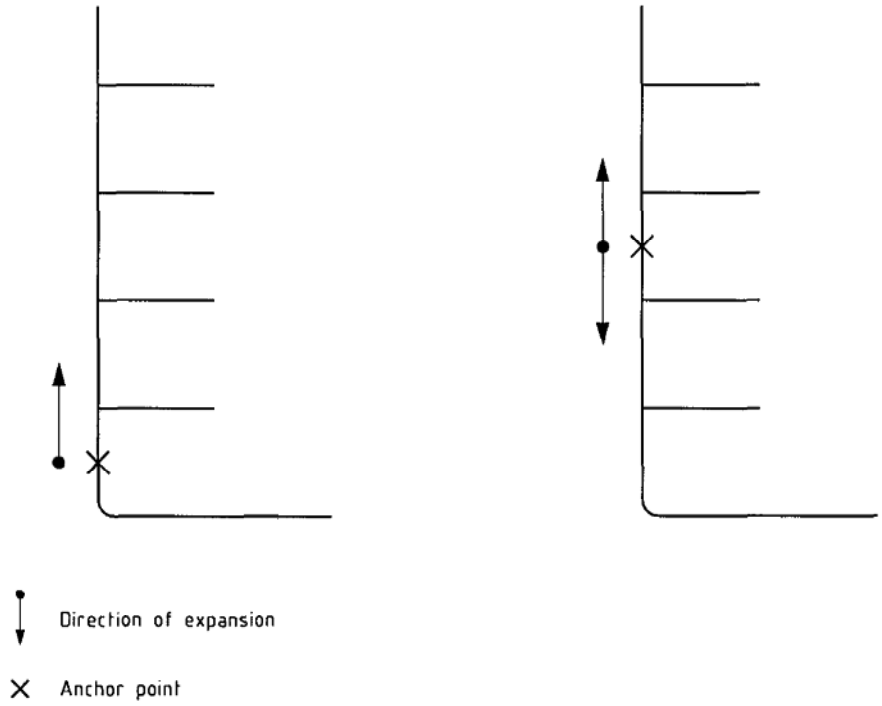


Figure 1 — Positioning of anchor points to guide the direction of thermal length variation (installation with branches)

6.2.3 Installation of pipes allowing thermal length variation by means of a flexible arm

The flexible arm should be sufficiently long to prevent damage.

The guide brackets should allow clearance to the wall also after thermal length variation. This is also applicable in cases where pipes are supported along their length.

A typical installation is shown in Figures 2 and 3.

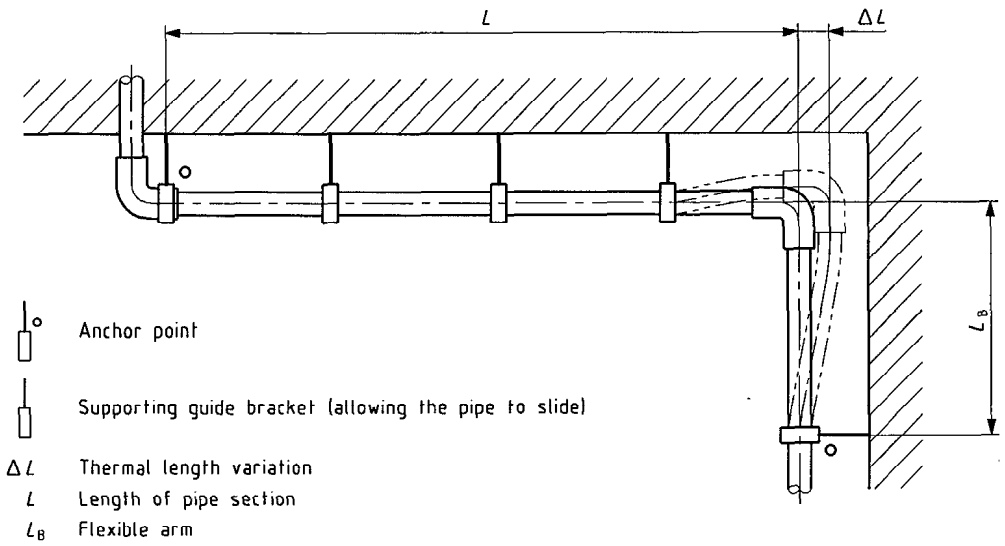


Figure 2 — Compensation of thermal length variation, ΔL, by flexible arm, L_B

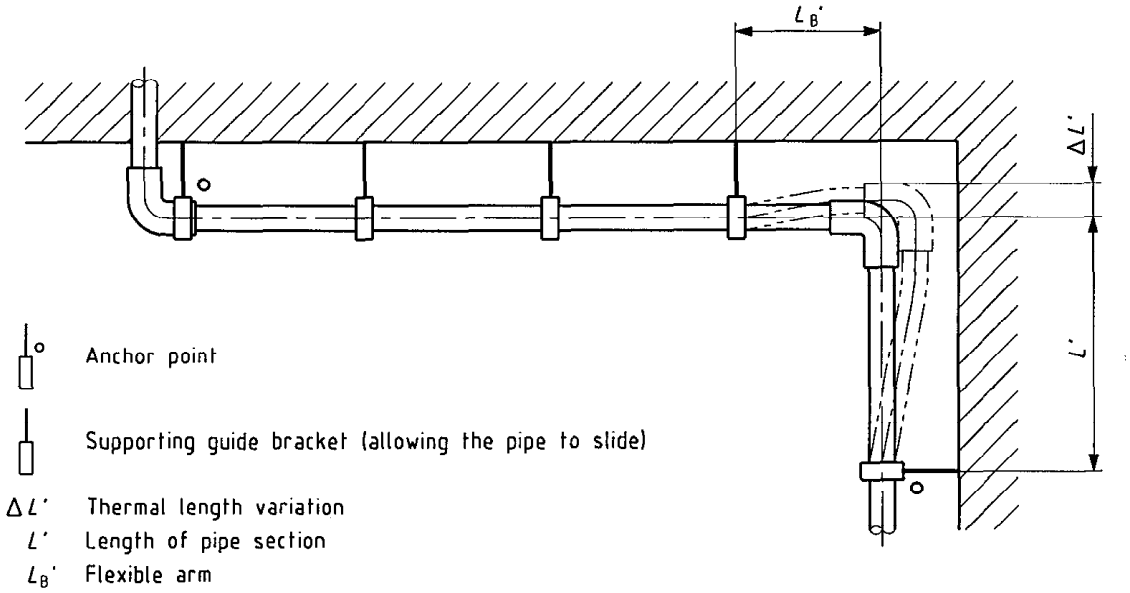


Figure 3 — Compensation of thermal length variation, $\Delta L'$, by flexible arm, L_B'

The minimum length of the flexible arm, L_B can be calculated according to Formula (2):

$$L_B = C\sqrt{d_e \times \Delta L} \qquad (2)$$

where

ΔL is the thermal length variation, in millimetres (see 6.2.1);

L_B is the flexible arm, in millimetres;

C is the material constant (see Table 2);

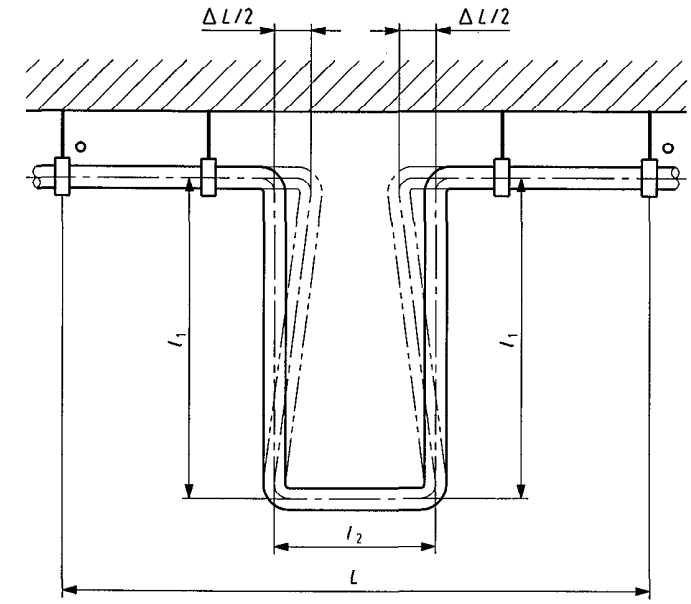
d_e is the outside diameter, in millimetres.

Table 2 — Value of *C*

Material	Material constant *C*
PVC-C	34
PE-X	12
PP-R	20
PB	10
PE-RT	14

6.2.4 Installation of pipes allowing expansion by means of an expansion loop

A typical installation is shown in Figure 4.



Anchor point

Supporting guide bracket (allowing the pipe to slide)

L Length of pipe section
l_1 Length of loop
l_2 Width of loop
ΔL Thermal length variation

Figure 4 — Compensation of the thermal length variation by expansion loop

It is preferable to design the loop so that $l_2 = 0{,}5l_1$.

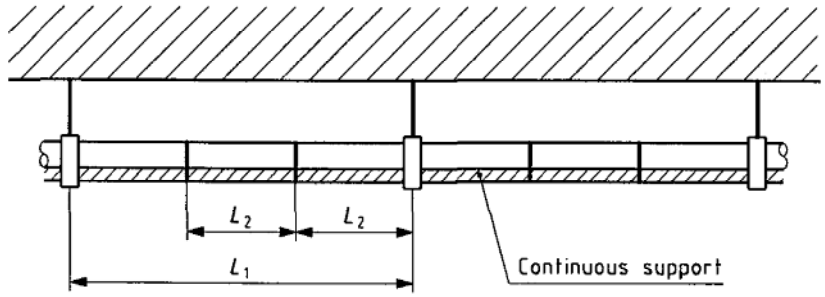
In this case the flexible arm is calculated according to Formula (3).

$$L_B = C\sqrt{d_e \times \frac{2\Delta L}{2}} = 2l_1 + l_2 \quad (3)$$

6.2.5 Installation of pipes allowing thermal length variation and with continuous support and supporting guide brackets

A typical installation is shown in Figure 5.

Maximum recommended distances between anchor point and supporting guide bracket respectively between supporting guide brackets, L_1, and between bindings, L_2, are given in Tables 3 and 4.



Supporting guide bracket (allowing the pipe to slide)

Binding

L_1 Distance between supporting guidebracket or between supporting guidebracket and anchor point

L_2 Distance between bindings

Figure 5 — Continuous support with supporting guide bracket allowing thermal length variation

Table 3 — Maximum recommended distance, L_1, between supporting bracket (approximate values)

Dimensions in millimetres

Pipe outside diameter	L_1	
	Cold water	Hot water
$d_e \leq 20$	1500	1000
$20 < d_e \leq 40$	1500	1200
$40 < d_e \leq 75$	1500	1500
$75 < d_e \leq 110$	2000	2000
$110 < d_e \leq 125$	2000	2000
$125 < d_e \leq 140$	2500	2500
$140 < d_e \leq 160$	2500	2500

Table 4 — Maximum recommended distance, L_2, between bindings (approximate values)

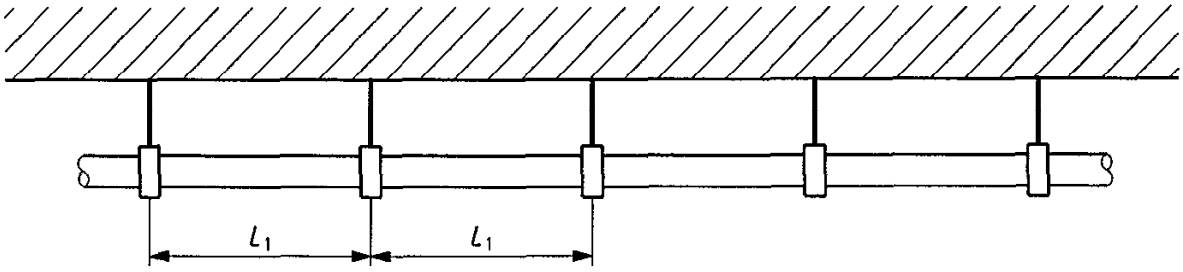
Dimensions in millimetres

Pipe outside diameter	L_2	
	Cold water	Hot water
$d_e \leq 20$	500	200
$20 < d_e \leq 25$	500	300
$25 < d_e \leq 32$	750	400
$32 < d_e \leq 40$	750	600
$40 < d_e \leq 75$	750	750
$75 < d_e \leq 110$	1000	1000
$110 < d_e \leq 125$	1000	1000
$125 < d_e \leq 140$	1250	1250
$140 < d_e \leq 160$	1250	1250

6.2.6 Installation of pipes allowing thermal length variation and with supporting guide bracket

A typical installation is shown in Figure 6.

Maximum recommended distances between anchor point and supporting guide bracket respectively between supporting guide brackets are given in Table 5.



Supporting guide bracket (allowing the pipe to slide)

L_1 Distance between supporting guide bracket or between supporting guidebracket and anchor point

Figure 6 — Supporting guide bracket allowing thermal length variation

Table 5 — Maximum recommended distance, L_1 between supporting guide brackets (approximate values)

Dimensions in millimetres

Pipe outside diameter	L_1 [1)]	
	Cold water	Hot water
$d_e \leq 16$	750	400
$16 < d_e \leq 20$	800	500
$20 < d_e \leq 25$	850	600
$25 < d_e \leq 32$	1000	650
$32 < d_e \leq 40$	1100	800
$40 < d_e \leq 50$	1250	1000
$50 < d_e \leq 63$	1400	1200
$63 < d_e \leq 75$	1500	1300
$75 < d_e \leq 90$	1650	1450
$90 < d_e \leq 110$	1900	1600
$110 < d_e \leq 125$	2100	1850
$125 < d_e \leq 140$	2300	2050
$140 < d_e \leq 160$	2500	2300

1) For vertical pipes L_1 should be multiplied by 1,3.

6.2.7 Installation of pipes on continuous horizontal supports

Pipes may be laid down on continuous horizontal supports (e.g. cable tray), where the thermal length variation is compensated by "snaking" of the pipe. The course of the pipe should be designed to give enough space for the thermal length variation of the pipe. To avoid vertical movement of the pipe, the pipe should be secured.

6.3 Installation of pipes not allowing thermal length variation (for PE-X, PB, PP and PE-RT)

6.3.1 General

Installation of pipes between anchor points is sometimes required for special situations, in this case the force due to thermal length variation are transmitted through the anchor points to the structure of the building. Examples are given in Figures 7, 8, 9 and 10.

6.3.2 Positioning of anchor points (for PE-X, PB, PP and PE-RT)

The anchor points should be positioned so that the thermal length variations cannot take place (see Figure 7). The maximum allowable distance between anchor points should be less than or equal to 6 m.

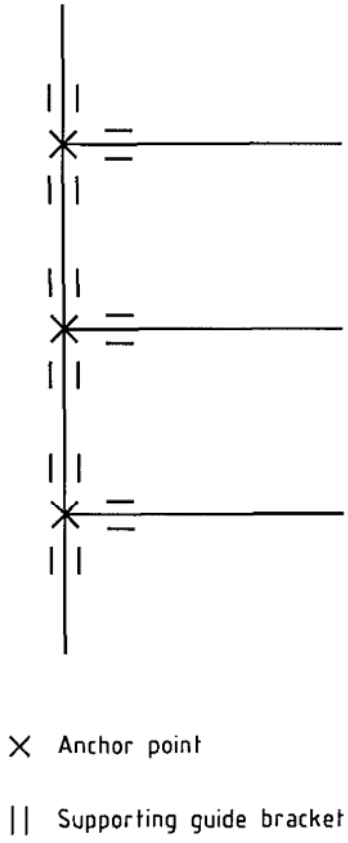


Figure 7 — Positioning of anchor points at branches

6.3.3 Installation of pipes between anchor points not allowing thermal length variation where pipe support is continuous (for PE-X, PB PP and PE-RT)

A typical installation is shown in Figure 8.

Maximum recommended distances between anchor point and supporting guide bracket respectively between guide brackets, L_1, and between bindings, L_2, are given in Tables 3 and 4.

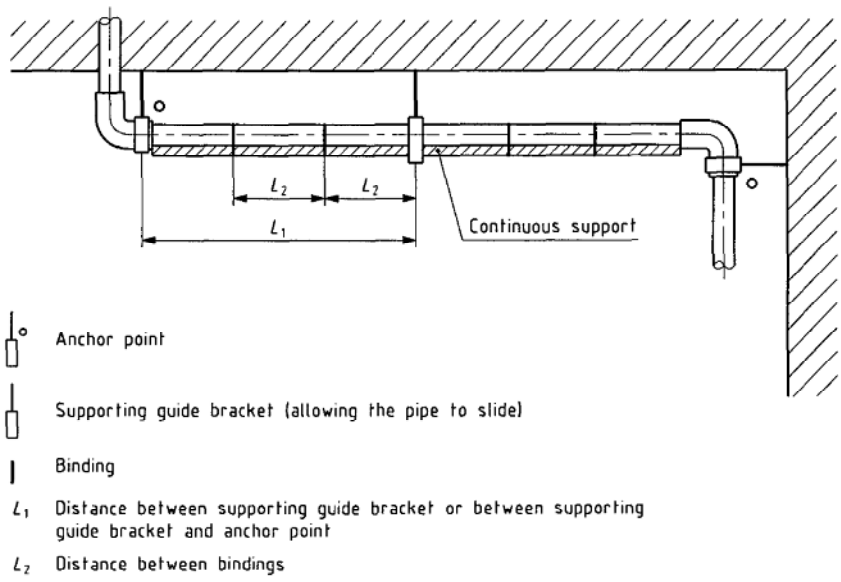


Figure 8 — Continuous support with supporting guide brackets and anchor points not allowing thermal length variation

6.3.4 Installation of pipes between anchor points not allowing thermal length variation with supporting guide brackets (for PE-X, PB, PP and PE-RT)

A typical installation is shown in Figure 9.

Maximum recommended distances between anchor point and supporting guide bracket respectively between guide brackets, L_1, are given in Table 6.

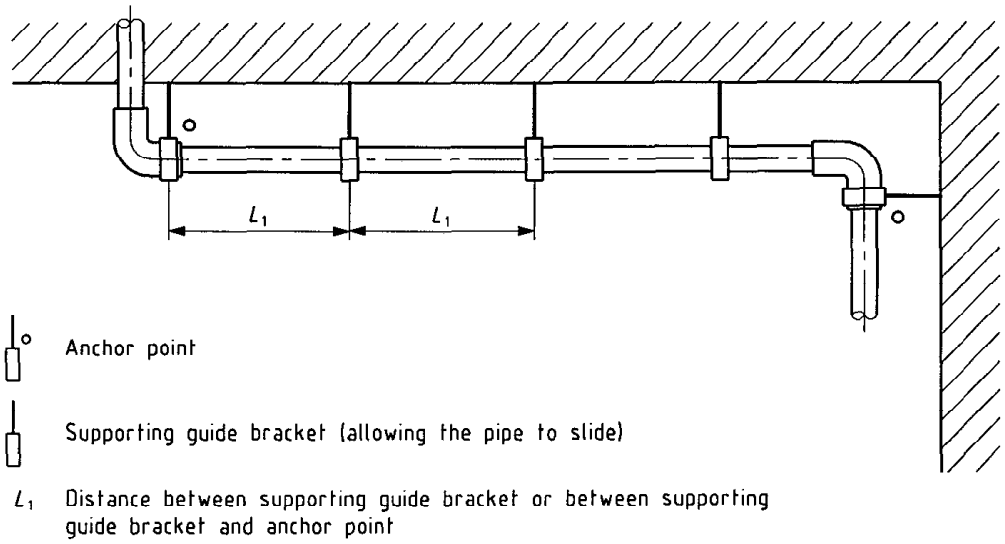


Figure 9 — Installation of pipes between anchor points with supporting guide bracket not allowing thermal length variation

Table 6 — Maximum recommended distance, L_1, between supporting guide brackets (approximate values)

Dimensions in millimetres

Pipe outside diameter	L_1 [1)]	
	Cold water	Hot water
$d_e \leq 16$	600	250
$16 < d_e \leq 20$	700	300
$20 < d_e \leq 25$	800	350
$25 < d_e \leq 32$	900	400
$32 < d_e \leq 40$	1100	500
$40 < d_e \leq 50$	1250	600
$50 < d_e \leq 63$	1400	750
$63 < d_e \leq 75$	1500	900
$75 < d_e \leq 90$	1650	1100
$90 < d_e \leq 110$	1850	1300
$110 < d_e \leq 125$	2000	1400
$125 < d_e \leq 140$	2150	1550
$140 < d_e \leq 160$	2500	1800

1) For vertical pipes L_1 should be multiplied by 1,3.

6.3.5 Installation of pipes supported only at the anchor points (for PE-X, PB, PP and PE-RT)

In this case the forces due to thermal length variation only partially are transmitted through the anchor points to the building structure.

This may be used where the movement caused by thermal length variation as shown in Figure 10, can be tolerated.

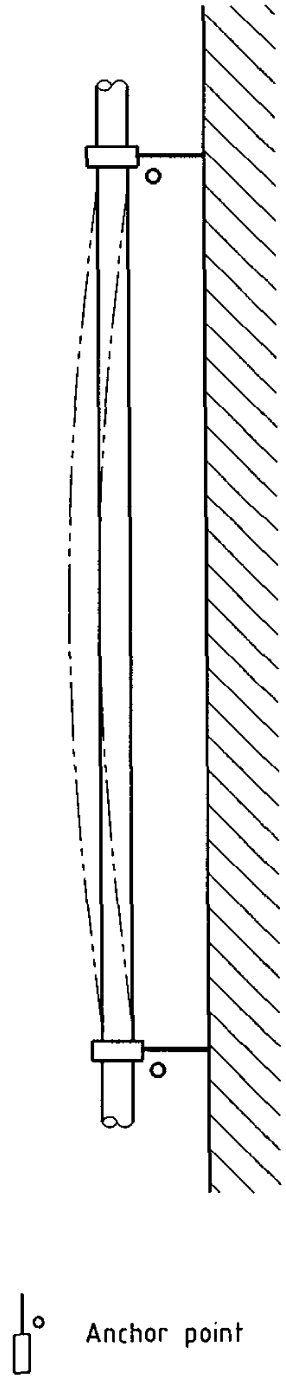


Figure 10 — Pipes supported only by anchor points

6.4 Embedded pipes

6.4.1 Pipes laid within protective pipes or ducts and/or insulation

Where protective pipes and/or insulations are embedded it is important to ensure that deformation or displacement does not occur. When using protective pipes in floor and wall of concrete it should be ensured that no liquid concrete can enter protective pipes.

Protective pipe should be laid with bending radius not less than 8 times the outside diameter of the water carrying pipe.

NOTE This pipe-in-pipe system is mostly used for diameters less or equal to 25 mm.

When the pipes are installed in protective pipes it is advisable to fix the pipe and the protective pipe where they emerge from the wall or floor.

6.4.2 Embedded bare pipes

Where bare pipes are embedded for instance in concrete they should be installed at acceptable depths under the surface of wall or floor taking into account thermal expansion. For polyolefins the bending radius should not be less than 8 times the outside diameter if it is less or equal to 25 mm and it is advisable to fix the pipe in the desired position before embedding and where it emerges from the wall or floor. Non-dismountable joints such as fused, adhesive cemented and crimped joints are permitted, however, the system supplier's instructions and local regulations concerning embedded pipes have to be taken into account.

6.5 Pipes and protective pipes hanging or looping free

The installer should be aware that the pipe carrying hot water will expand with heat and should therefore take measures when the pipes are hanging or looping free within wall or floor constructions to fix the ends of the pipes where they emerge from the structure (as shown in Figure 11). Recommendations of installation of system hanging or looping free is to be sought by the system supplier.

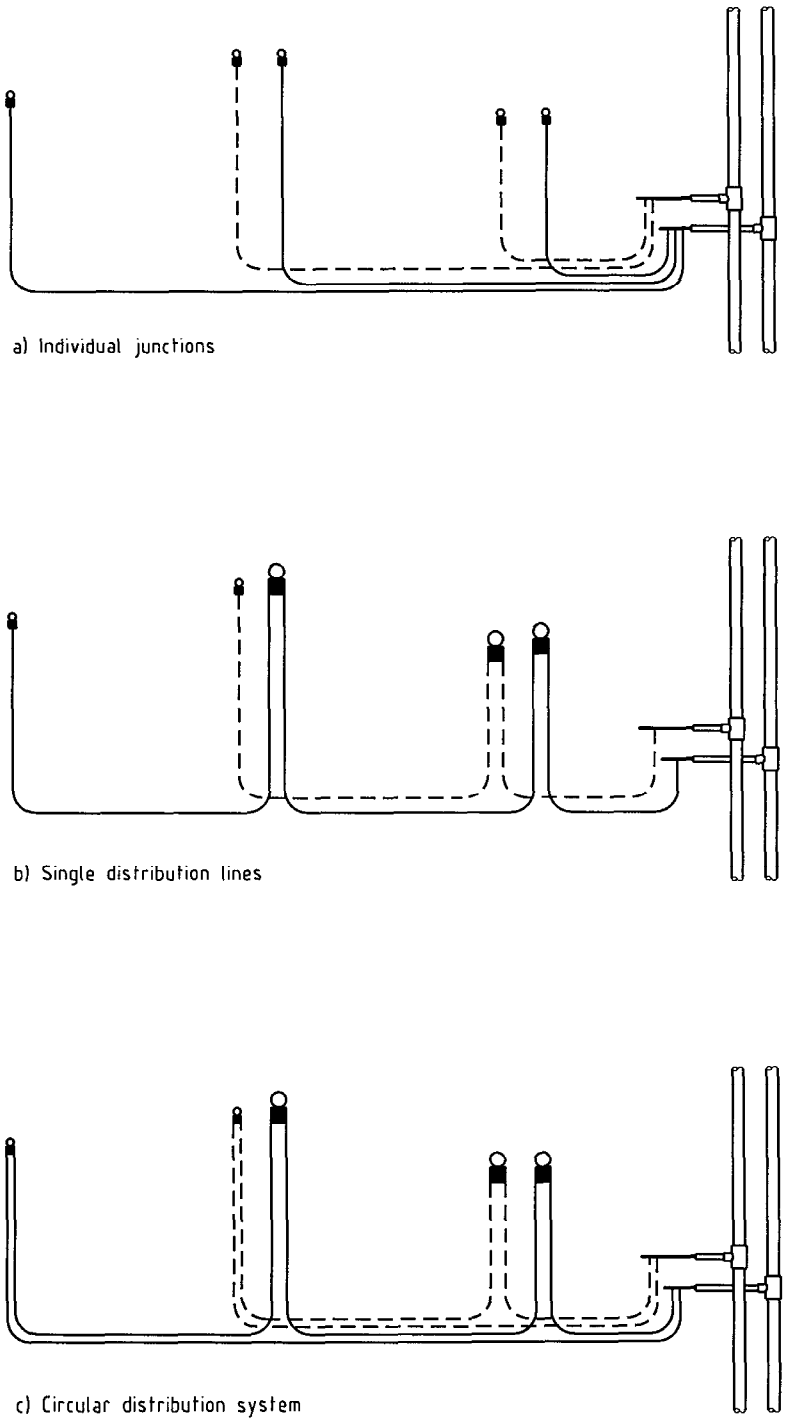


Figure 11 — Pipes hanging or looping free

Bare pipes should not contact joist beams, floor boards and other pipes. To prevent contact, pads of rubbing piece material or insulation should be fitted between the pipe and the structure.

7 Jointing

7.1 General

All joints should be made in accordance with the instructions of the system supplier/fittings manufacturer and the procedures given in 7.2 to 7.5.

Joints may be classified in three categories as follows:

a) mechanical fittings and including joints made by shrinking, which can be compression, crimping, push-fit, and/or flat-faced unions, flanges and/or screwed unions;

b) solvent-cement fittings, in which solvent cement is applied to the spigot end and to the socket;

c) thermal fusion fittings, in which pipes are jointed to pipes and/or fittings by the application of heat under controlled conditions to the fusion zone.

7.2 Preparation of pipe

Pipes may be cut to length with tools recommended by the system supplier/manufacturer. Pipes should be cut at right angles to their axis without burrs and shall not show any gouges, splits or other damage to the pipe end before jointing.

7.3 Jointing procedures

Mechanical fittings comprise:

— compression fittings and crimped fittings;

— flanged fittings;

— flat seat union fittings.

7.3.1 Compression fittings and crimped fittings

Compression fittings in which the joint is made by the compression of a ring or sleeve on the outside wall of the pipe with or without additional sealing elements and with internal support are of two main types which require different jointing procedures as follows:

a) joints which rely on the compression of an olive or an elastomeric component, such as a joint ring or compression of a sleeve, to effect a seal;

b) joints where an elastomeric ring is used and the fitting is secured to the pipe by compressing a locking ring onto the pipe by means of a screwed nut or similar.

Crimped fitting in which the sealing is made by crimping of the fitting and/or a ring on the outside wall of the pipe by means of a special tool.

7.3.2 Flanged fittings

A fitting in which the pipe connection consists of two mating flanges which are mechanically pressed together and sealed by the compression of an elastomeric sealing element between them.

7.3.3 Flat-seat union fittings

A fitting in which the pipe connection consists of two components (at least one of which normally incorporates a flat sealing surface) which are mechanically pressed together by means of a screwed nut or similar and sealed by the compression of an elastomeric sealing element between them.

7.4 Solvent-cement or adhesive-bonded fittings

This procedure is applicable to PVC-C components. Joints should be made in accordance with the instructions of the system supplier/fittings' manufacturer and generally in line with the following.

Only solvent cements or adhesives and cleaners recommended by the system supplier respectively PVC-C pipe and fitting manufacturers should be used.

Solvent cements or adhesives and cleaners should be used only in areas of adequate ventilation. Labels incorporate statutory hazard warning signs and these labels should be read prior to using these cements or adhesives and cleaners. It is advisable to use small containers and to close them immediately after use in order to minimise evaporation.

The solvent cement or adhesive shelf life has to be taken into consideration.

Solvent cements or adhesives should not be diluted.

7.5 Fused joints

This procedure is applicable to fused components only.

NOTE It is essential that electrically powered devices used to produce heat conform to their manufacturer's specifications in order to prevent hazard.

Thermal fusion joints achieve sealing by melting together pipes and/or fittings by means of heated tool (socket fusion fittings) or by heat induced by current flowing in an appropriate resistor inserted in the fitting bulk (electrofusion fittings). Elements to be jointed should be of types/grades that are fusible together.

8 Boiler and instantaneous water heaters connections

Boilers and instantaneous water heaters may be connected directly with plastics pipework if the safety devices do not allow short term maximum temperature higher than the malfunction temperature (95 °C for hot drinking water and 100 °C for heating, except for underfloor heating) and an internal pressure not higher than 1,2 times the design pressure. According to local practices, a metal transition piece between a boiler or an instantaneous water heater and plastics piping can be used, located not less than 350 mm from the connection to the boiler or circulator.

9 Painting

When required, plastics can be painted using normal household dispersion paints and normal methods of application. The advice of the plastics component manufacturer or system supplier should be sought as to the suitability of the paint to be used. In particular the paint should not induce stress cracking.

10 Filling and inspection

10.1 General

The system should be filled slowly with drinking water to ensure the complete elimination of air pockets, thus preventing pressure surges.

10.2 Testing and commissioning

10.2.1 General

Alternative hydrostatic pressure tests for installed pipework systems and commissioning of such systems are given in 10.2.2 and 10.2.3 respectively.

10.2.2 Test procedure A

To use Procedure A to apply the hydrostatic test pressure conduct the procedure as follows.

a) Open the venting system;

b) purge the system with water to expel all air that can be removed thereby. Stop the flow and close the venting system;

c) apply the selected hydrostatic test pressure equal to 1,5 times the design pressure by pumping according to Figure 12 during the first 30 min, during which time an inspection should be carried out to identify any obvious leaks with the system under test;

d) reduce the pressure by rapidly bleeding water from the system to 0,5 times design pressure according to Figure 12;

e) close the valve. The recovery of a constant pressure, which is higher than 0,5 times the design pressure, is indicative of a sound system. Monitor the situation for 90 min. Visually check for leaks. If during that period there is a falling away of pressure, this indicates a leak within the system;

f) the test result should be recorded.

10.2.3 Test procedure B

To use Procedure B to apply the hydrostatic test pressure conduct the procedure as follows.

a) Open the venting system;

b) purge the system with water to expel all air that can be removed thereby. Stop the flow and close the venting system;

c) apply the selected test pressure equal to 1,5 times the design pressure by pumping according to Figure 13 during the first 30 min;

d) read the pressure when the first 30 min have elapsed;

e) read the pressure after another 30 min and visually check for leaks. If the pressure has dropped by less than 0,6 bar conclude the system has no obvious leakage and continue the test without further pumping;

f) visually check for leaks and if during the next 2 h, the pressure drops by more than 0,2 bar this indicates a leak within the system;

g) the test result should be recorded.

For smaller sections of an installation the test Procedure B may be reduced to only stages a) to e) and g).

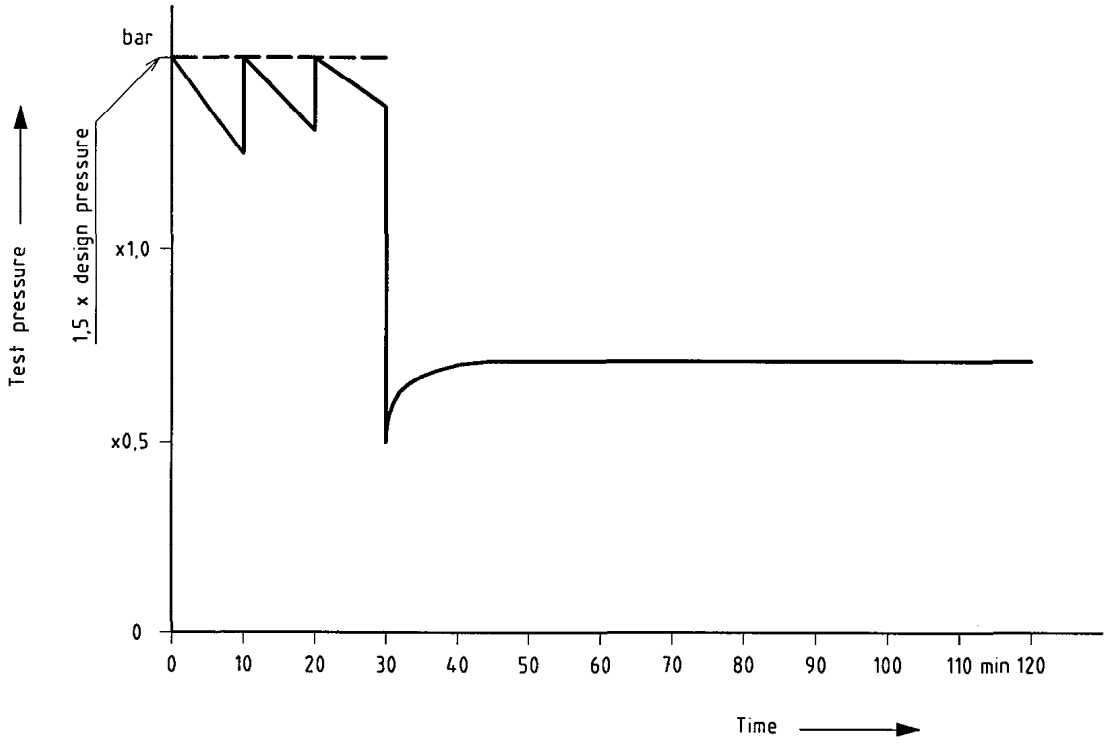


Figure 12 — Testing for water tightness — Test procedure A

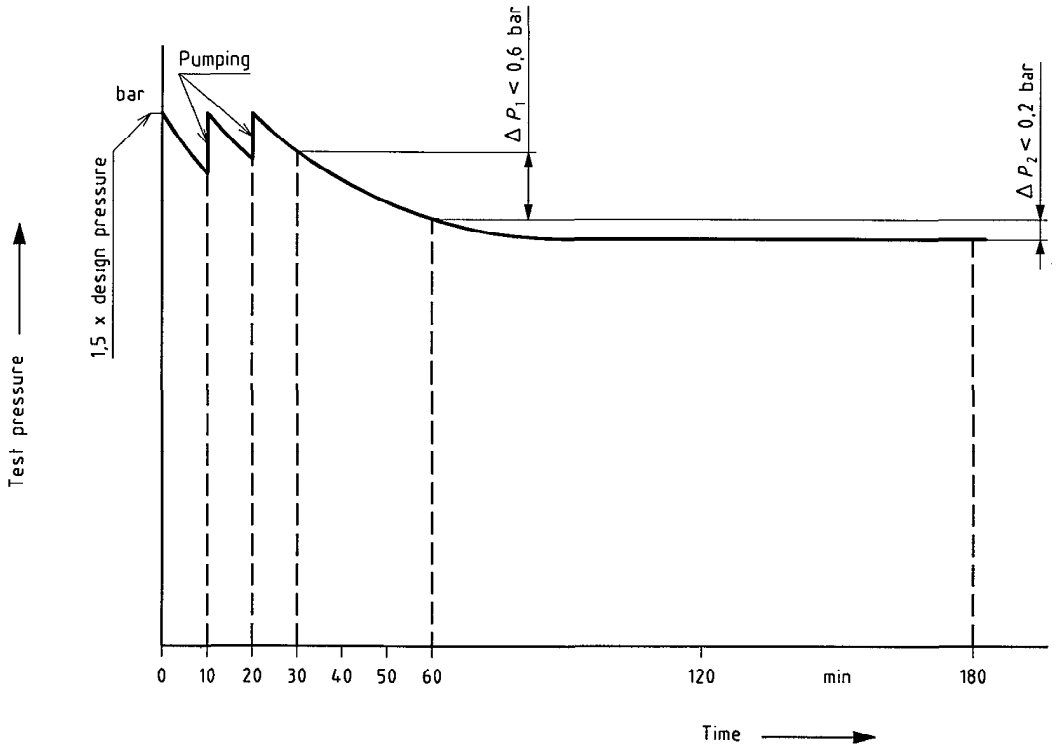


Figure 13 — Testing for water tightness — Test procedure B

Annex A
(informative)

Thermal length variation as a function of the pipe length and temperature difference for pipe materials

Thermal length variation as a function of the pipe length and temperature difference are shown for individual materials in Figures A.1 to A.4.

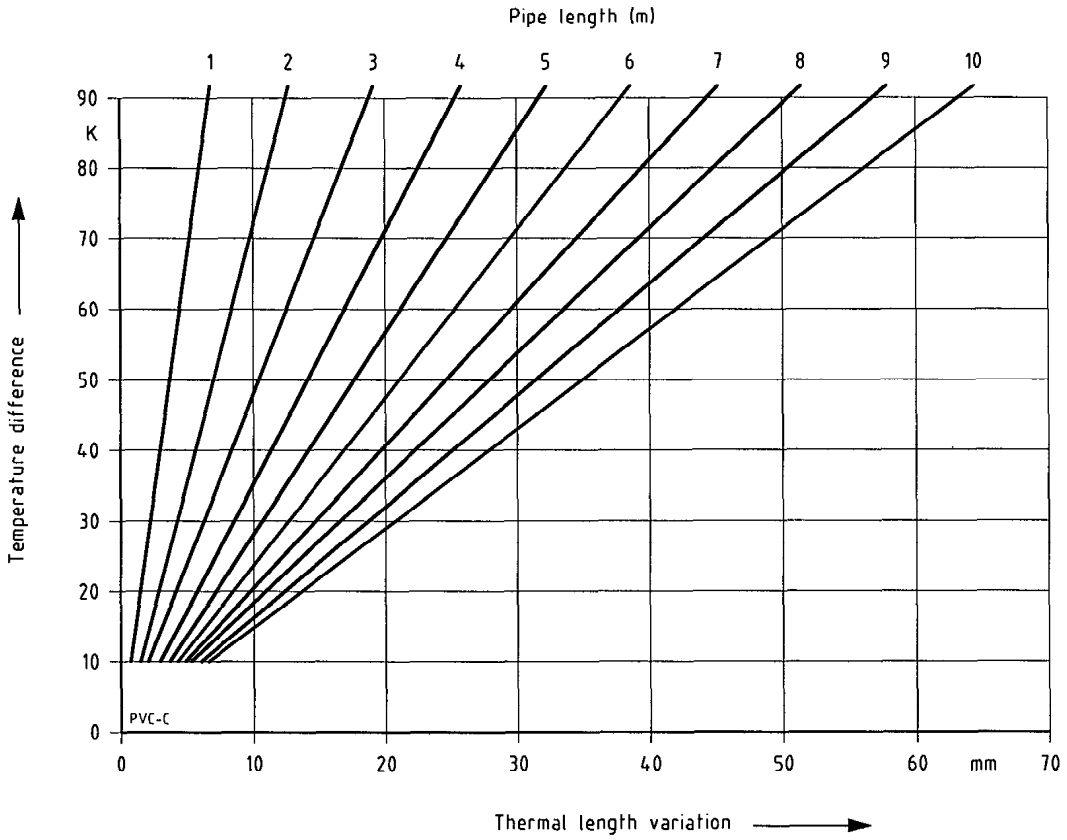


Figure A.1 — PVC-C

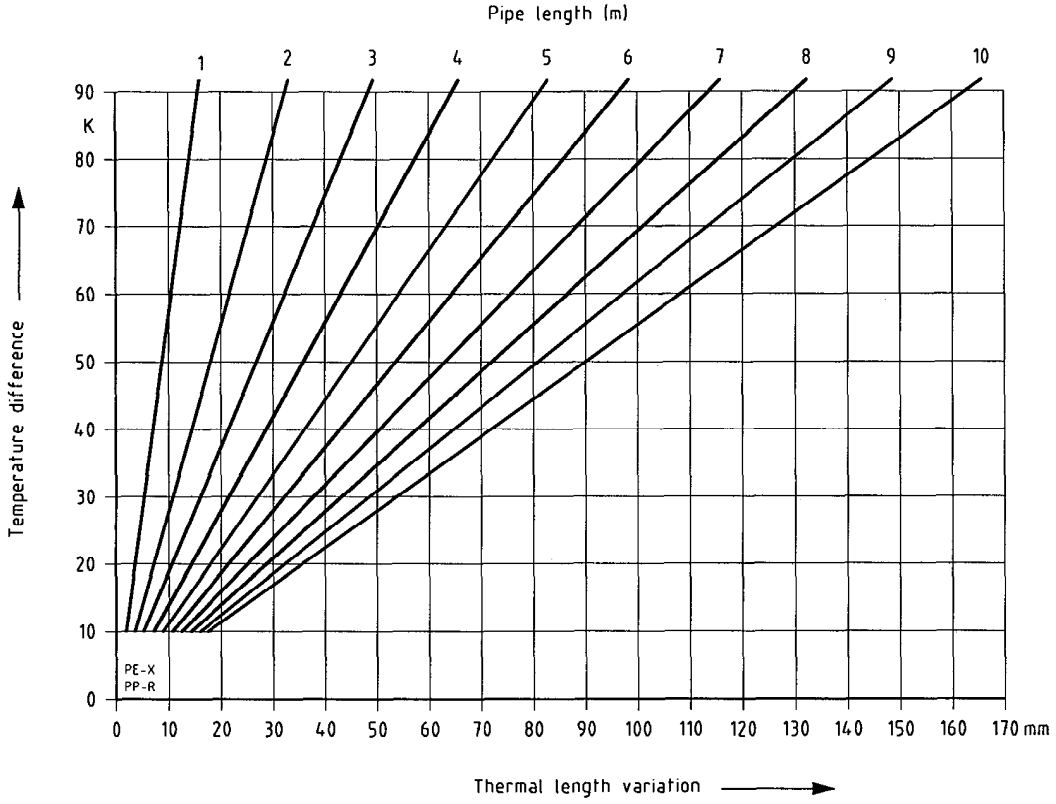


Figure A.2 — PE-X and PP-R

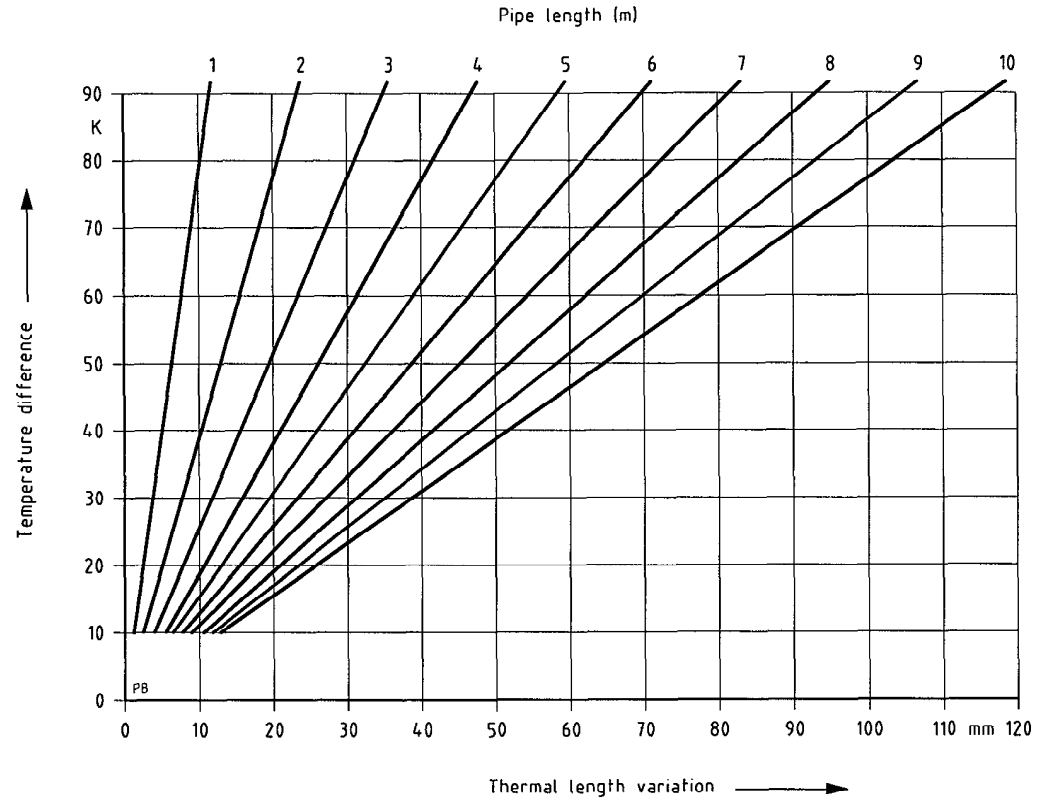


Figure A.3 — PB

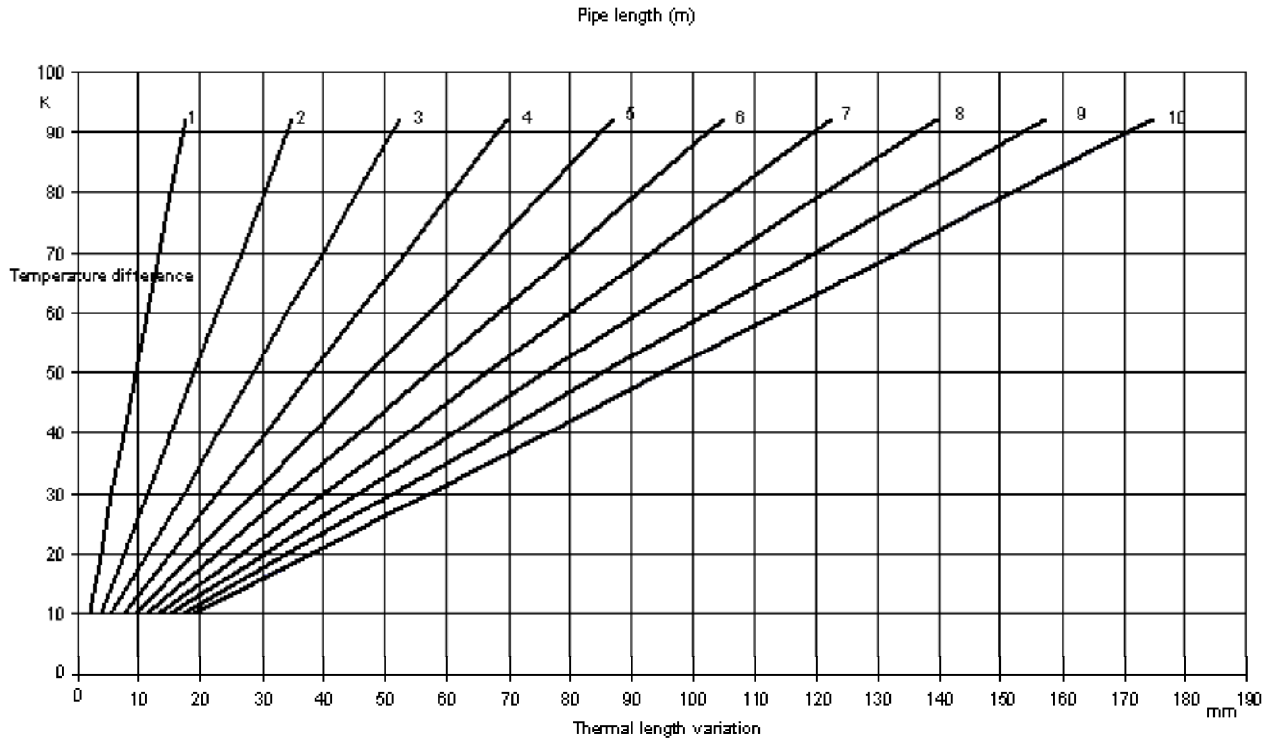


Figure A.4 — PE-RT

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