TECHNICAL SPECIFICATION

ISO/TS 7024

First edition
2005-10-01

Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Thermoplastics — Recommended practice for installation

Systèmes de canalisations en plastique pour l'évacuation des eaux-vannes et des eaux usées (à basse et à haute température) à l'intérieur des bâtiments — Thermoplastiques — Pratiques recommandées pour la pose

Reference number
ISO/TS 7024:2005(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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

ISO/TS 7024 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage)*.

This Technical Specification is a guidance document only, to be mainly used as a basis for preparing more specific manufacturer's instructions. It is associated with standards for piping systems covering a particular thermoplastic material for a specified application. There are a number of such standards.

This Technical Specification is consistent with general standards on functional requirements and on recommended practice for installation.

This first edition cancels and replaces Technical Report ISO/TR 7024:1985.

Introduction

This Technical Specification covers the recommended practice for installation of the thermoplastics piping systems for soil and waste discharge. The most important recommendations are expressed by the use of the imperative. These are strongly recommended.

Guidance for installation is presented, e.g. by the use of “may” or “is recommended”, for consideration as a matter of judgement in each case.

This Technical Specification refers to ISO standards in which buried application is not covered. Buried application is described, for information only, in Annex A.

Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Thermoplastics — Recommended practice for installation

1 Scope

This Technical Specification gives the recommended practice for installation of thermoplastics piping systems in the field of soil and waste discharge (low and high temperature) inside buildings (marked with "B").

This Technical Specification is applicable to thermoplastics pipes and fittings as specified in the associated standards ISO 3633 (PVC-U), ISO 7671 (PP), ISO 7682 (ABS), ISO 8770 (PE-HD), ISO 19220 (SAN + PVC) and ISO 7675 (PVC-C), their joints and to joints with components of other plastics and non-plastics materials intended to be used for the following purposes.

a) Soil and waste discharge pipework for the conveyance of domestic waste waters (low and high temperature).

NOTE 1 See Clause 4 for waste discharge temperature limits.

b) Ventilating pipework associated with a).

c) Rainwater pipework within the building structure (see Figure 1).

If specified in the relevant associated standard, this Technical Specification also covers soil and waste discharge pipework fixed externally on to the building (See Figure 1). It is not applicable to pipework that passes under the building without any connection from the discharge system.

NOTE 2 According to the associated standards, for external above-ground soil and waste discharge, additional requirements depending on the climate are to be agreed between the manufacturer and the user.

NOTE 3 According to the associated standards, components conforming to other standards on plastic piping systems may be used with pipes and fittings conforming to a given associated standard, if they conform to the requirements for joint dimensions and functional requirements of the given associated standard.

2 Normative references

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

ISO 3633, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U)*

ISO 7671, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Polypropylene (PP)*

ISO 7675, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Chlorinated poly(vinyl chloride) (PVC-C)*

ISO 7682, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Acrylonitrile/butadiene/styrene (ABS)*

ISO 8770, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — polyethylene (PE)*

ISO/TR 10358, *Plastics pipes and fittings — Combined chemical-resistance classification table*

ISO 19220, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Styrene copolymer blends (SAN + PVC)*

EN 12056-1, *Gravity drainage systems inside buildings — Part 1: General and performance requirements*

EN 12056-2, *Gravity drainage systems inside buildings — Part 2: Sanitary pipework, layout and calculation*

EN 12056-3, *Gravity drainage systems inside buildings — Part 3: Roof drainage, layout and calculation*

EN 12056-5, *Gravity drainage systems inside buildings — Part 5: Installation and testing, instructions for operation, maintenance and use*

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the following terms, definitions, symbols and abbreviations apply.

3.1 General terms

For the general terms, refer to EN 12056-1, EN 12056-2 or EN 12056-3, where applicable, and see Figure 1 (the figure is schematic only).

Local and/or national regulations may require separate drainpipe systems for foul and rainwater.

3.2 Terms and definitions

For the purposes of this document, the terms and definitions given in the relevant associated standard apply, together with the following.

3.2.1
associated standard
standard which specifies all requirements applicable to pipes, fittings and joints made of a particular material to be installed according to the recommendations of this Technical Specification

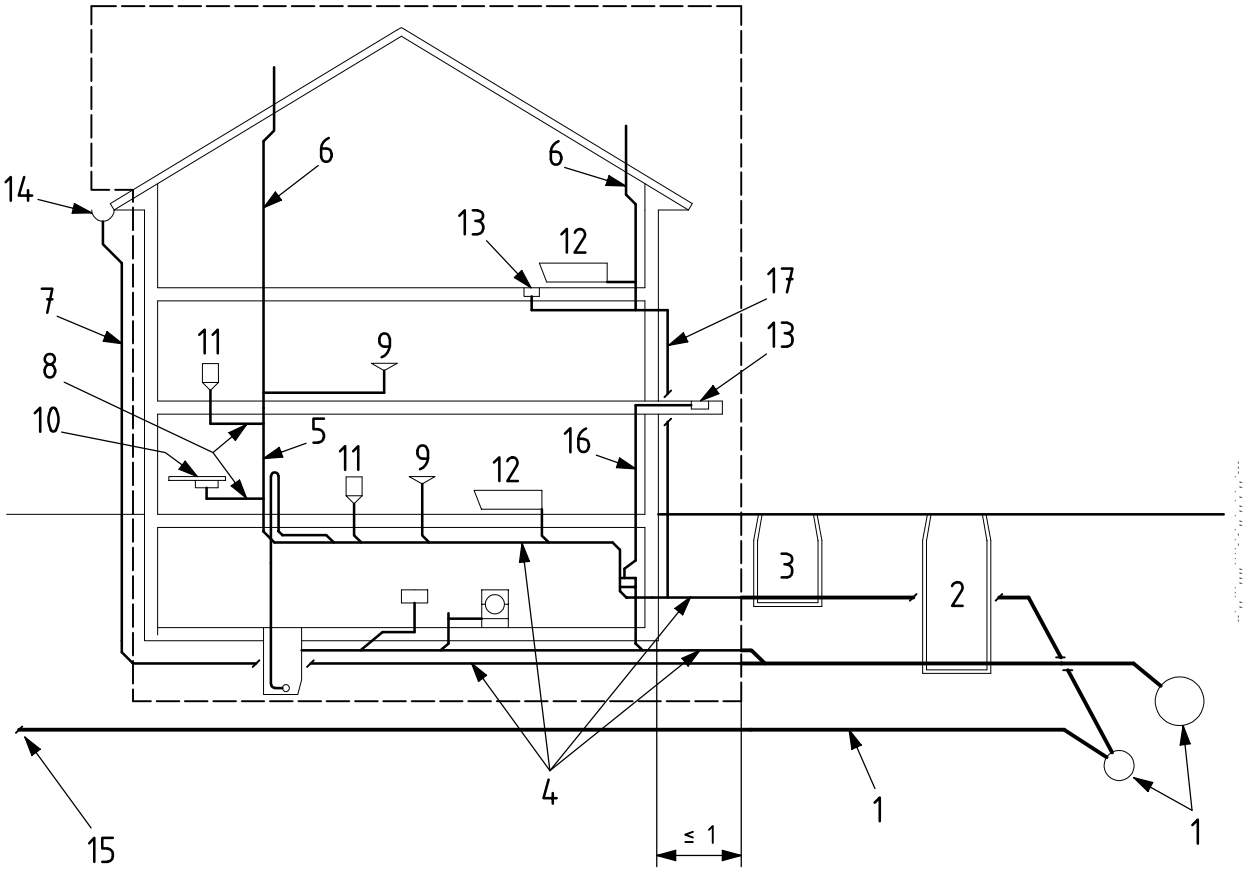
3.2.2
ring seal socket length
type S, type N or M or type L
length of a ring seal socket, which is designated as short (type S), normal or medium (type N or type M), or long (type L) in the relevant associated standards

NOTE In some cases, type N sockets are designated by type M (medium).

3.2.3
flexible leg
L_1 and L_2
free length between two fixed points either sides of a bend of a solvent cement system designated L_1 and L_2

3.2.4
expansion gap
E, E_1, E_2
distance left during installation between the bottom of a socket and the spigot of the inserted component, allowing expansion of the system

Dimensions in metres



Key

1	sewer	7	rainwater down pipe	13	floor gully/trap
2	manhole	8	branch discharge pipe	14	gutter
3	inspection chamber	9	wash basin	15	pipework from other buildings
4	drains	10	sink	16	internal rainwater down pipe
5	discharge stack	11	water closet	17	external discharge stack
6	stack vent	12	bath		

NOTE Keys 1, 2, 7 and 14 are not covered by this Technical Specification. Key 3 is covered if the distance to the building wall is smaller than or equal to 1 m.

Figure 1 — Terms for a soil and waste discharge system

3.3 Symbols

3.3.1 Symbols for installation

D_{max} recommended maximum distance between support centres in above-ground installation (see 6.2.4.2)

$L_{c,max}$ maximum recommended distance between anchored brackets in concreted-in installation (see 7.1.2.7)

L_F free length between fixed points in above-ground installation (see 6.2.3.1)

Y effective sealing length (see 6.2.3.2)

3.3.2 Symbols for junctions

NOTE The symbols of a basic nature for junctions are given in ISO 2553, ISO 14617-3 and ISO 14617-15.

3.3.2.1 Symbol for sockets for solvent cement jointing

The design symbol (square-shaped) given in Figure 2 signifies a rigid, non-removable connection of two pipes and/or fittings made by means of a solvent cement socket.

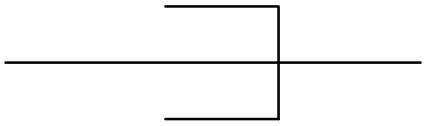


Figure 2 — Design symbol for solvent cement joint

3.3.2.2 Symbols for sockets for ring seal jointing

The design symbols (cup-shaped) given in Figure 3 signify a non-rigid, removable connection of two pipes and/or fittings made by means of a rubber seal in a type S, type N, type M or type L socket.

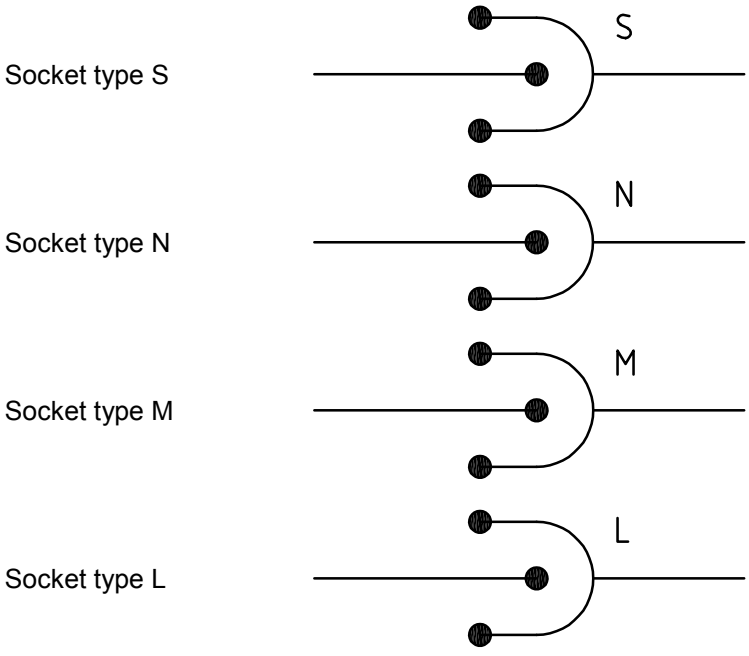
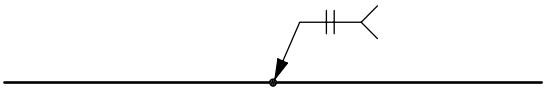


Figure 3 — Design symbols for ring seal joint

3.3.2.3 Symbol for butt-fusion joint

The design symbol given in Figure 4 signifies a rigid, non-removable connection of two pipes and/or fittings made after fusion by means of a heating plate.

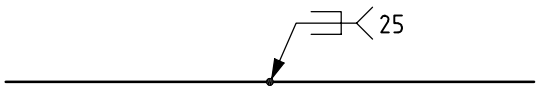


NOTE A number should be written between the two branches of the fork. It refers to the number of the welding process given in ISO 4063.

Figure 4 — Design symbol for butt-fusion joint

3.3.2.4 Symbol for electrofusion sleeve coupling

The design symbol given in Figure 5 signifies a rigid, non-removable connection of two pipes and/or fittings made by means of integral electrically powered fusion.



NOTE The number written between the two branches of the fork refers to the number of the welding process given in ISO 4063; in this case, the number is 25 for resistance butt welding.

Figure 5 — Design symbol for electrofusion sleeve coupling

3.3.2.5 Symbol for flange and backing ring joint

The design symbol given in Figure 6 signifies a rigid connection of two pipes and/or fittings made by means of bolts and nuts.

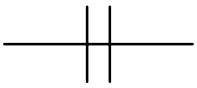


Figure 6 — Design symbol for flange and backing ring joint

3.3.2.6 Symbol for compression joint

The design symbol given in Figure 7 signifies a rigid connection of two pipes and/or fittings made by means of thread, rubber ring and screw.

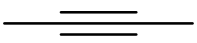


Figure 7 — Design symbol for compression joint

3.3.3 Symbols for brackets

The design symbols for brackets given in Figure 8 signify an anchor bracket or a guide bracket, respectively.

Anchor bracket (for fixed point)

Guide bracket (for free movement of pipe)

Figure 8 — Design symbols for brackets

3.4 Abbreviations

For the thermoplastics materials, the following abbreviations apply:

ABS	Acrylonitrile-butadiene-styrene
PE	Polyethylene
PP	Polypropylene
PP-H	Polypropylene homopolymer
PVC-C	Chlorinated poly(vinyl chloride)
PVC-U	Unplasticized poly(vinyl chloride)
SAN + PVC	Styrene copolymer blend

4 Design limits of the system

Discharge systems of thermoplastics are primarily designed for intermittent waste discharge of domestic origin, including from washing and dishwashing machines. Discharge systems of PE, PP, ABS and PVC-C are also designed for discharges from public laundries, launderettes or other installations where long periods of high temperature discharge occur. For the design of systems for other discharges than domestic waste, see Clause 13 and manufacturer's recommendations.

Apply the requirements for the calculation of the flow capacity of plumbing installations, as specified in relevant European Standards, subject to any applicable national and/or local regulations.

NOTE Among European Standards, EN 12056-2 and EN 12056-3 are primarily applicable for flow capacity calculation.

5 Storage, transport and handling

5.1 General

Attention is drawn to any relevant local and/or national safety regulations.

Avoid damage to the surfaces and ends of pipe and fittings.

Loading and handling of components made of PP-homopolymers (marked PP-H), for which performance impact testing is carried out at 23 °C (see ISO 7671) is not recommended at ambient temperatures lower than + 5 °C. For components made of other materials, follow the manufacturer's instructions regarding installation at low temperature.

Support pipes with sockets and with pre-assembled fittings, in such a way that they are protected from damage and that the ends are free from loading, e.g. by alternating the socket and non-socket ends in given or adjacent layers.

5.2 Transport

Load pipes and fittings in such a way that no damage occurs during transport (see Figure 9).

Stack the pipes at a maximum stacking height of 1,5 m, unless otherwise specified in the manufacturer’s instructions, e.g. when transporting caged bundles.

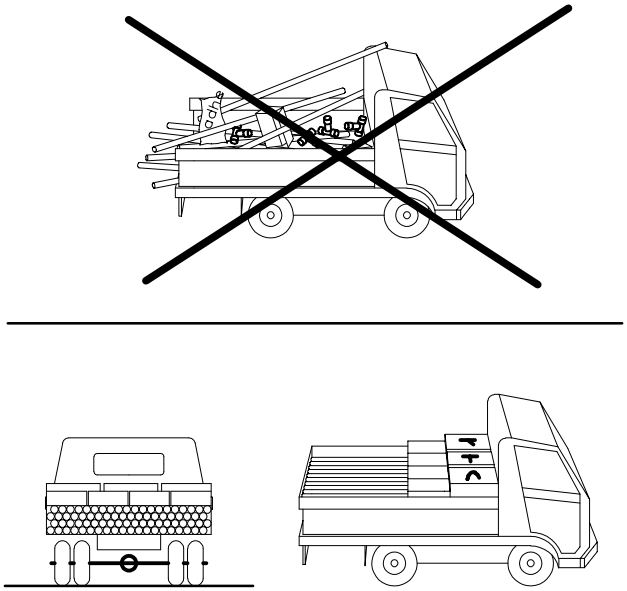


Figure 9 — Loading for transport

5.3 Storage

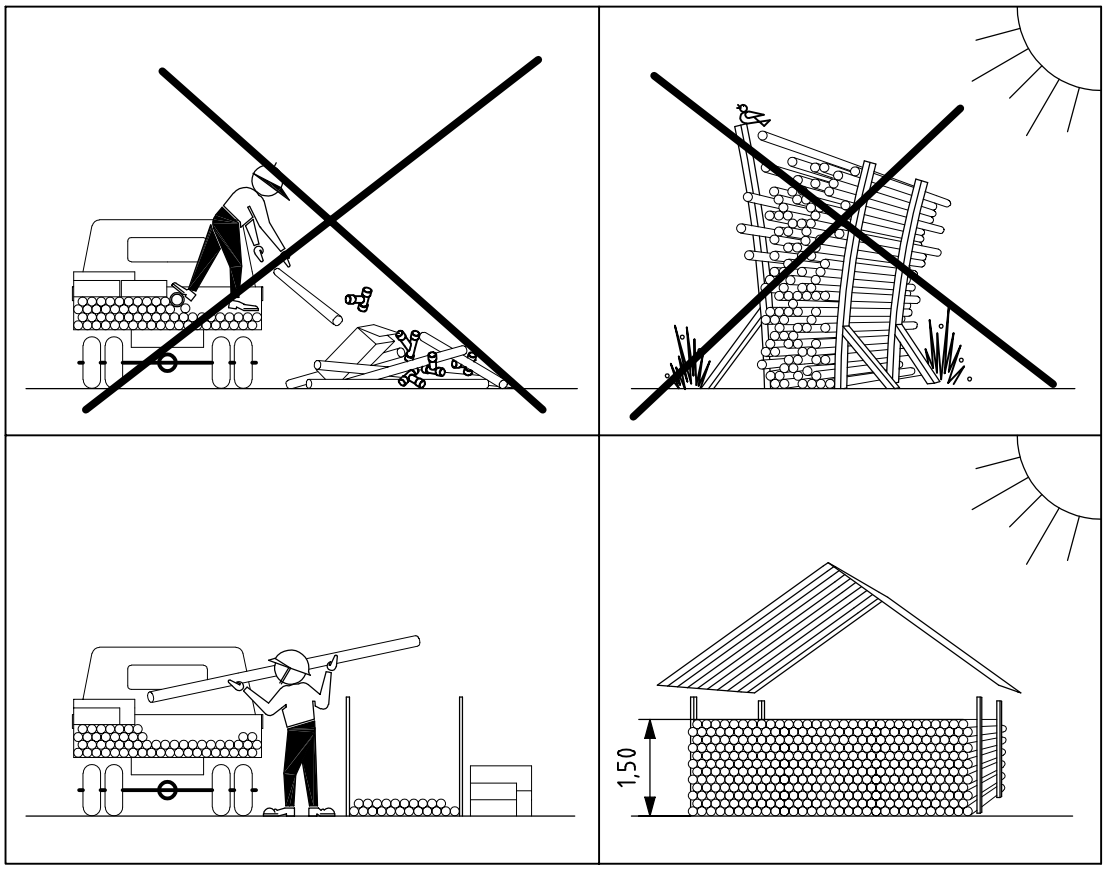
Do not carelessly unload pipes and fittings (see Figure 10).

Provide a storage area free from substances harmful to the relevant thermoplastics (see Clause 13), comprising smooth and level ground or a flat timber base to avoid the risk of bent or damaged pipes. Where PE pipes are supplied in coils, store them either stacked flat one on top of the other or (chiefly for sizes greater than DN 90) vertically in purpose-built racks or cradles.

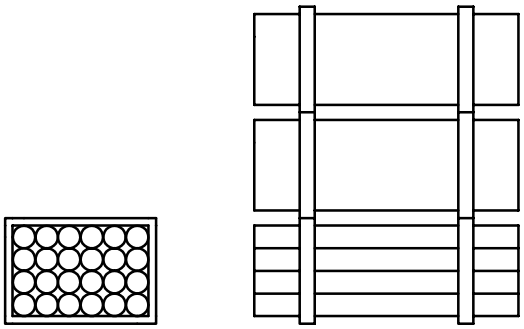
Avoid storage in direct sunlight over a period longer than one year. Where long-term storage and/or strong sunlight is expected, screening from the direct rays of the sun is recommended, except for black-coloured PE components.

Recommended maximum stacking height is 1,5 m [see Figure 10, a)], unless otherwise stated in the manufacturer's instructions, e.g. when stacking caged bundles [see Figure 10, b)].

Dimensions in metres



a)



b)

Figure 10 — Storage on site

5.4 Handling on site

To avoid risk of damage, carry (i.e. do not drag) pipes and fittings to the work place (see Figure 11).

NOTE Careless handling might lead to damaged materials and faulty installations.

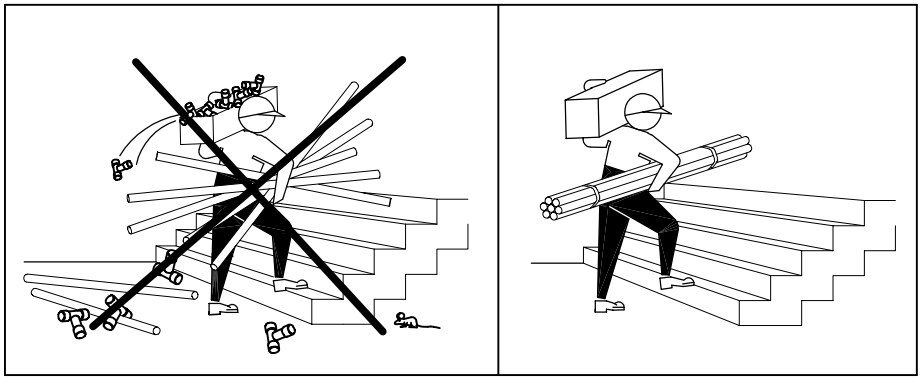


Figure 11 — Handling on site

6 Installation

6.1 General recommendations for installation

6.1.1 Cutting of pipe

Cut pipe square to length with a fine-tooth saw, or special purpose equipment (see Figure 12). Remove all burrs at the inside and outside edges of the cut surfaces.

Prior to fusion jointing, if necessary, e.g. if the pipe ends were slightly tapered during their production, cut 10 mm to 15 mm from the factory-made pipes.

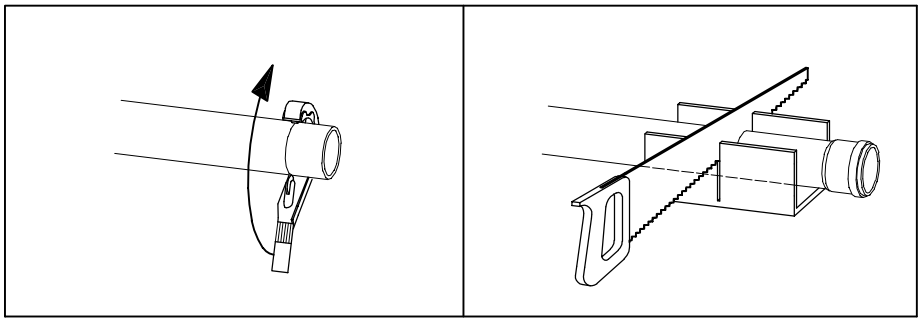


Figure 12 — Cutting of pipe

To obtain a square guide line, a piece of paper may be wrapped around the pipe and the edges brought together (see Figure 13).

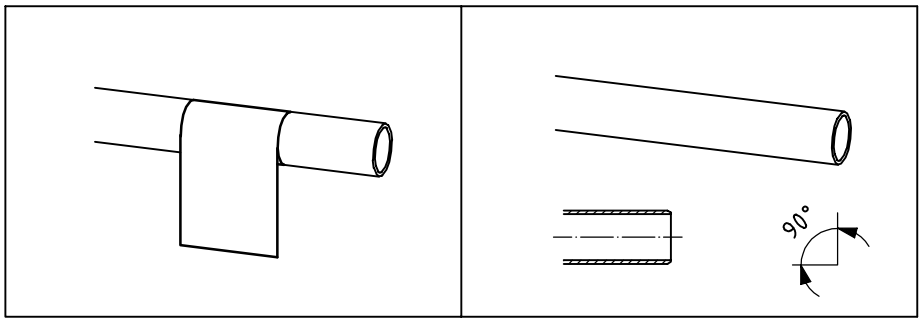


Figure 13 — Optional method for square cutting

6.1.2 Chamfering of pipe

6.1.2.1 Do not chamfer components made of PE or PP, which are designed for butt-fusion jointing (see 6.3.3.2).

6.1.2.2 For components to be jointed by other techniques, the pipes may be chamfered, if necessary, according to the manufacturer's instructions. Chamfer the pipes with a medium file or special purpose equipment. Provide approximately matching chamfers on the pipe and the socket; with an angle, α, of between 15° and 45°. Keep a remaining wall thickness of at least $e/3$ (see Figure 14).

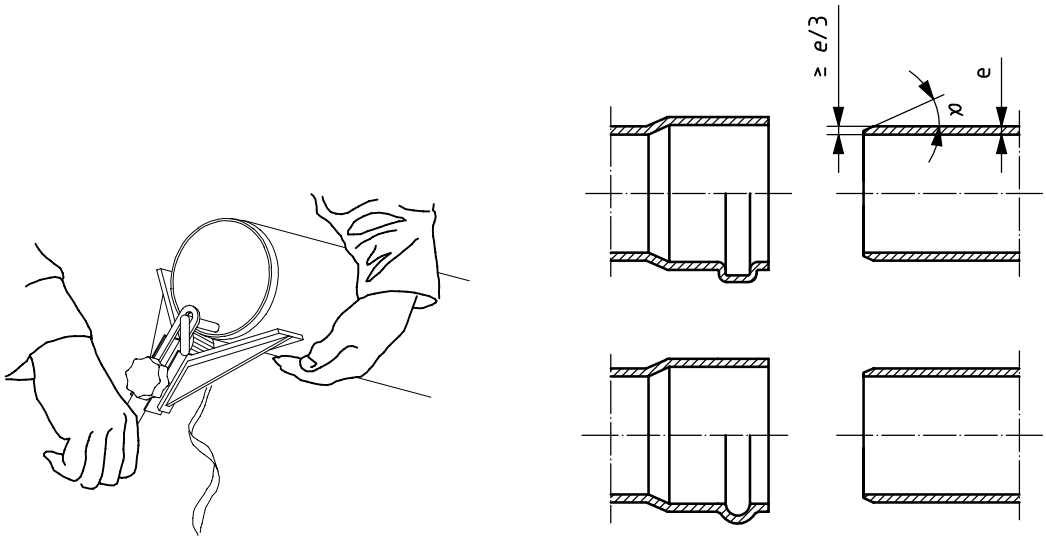


Figure 14 — Chamfering of pipe end

6.1.3 Fabricating

Do not fabricate on-site thermoplastics components by any other means (fusion, socket forming, bending etc.) than those described in 6.1.1 and 6.1.2.

6.2 Recommendations for above-ground installation

6.2.1 General

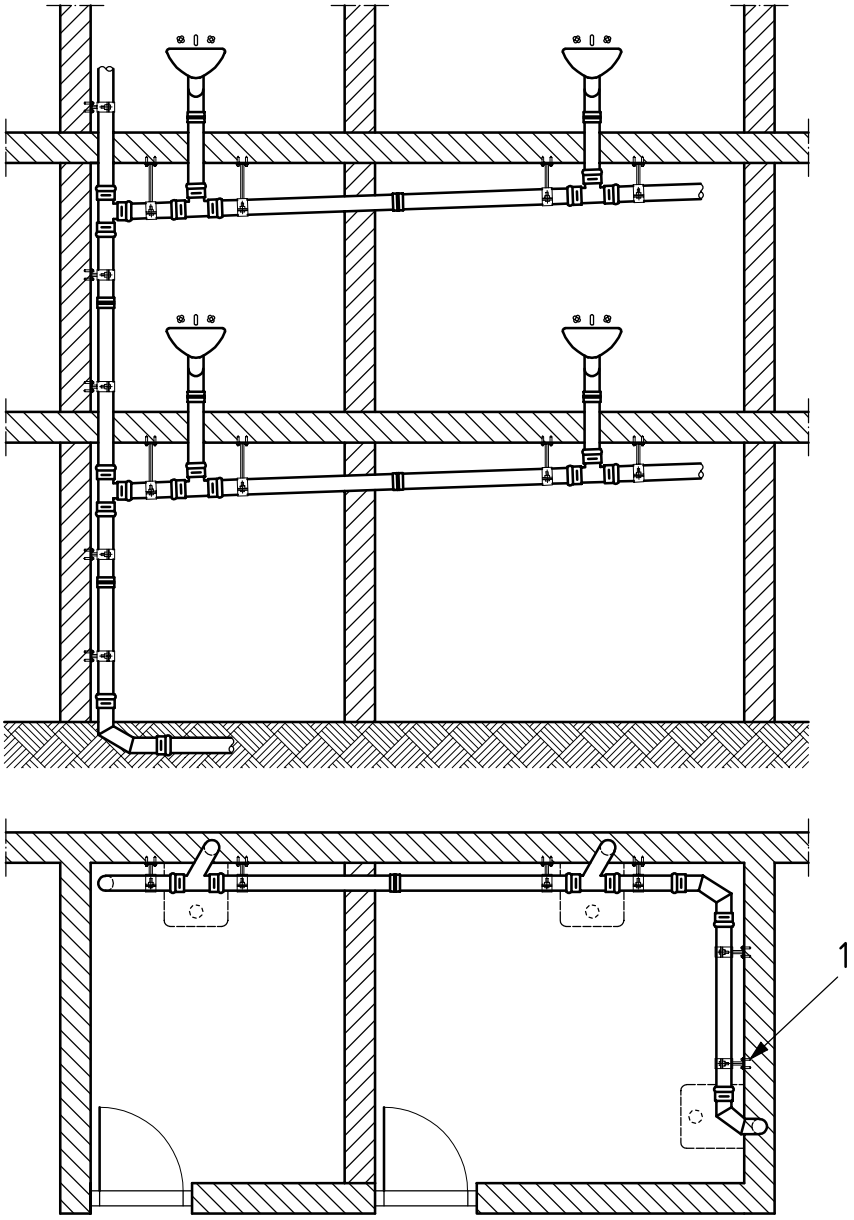
When thermoplastics are subject to changes in temperature, thermal movement or forces occur. The actual forces or movement are a function of variation in temperature and cannot be calculated directly from the coefficient of thermal expansion formula and the water temperature. This is because hot discharges are intermittent, resulting in a difference in temperature between the internal and the external surfaces of the pipe due to the low coefficient of conductivity through the wall.

6.2.2 Installation of PE and PP pipeworks with non-removable rigid joints

PE and PP pipeworks with non-removable rigid joints (e.g. PE or PP butt-fused joints or joints with electrofusion sleeve couplings, see 6.3.3 or 6.3.4 respectively) may be installed, preventing any thermal movement. In this case, the pipework components and the supports are intended to withstand the forces that occur due to changes in temperature and result in stress in the pipework.

Fix all pipes rigidly to the building structure and fasten each branch to the building structure by anchor brackets (e.g. with an arrangement of fixed points as shown in Figure 15). This Figure is given as an example and does not apply for support centres (see Table 3).

For fixed point design, refer to the note in 6.2.4.1, and carefully follow the manufacturer's instructions.



Key

1 anchor bracket (also all other brackets)

Figure 15 — Typical arrangement of fixed points for PE and PP pipework with rigid joints

6.2.3 Installation with joint design taking account of thermal movement

6.2.3.1 Expansion gap and length between fixed points

In all the other cases which are not covered by 6.2.2, the thermal movement is not prevented and it is relieved by the joint design.

The effective maximum temperature has been used for designing the socket depth and the maximum recommended free length of pipe permitted by each joint, when the installation is operated at temperatures ranging from 0 °C to 30 °C.

The coefficients of thermal expansion for thermoplastics are given in Table 1.

Table 1 — Coefficients of thermal expansion

Material	Coefficient of thermal expansion $°C^{-1}$
ABS	8×10^{-5} to 9×10^{-5}
PE	17×10^{-5} to 20×10^{-5} [a]
PP	11×10^{-5} to 18×10^{-5}
PVC-C	6×10^{-5} to 8×10^{-5}
PVC-U	6×10^{-5} to 8×10^{-5}
PVC-U with structured-wall pipes	6×10^{-5} to 8×10^{-5}
SAN + PVC	6×10^{-5} to 8×10^{-5}

[a] This is the conventional range of coefficients; other values may be used, with reference to manufacturer's instructions.

In above-ground installations, such systems require fixed points (secured with anchor brackets or built into the building structure) and intermediate supports provided by guide brackets. Branches are always considered as fixed points.

Hence, when the length between fixed points, L_F, in above-ground horizontal installation exceeds 1 m, use non-rigid joints for expansion: a relevant ring seal socket (type S, type N or M or type L), as specified in the relevant associated standard, may be suitable. Therefore, conform to Table 2 for the maximum recommended lengths, L_F, permitted by each type of expansion socket. During installation, keep also an expansion gap, E, according to Table 2, at each socket bottom.

NOTE For PE systems, the ring seal sockets type L have been specially designed to allow thermal movement; refer to ISO 8283-2 for the selection of the appropriate design.

Table 2 — Recommended length between fixed points, and recommended expansion gap at each socket, for above-ground horizontal installation

Material	Type S socket		Type N or M socket		Type L socket	
	L_F [a] m	E mm	L_F [a] m	E mm	L_F [a] m	E mm
ABS	$1 \leqslant L_F \leqslant 4$ [b]	$\geqslant 10$	$1 \leqslant L_F \leqslant 4$	$\geqslant 10$	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$
PE	(no type S for PE)		$1 \leqslant L_F \leqslant 4$ [b]	$\geqslant 20$	$1 \leqslant L_F \leqslant 8$	$\geqslant 50$
PP	(no type S for PP)		$1 \leqslant L_F \leqslant 4$	$\geqslant 15$ [c]	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$
PVC-C	$1 \leqslant L_F \leqslant 4$ [b]	$\geqslant 10$	$1 \leqslant L_F \leqslant 4$	$\geqslant 10$	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$
PVC-U	$1 \leqslant L_F \leqslant 4$ [b]	$\geqslant 10$	$1 \leqslant L_F \leqslant 4$	$\geqslant 10$	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$
PVC-U with structured-wall pipes	$1 \leqslant L_F \leqslant 4$ [b]	$\geqslant 10$	$1 \leqslant L_F \leqslant 4$	$\geqslant 10$	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$
SAN + PVC	(no type S for SAN + PVC)		$1 \leqslant L_F \leqslant 4$	$\geqslant 10$	$1 \leqslant L_F \leqslant 8$	$\geqslant 20$

NOTE These recommendations apply for ambient installation temperatures between 0 °C and + 30 °C.

[a] Where $L_F \leqslant 1$ m, then E is not specified.

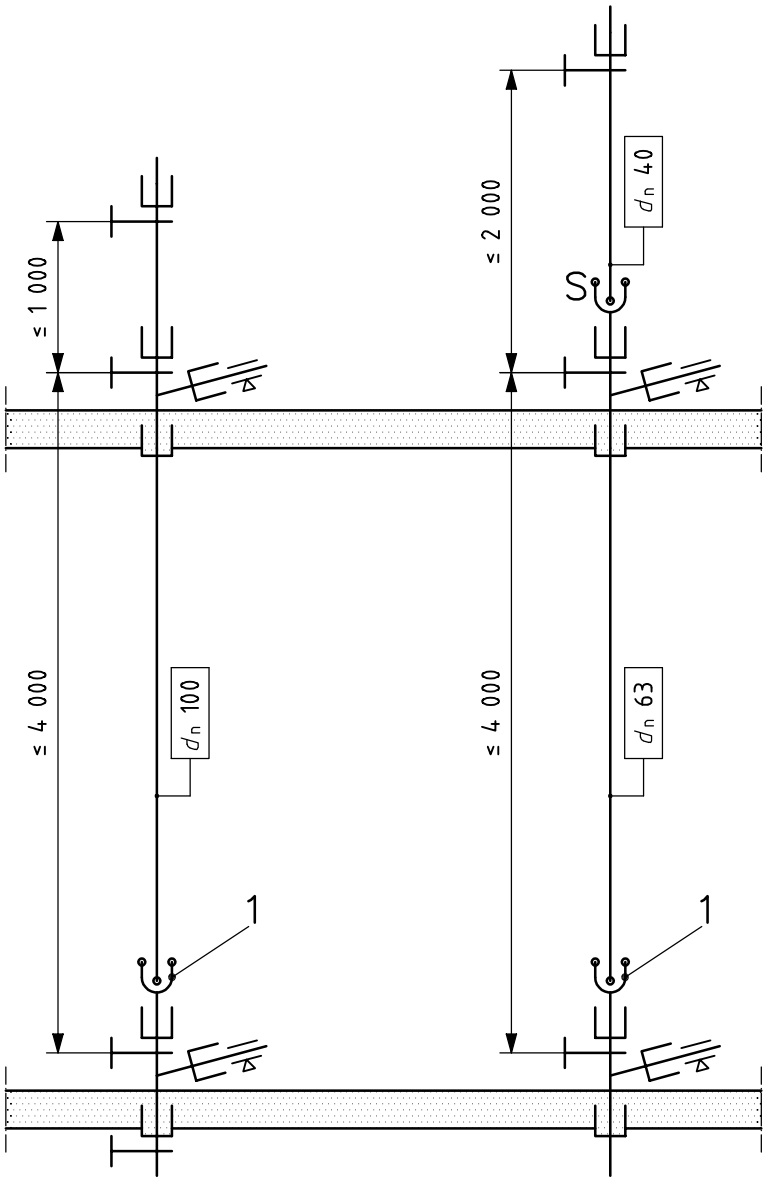
[b] For nominal outside diameter, $d_n \leqslant 50$ mm, reduce L_F to $\leqslant 2$ m, and prefer type N or M sockets.

[c] Reduce E to $\geqslant 10$ mm where $L_F \leqslant 2$ m.

For expansion of soil and waste vertical pipes, install a ring seal joint at least at each storey height. Typical above-ground installations with solvent-cement and ring seal joints are given in Figures 16 and 17, respectively. Both figures are given as examples and do not apply for support centres.

For expansion of rainwater vertical pipes, install a ring seal joint at least every second storey height.

Dimensions in millimetres

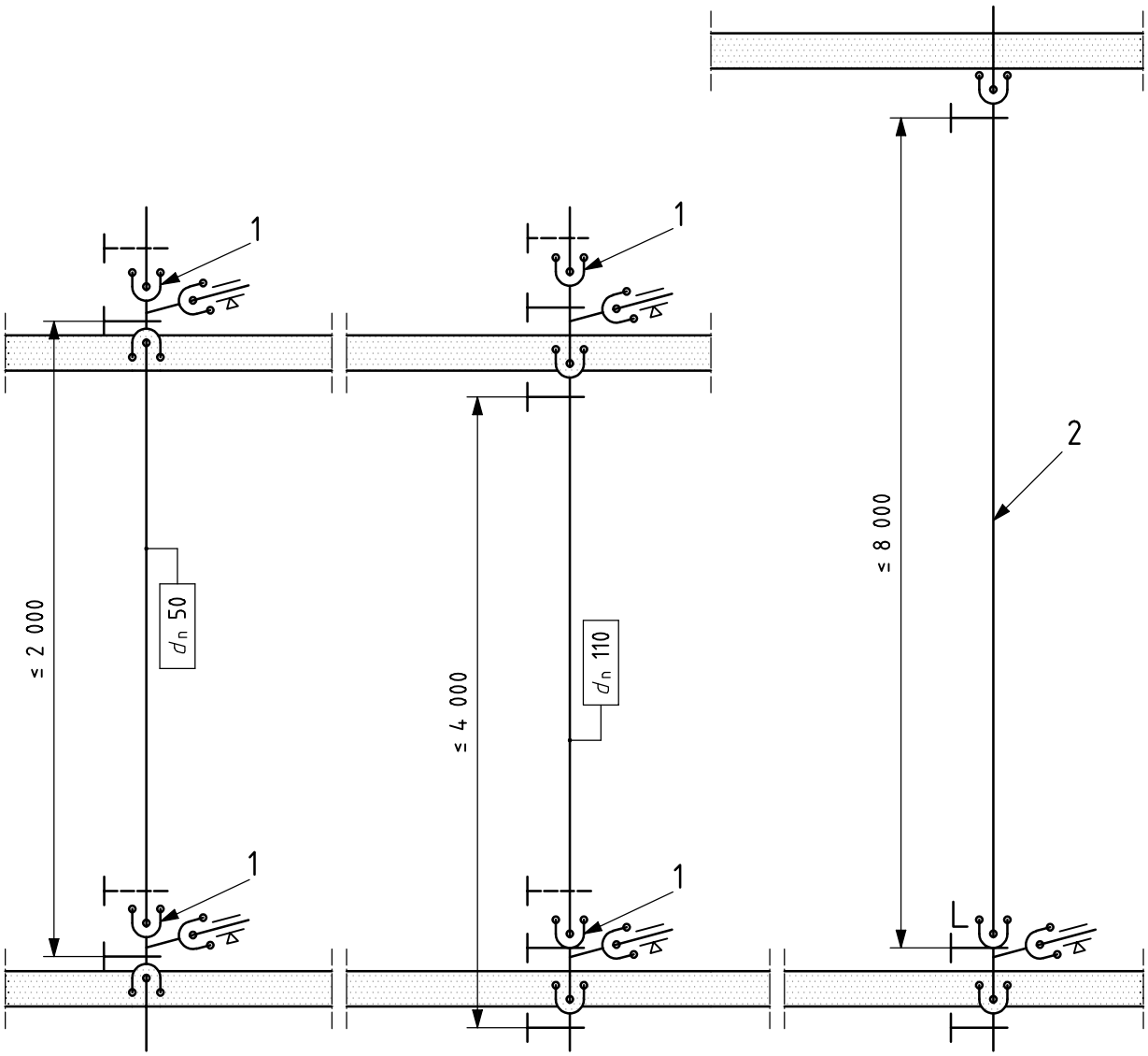


Key

1 socket type N or M

Figure 16 — Example of installation with solvent cement joints and expansion sockets

Dimensions in millimetres



Key

1 socket type N or M

2 pipe of any diameter

Figure 17 — Example of installation with ring seal joints

6.2.3.2 Effective sealing length

When jointing spigots of pipes or fittings into ring seal sockets, including into expansion sockets combined with other jointing techniques, e.g. fusion or solvent-cement joints, take care to ensure that the cylindrical part of the spigot is sufficiently inserted in the seal in the socket. The recommended minimum effective sealing length, Y (see Figure 18), for such joint is 10 mm for $d_n \leqslant 50$ mm and 0,2 d_n for $d_n > 50$ mm.

Figure 18 — Effective sealing length

6.2.4 Supports

6.2.4.1 Bearing capacity, fit and fixing of brackets

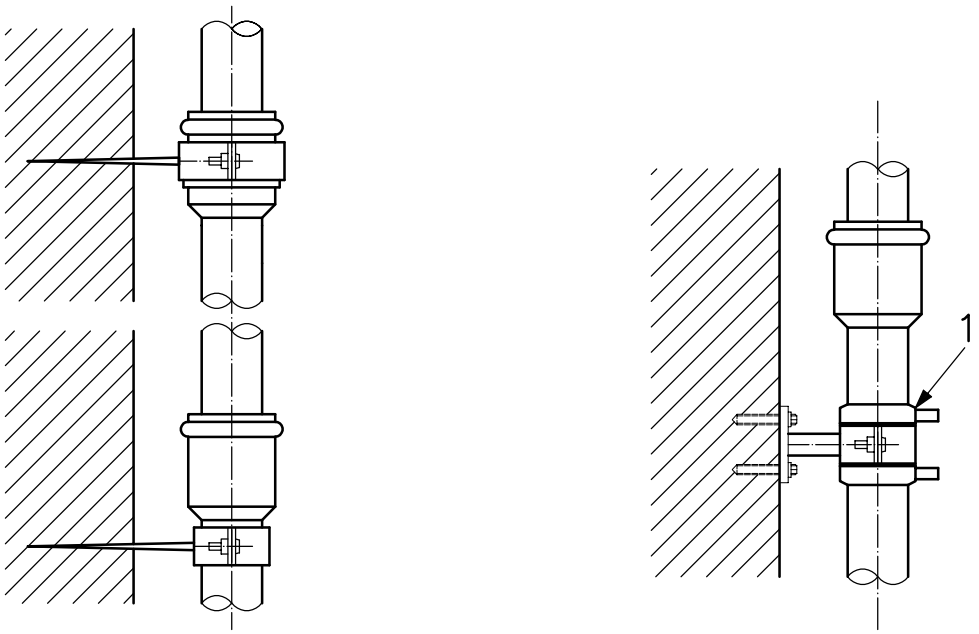
Brackets are made of metals or plastics.

Where applicable, check the brackets for marking and/or associated information to confirm that the bracket is intended to carry the size and weight of the system components to be supported.

For brackets to be used as fixed points [see Figure 19 a)], ensure that the bracket can grip the pipe or fitting firmly but not clamp it hard, taking account of the thickness of any coatings and/or sleeves involved.

NOTE For PE systems, if the ring seal socket type L has no special anchoring device such as factory-made collar, the construction of anchor bracket may be made using an electrofusion tape [see Figure 19 b)].

For brackets to be used as guide brackets (see Figure 20), ensure that the guide is smooth and allows the pipe to move linearly, taking account of the thickness of any coating and/or sleeves involved. If any sleeves are to be used, locate them in position.

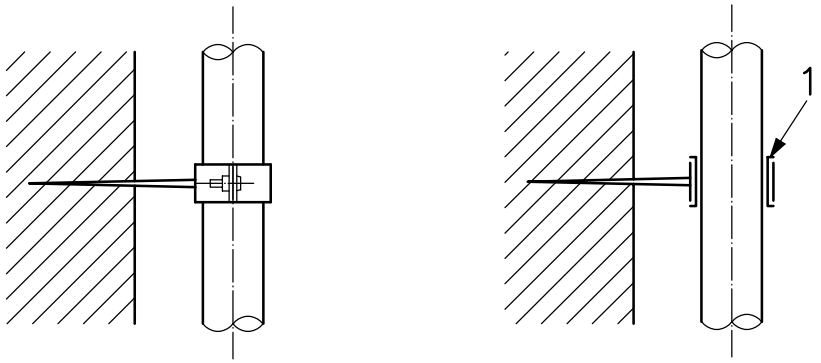


a) **b)**

Key

1 electrofusion tape for fixed point constructions

Figure 19 — Typical anchor brackets



Key

1 sleeve of soft material

Figure 20 — Typical guide brackets

6.2.4.2 Distance between support centres

For simple installations, unless otherwise specified in the manufacturer's instructions, do not exceed the recommended value for D_{max} given in Table 3 as the distance between two following support centres, either fixed or guide centres.

When the design of brackets does not allow to sustain the distances of Table 3, then use shorter distances according to the manufacturer's instructions.

NOTE Continuous support may be used for horizontal pipes.

Table 3 — Recommended maximum distance, D_{max}, between support centres

Nominal outside diameter	Distance between support centres	
	Horizontal pipework	Vertical pipework
d_n mm	D_{max} m	D_{max} m
32	0,5	1,2
40	0,5	1,2
50	0,5	1,5
63	0,8	1,5
75	0,8	2,0
80	0,8	2,0
82	0,8	2,0
90	0,9	2,0
100	1,0	2,0
110	1,1	2,0
125	1,25	2,0
140	1,4	2,0
160	1,6	2,0
180	1,7	2,0
200	1,7	2,0
250	2,0	3,0
315	3,0	3,0

For more demanding applications, see manufacturer's instructions.

Attention is drawn to specific requirements that may be needed, for instance, for solvent cement jointed systems presenting a bend. In such a case, a flexible leg may be installed (see Figure 21) in which the total length $L_1 + L_2$ does not exceed the recommended value D_{max} of Table 2: $L_1 + L_2 \leqslant D_{max}$. It is recommended for each length L_1 or L_2 not to exceed the value given in Table 4.

Table 4 — Recommended maximum distance between support centres for bends of solvent cement jointed pipework systems

Nominal outside diameter d_n mm	Distance between support centres and bend L_1 or L_2 mm
$\leqslant$ 40	$\leqslant$ 200
$>$ 40 and $\leqslant$ 50	$\leqslant$ 250
$>$ 50 and $\leqslant$ 75	$\leqslant$ 375
$>$ 75 and $\leqslant$ 110	$\leqslant$ 550
$>$ 110 and $\leqslant$ 125	$\leqslant$ 625
$>$ 125 and $\leqslant$ 160	$\leqslant$ 800

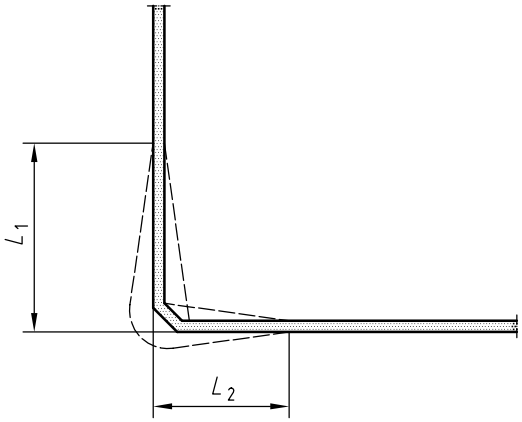


Figure 21 — Flexible leg

6.2.4.3 Installation of brackets

6.2.4.3.1 General

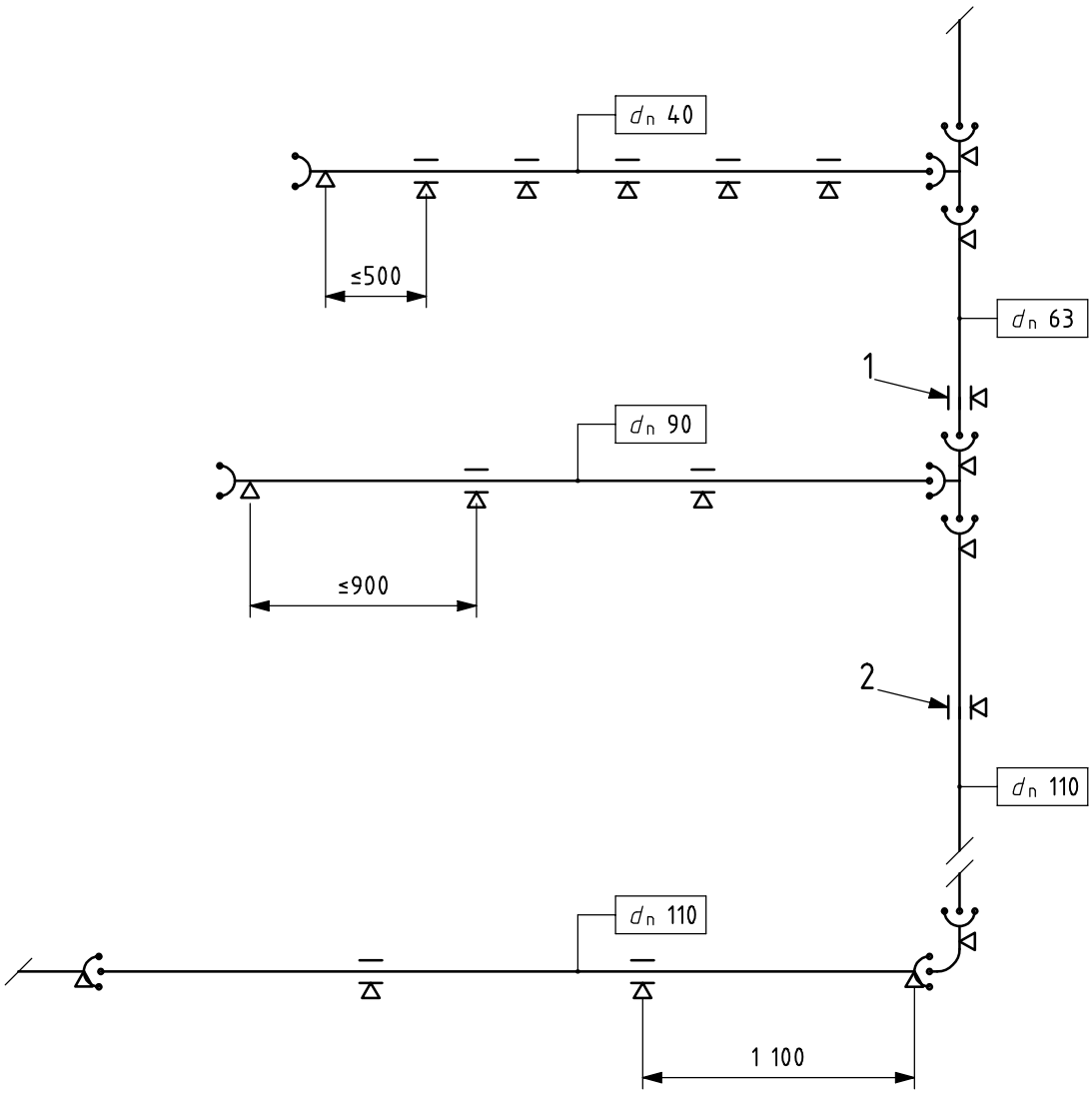
Make fixed points at the pipe sockets or at the sockets of fittings (see Figures 22 and 23).

NOTE For PE systems an electrofusion tape can be used, see Figure 24 as an example. If no electrofusion tape is available, two electrofusion couplings can be used, instead.

Install for each pipe only one anchor bracket for a fixed point.

Install guide brackets in such a way that the distance between the centres of the brackets (support centres) never exceeds the maximum recommended distance, D_{max}, given in Table 3.

Dimensions in millimetres

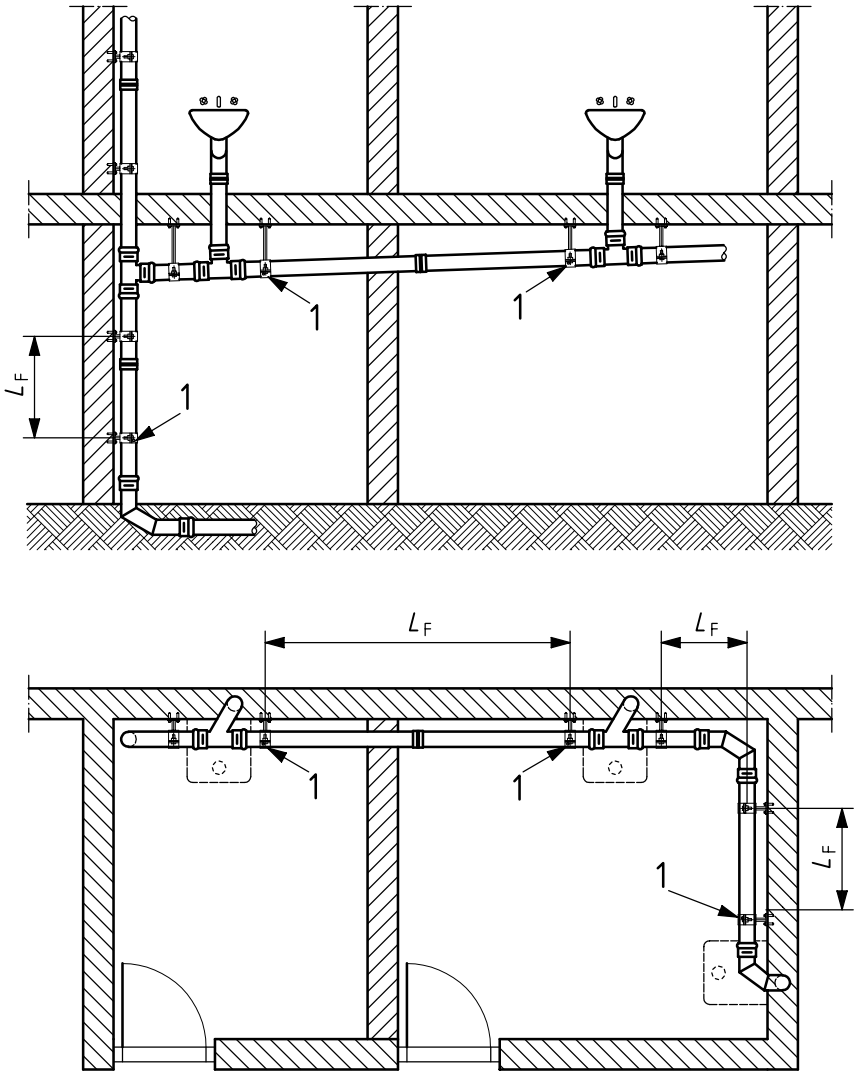


Key

1 guide bracket for pipe length ⩾ 1,5 m

2 wide guide bracket for pipe length ⩾ 2 m

Figure 22 — Typical above-ground installation with d_n of 40 mm, 63 mm, 90 mm and 110 mm pipes and fittings

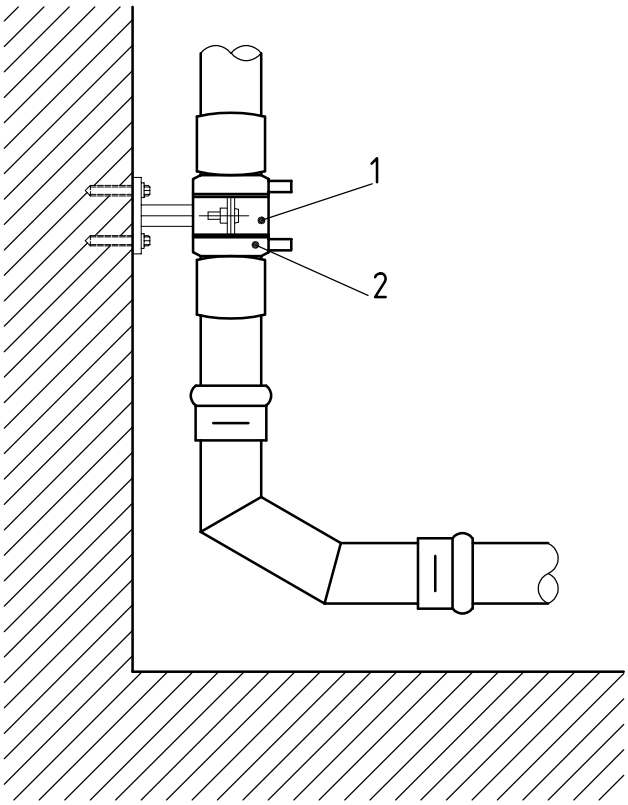


Key

L_F recommended length between fixed points, see Table 2

1 ring seal socket type L or type N or type M, according to L_F value (see Table 2)

Figure 23 — Typical general sketch for above-ground installation



Key

1 anchor bracket
2 electrofusion tape

Figure 24 — Fixing with an electrofusion tape

6.2.4.3.2 Supports for jointing with double sockets

Always use an anchor bracket to fix the double socket.

For horizontal pipes, arrange the sum of the expansion gaps, $E_1 + E_2$ (see Figure 25), to be equal to, or greater than, the value of E, as recommended in 6.2.3.1.

Keep the distance between support centres smaller than or equal to D_{max} as recommended in Table 3.

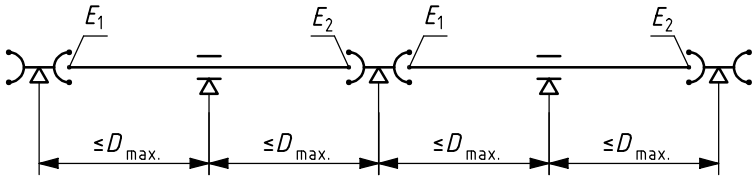


Figure 25 — Expansion gaps with double sockets

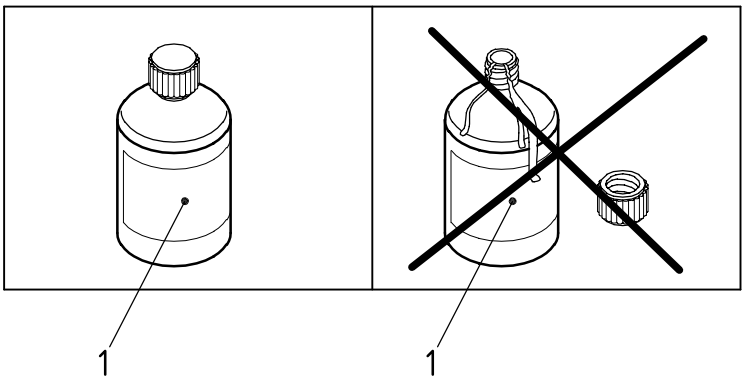
6.3 Jointing procedure

6.3.1 Jointing with solvent cement joints

This technique is applicable to above-ground or below-ground installations with ABS, PVC-C, PVC-U and SAN + PVC systems and provides rigidly jointed pipework.

Solvent cementing is recommended to be made only at ambient temperatures ranging between − 5 °C and + 30 °C, unless otherwise specified by the adhesive manufacturer.

Cut and chamfer pipe as required. Use only those solvent adhesives that are specified by the manufacturer and in accordance with the relevant associated system standard. To avoid evaporation, use small cans or tubes; reseal immediately after use (see Figure 26). Attention is drawn to any relevant local and/or national health and safety regulations; seek manufacturer's advice.

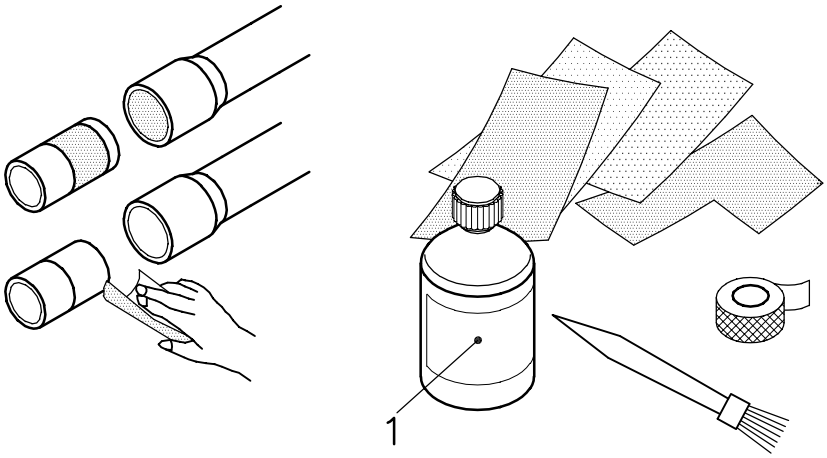


Key

1 can with solvent adhesive

Figure 26 — Sealing the can

If not specified by the manufacturer's instructions, the pipes may be prepared by abrading the mating surfaces with abrasive paper, then cleaning the surfaces with a cleaning fluid (see Figure 27).



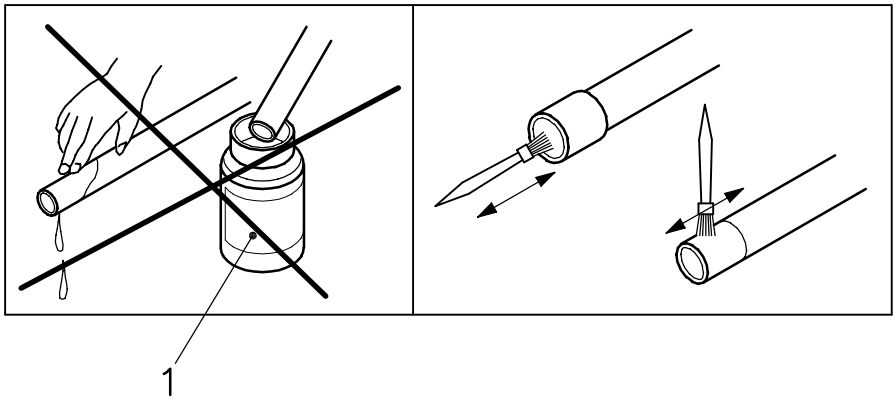
Key

1 can with cleaning fluid

Figure 27 — Abrading and cleaning the pipe end

Do not thin or dilute solvent adhesives, except for ABS systems where solvent adhesive may be thinned with thinners recommended by the adhesive manufacturer only.

Apply an even coat of solvent adhesive to the socket and the pipe. It is preferable to use axial strokes of the brush so as to avoid a build-up of solvent adhesive on the pipe and in the socket, or the formation of large bubbles in the film layer (see Figure 28).



Key

1 can with solvent adhesive

Figure 28 — Brushing with axial strokes

Immediately after applying adhesive, insert the pipe in the socket to its full depth without excessive twisting and ensure correct alignment (see Figure 29). Remove excess adhesive. Leave joint undisturbed for the time recommended by the pipe manufacturer.

It is recommended to clean the brushes immediately after use with a suitable thinner or cleaning fluid, and to ensure that they are dry before being used again.

NOTE Attention is drawn to 8.2 for the solvent cement jointing of components made of different plastics.

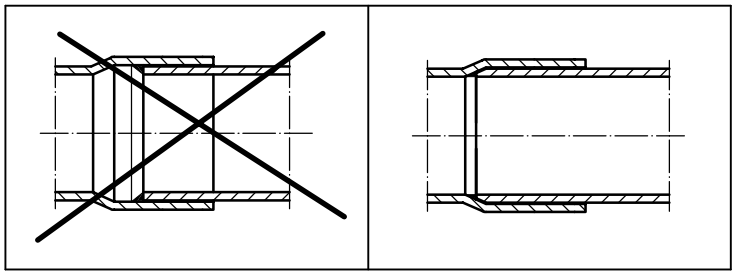


Figure 29 — Full insertion of the spigot end

6.3.2 Jointing with ring seal joints

This technique is applicable to above-ground or below-ground installations of components made of all the materials covered by the associated system standards and provides non-rigidly jointed pipework.

When the sealing ring is not placed in the socket by the manufacturer, use only the sealing rings specified by the manufacturer. Clean the groove of the ring seal socket, wipe the sealing ring clean and dry. Insert the ring in the groove, ensuring that the ring is not distorted or misaligned.

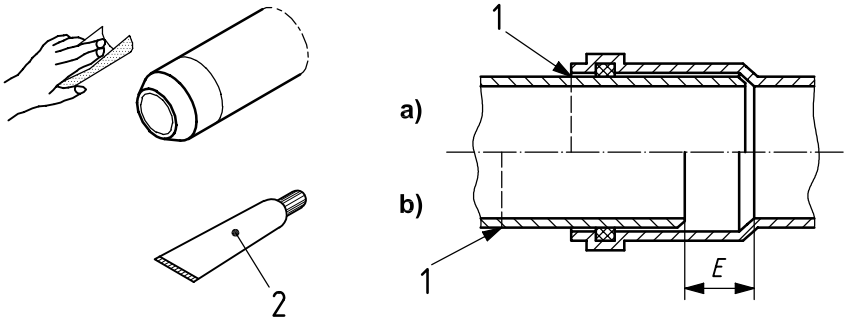
Cut and chamfer the pipe as required. Clean the end of the pipe. Apply the lubricant to the spigot end and insert the spigot into the socket, keeping an expansion gap, E, equal to the recommended value given in Table 2. Use only the lubricant recommended by the manufacturer.

Inserting the spigot (ensuring that the expansion gap left is the relevant length) can be done by using one of the following techniques:

— inserting to the full depth, marking the pipe around the mouth of the socket [see Figure 30 a)] and then withdrawing it by the relevant amount [see Figure 30 b)];

— marking the spigot end to the relevant depth, as specified by the manufacturer, then inserting the spigot to the mark (see Figure 31).

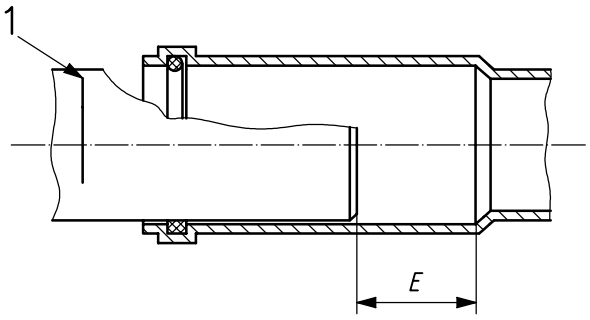
Expansion units are ready for use according to the second technique, as shown in Figure 31, because these are premarked and preassembled.



Key

1 insertion mark
2 lubricant

Figure 30 — Expansion gap with a ring seal joint

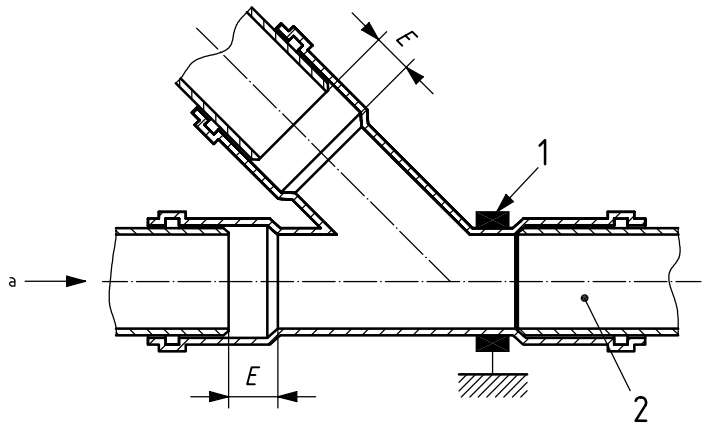


Key

1 insertion mark

Figure 31 — Expansion gap with an expansion unit

In horizontal pipework, double socketed fittings may also be installed with an expansion gap on the upstream end of the fitting. In this case, anchor the fitting with a bracket (see Figure 32), and anchor the pipe upstream with a bracket approximately in the middle of the pipe (see 6.2.4.3.2).



Key

1 anchor bracket

2 plain end pipe inserted to the bottom of fitting socket

a Direction of flow.

Figure 32 — Normal positioning of expansion gaps in double socketed fittings

6.3.3 Jointing with butt fusion

6.3.3.1 General

The butt fusion technique is applicable to above-ground or below-ground installation with PP and PE components and provides rigidly jointed pipework. The pipe or fitting ends to be fused are heated by means of a heating element, then pressed together using a given pressure.

NOTE 1 The fused joints have physical and mechanical properties similar to those of the pipe material, since an interlacing of the material molecule chains occurs.

For components made of PP, joint by butt fusion, only those that are made of materials with melt mass-flow rate (MFR) in the same class or in adjacent classes, and that are MFR class marked on the component itself (e.g. MFR B).

NOTE 2 Classes of MFR (230/2,16) for PP materials are as follows:

Class A: $0 < [\text{MFR}] \leqslant 0{,}3$ g/10 min;

Class B: $0{,}3 < [\text{MFR}] \leqslant 0{,}6$ g/10 min;

Class C: $0{,}6 < [\text{MFR}] \leqslant 0{,}9$ g/10 min;

Class D: $0{,}9 < [\text{MFR}] \leqslant 1{,}5$ g/10 min.

In all cases, follow the manufacturer's instructions to ensure a leak- and trouble-free joint.

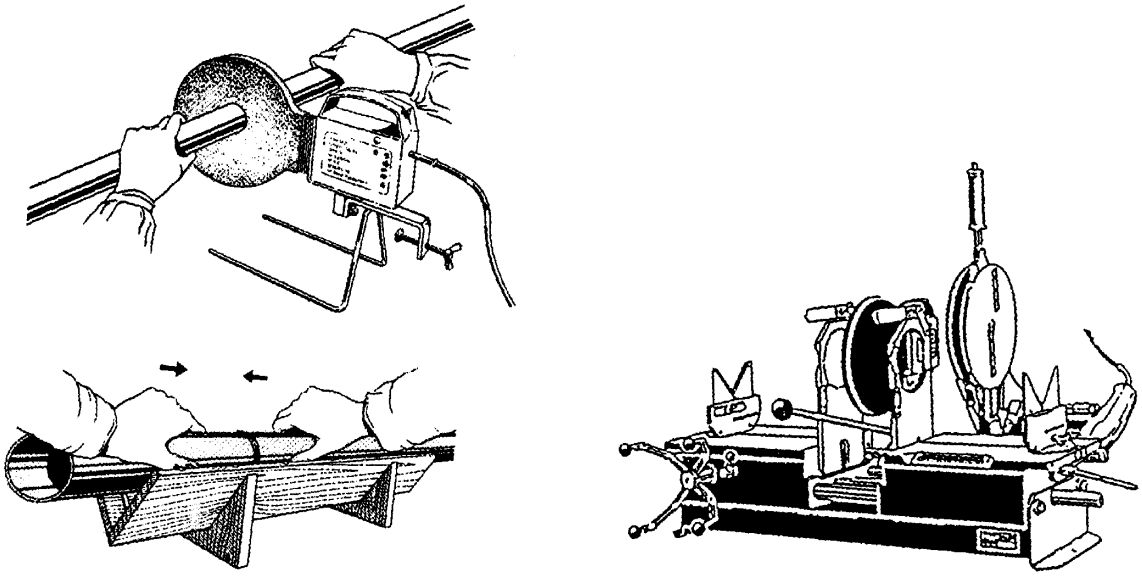
6.3.3.2 Jointing recommendations

6.3.3.2.1 General

Carry out the fusion operation in a clean place, protected from frost and high levels of humidity.

Depending on the dimension of the pipes and fittings to be fused, use the equipment and techniques as shown in Figure 33.

The method of butt welding comprises three stages as described in 6.3.3.2.2 to 6.3.3.2.4.



a) $d_n \leqslant 75$ mm **b)** $d_n > 75$ mm

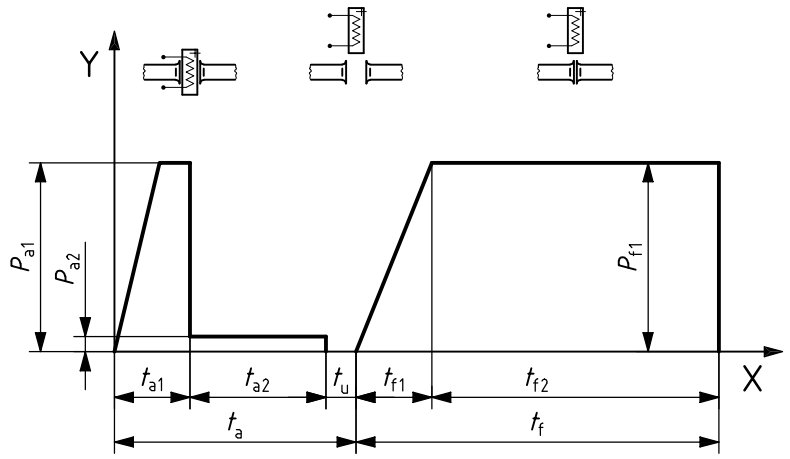
Figure 33 — Butt fusion techniques

6.3.3.2.2 Surface preparation

Check that the matching surfaces for assembly are cut square, without chamfer, and are free from defects.

6.3.3.2.3 Heating of surfaces

Before starting the fusion process, check the operation of the fusion machine. Raise the temperature of the heater according to the manufacturer's instructions, normally between 200 °C and 230 °C for PE, and between 190 °C and 220 °C for PP. Align the joint surfaces of the jointing components to be fused and insert the hot heating plate between them. Press the two components together with the heating plate at a pressure in the fusion surface between 0,12 MPa and 0,22 MPa for PE, and between 0,10 MPa and 0,20 MPa for PP. Maintain the heating-up pressure until a bead of melt material is formed around the whole circumference of the components to be fused. Manufacturer's instructions may include recommendation for parameters of the fusion operation, as shown in Figure 34, including time intervals and related pressures together with the preferred ranges of temperature.



Key

X	time, t, in seconds
Y	pressure, P, in megapascals
P_{a1}, P_{a2}	heating pressures, high and low
P_{f1}	fusion pressure
t_{a1}, t_{a2}	heating times with high and low pressures
t_a	total heating time
t_{f1}	pressure build-up time
t_{f2}	cooling time
t_f	total cooling time
t_u	change-over time

Figure 34 — Parameters for fusion operation

6.3.3.2.4 Fusion

Remove the hot plate and press the heated surfaces together. Maintain the pressure according to the manufacturer's instructions with a correct alignment of the two components until the fusion zone has cooled. Parameters for fusing the parts together and for the cooling operation may be given in the manufacturer's instructions (see Figure 34).

Do not accelerate the cooling process by means of cold water or any other cooling equipment since this may impair the quality of the joint.

6.3.4 Jointing with electrofusion sleeve couplings

6.3.4.1 General

Electrofusion sleeve couplings are applicable to above-ground and below-ground installations with PE components and provide rigidly jointed pipework.

The parts (pipe or fitting ends) to be fused are inserted, after cleaning, into the coupling and brought to the fusion temperature produced by a built-in heating coil.

6.3.4.2 Additional preparation of pipe ends

The pipe ends may be chamfered. Mark the pipe at the insert length required by the coupling. If a repair coupling without a butt ring is to be used, the insert lengths correspond to half the length of the coupling. If recommended by the manufacturer's instructions, scrape the marked area with a knife or special equipment (see Figure 35).

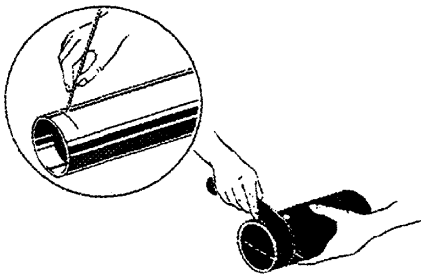


Figure 35 — Preparation of pipe end

6.3.4.3 Jointing recommendations

Ensure that the electrofusion sleeve coupling is clean and free from grease and dust.

If necessary, clean the coupling by abrading, but without using soap or any other cleaning agents.

Insert the prepared pipe or fitting ends into the coupling, until the inserted ends reach the butt rings, if any, or, if a repair coupling without butt ring is used, until the marked length has been inserted (see 6.3.4.2).

Prior to the welding procedure, check the pipe and/or fitting for correct alignment.

NOTE 1 Incorrect alignment causes stress.

Connect the terminals to an electrical power source and operate the power input according to the manufacturer's instructions.

NOTE 2 A fully automatic electrofusion machine is recommended.

Once the fusion operation is done, check visually for the successful completion.

NOTE 3 Some electrofusion sleeve couplings are provided with ejectable pins or thermochromatic indicators that have the function of witnessing the satisfactory execution of the fusion (refer to manufacturer's instructions).

6.3.5 Jointing with flanges and backing rings

6.3.5.1 General

Joints with flange and backing rings are applicable to above-ground installations of PE and provide rigidly jointed pipeworks.

The pipe ends or fittings are connected to the flange adaptors by means of butt fusion or electrofusion sleeve coupling. The adaptors are tightened by compressing the flange rings by means of bolts and nuts.

6.3.5.2 Jointing recommendations

Ensure that the fusion flange adaptors are correctly aligned prior to connection. Insert the seal between the adaptors, set in all bolts, washers and nuts and tighten in correct sequence.

6.3.6 Jointing with compression joints

6.3.6.1 General

Joints with compression couplings are applicable to above-ground installations of PE and provide rigidly jointed pipeworks.

NOTE Compression couplings are designed to grip and seal on to the outer surface of a pipe or spigot end. They are not designed to compensate thermal movement within the pipework.

6.3.6.2 Jointing recommendations

Cut the pipe as required. Clean the end of the pipe with a clean cloth. Split the nut, the antifriction ring and the rubber seal over the pipe end and insert the pipe end fully into the coupling. Securely tighten the nut.

7 Special precautions

7.1 Concreting of thermoplastics systems within the building structure

7.1.1 General

Carefully follow the manufacturer's instructions, subject to any relevant local and/or national regulations.

Provided they are rigidly jointed (e.g. systems with fused joints) PE and PP components may be concreted in without any special precaution (see Figure 36 in comparison with Figure 23).

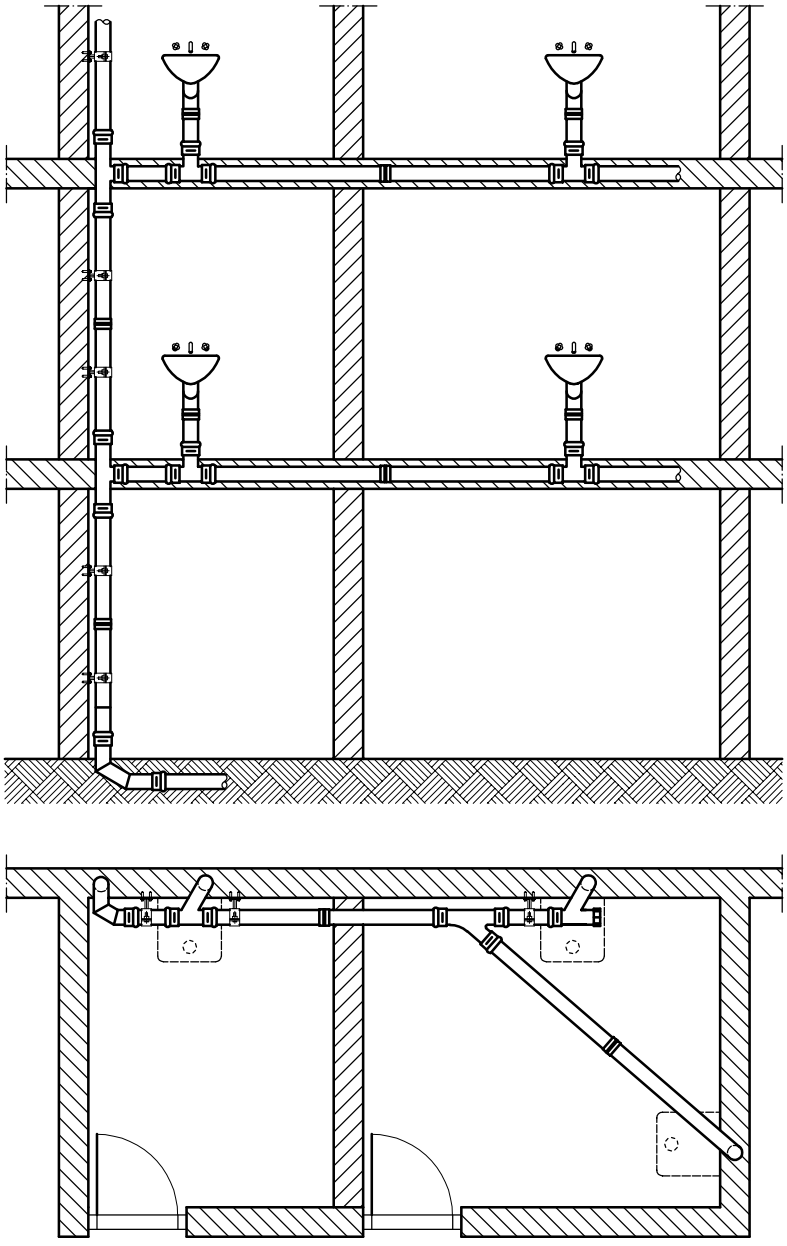


Figure 36 — Example of concreted-in rigidly jointed PE or PP system

For the other situations with PE and PP systems, and for all systems made of the other materials, 7.1.2 or 7.1.3 apply, whichever is relevant according to the curing temperature of concrete, ambient or with post-heating. Take care not to exceed the recommended maximum cover height of concrete above the components, given in Table 5.

Table 5 — Recommended maximum cover height of concrete

Material	Pipe S-Series from the associated system standards	Recommended maximum cover height of concrete		
		at ambient temperature	with post-heated concrete	
			at 50 °C	at 70 °C
		m	m	m
ABS	S-25	0,5	no	no
	S-16,7	1,5	0,5	no[a]
PE	S-16	1,0	—	0,5
	S-12,5	2,5		1,0
PP	S-20	0,5	no	no
	S-16	1,5		0,5
	S-14	2,5		1,0
PVC-C	S-25	0,5	no	no
	S-16,7	3,0	1,25	no[a]
PVC-U	S 25	no	no	no
	S 20	1,0	no	no
SAN + PVC	S-25	0,5	no	no
	S-16,7	2,0	0,75	no[a]

[a] Post-heating between 50 °C and 70 °C is recommended with PE and PP systems only (see 7.1.3.1).

7.1.2 Inserting systems in concrete setting at ambient temperature

7.1.2.1 Attention is drawn to any relevant local and/or national regulations.

7.1.2.2 Fasten systems with ring seal assemblies to prevent floating and support them sufficiently to prevent deflection during pouring of the concrete.

7.1.2.3 During pouring and vibration of the concrete take great care to prevent damage to the pipework.

7.1.2.4 Protect the ring seal sockets with tape on the outside to prevent concrete entering the socket mouths. Cap or plug open pipes in order to prevent the entry of water or concrete.

7.1.2.5 Fix all connected pipes which are branched off in the same way as the pipe they are connected to in order to avoid displacements or bending forces.

7.1.2.6 When a run of pipework is jointed by a branch of smaller diameter, use an appropriate means of fixing the larger pipe close to the branch in order to protect against shearing of the smaller pipe.

7.1.2.7 Figure 37 shows how fixing to the concrete formwork may be carried out. It is recommended that the fixing brackets have a strength sufficient to hold the pipe in the correct position. For the distances between support centres for concreted systems, do not exceed the recommended maximum value, $L_{c,max}$, given in Table 6.

NOTE The pipe can also be fixed to the steel reinforcement.

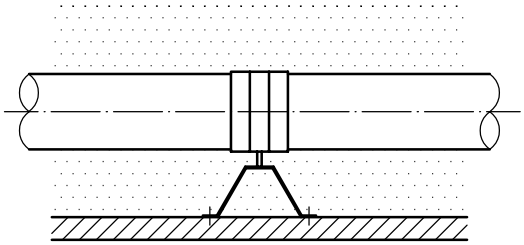
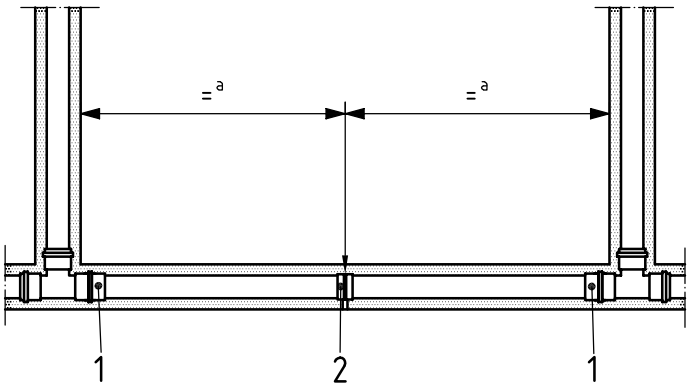


Figure 37 — Typical fixing to the concrete formwork

Table 6 — Recommended maximum distance between support centres for pipes to be concreted in

Nominal outside diameter	Distance between support centres	
	Horizontal pipework	Vertical pipework
d_n mm	$L_{c,max}$ m	$L_{c,max}$ m
32	0,4	0,8
40	0,5	1,0
50	0,5	1,0
63	0,5	1,0
75	1,0	1,5
80	1,0	1,5
82	1,0	1,5
$\geqslant$ 90	1,0	2,0

7.1.2.8 For pipes that are completely concreted-in, do not exceed the recommended maximum cover height of concrete given in Table 5 and do not install more than a 3 m length without a fixed point in the concrete (see Figure 38). Sockets, electrofusion sleeve couplings and various types of fittings will act as fixed points in the concrete. A ring made of the same material as the pipe may be cement-welded or fused, as applicable, to the outside of the pipe in order to act as an extra fixed point when the pipe length exceeds 6 m.



Key

1 socket with ring seal and expansion gap

2 anchor bracket fastened to concrete formwork

[a] $\leqslant$ 3 m

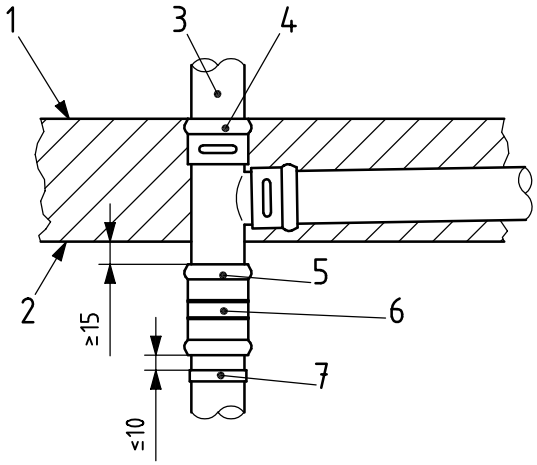
Figure 38 — Typical completely concreted-in pipe system

7.1.2.9 Install at least one ring seal socket between two fixed points to accomodate the expansion of the pipes. To ensure free movement of the pipes in the ring seals, lubricate the spigot-ends of the pipes.

For expansion gaps, conform to the recommendations for E in Table 2.

7.1.2.10 Always install partly concreted-in pipe systems with fixed points in the concrete ceiling or floor (see Figure 39).

Dimensions in millimetres



Key

1 floor
2 ceiling
3 pipe to be installed after concreting
4 sealing ring socket with expansion gap
5 expansion gap in this socket (example with double socket)
6 expansion gaps in double socket (example)
7 guide bracket or solvent cemented or fused ring to secure the double socket

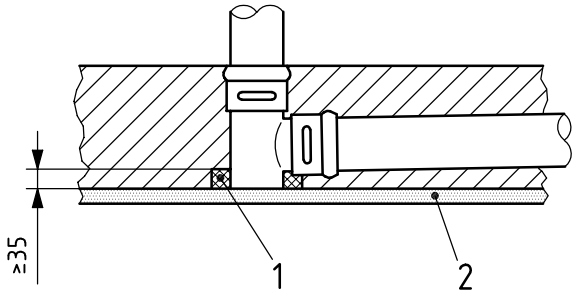
Figure 39 — Typical partly concreted-in pipe systems

7.1.2.11 Pipes that are connected to partly concreted-in pipe systems between concrete floors and ceilings are often installed after the concreting.

The spigot or pipe end may end directly against the concrete formwork. A collar made of expanded polystyrene may be placed around the spigot or the pipe end as shown in Figure 40. Once the concrete has been established, remove the collar to enable connection of further pipework to the spigot end, as shown in Figure 41 a) is applicable to all non-rigidly jointed systems, and Figure 41 b) to rigidly jointed PE and PP systems.

Pipe ends in the upper part of the formwork may be arranged in the same way in order to avoid damage to pipes above the formwork during the concreting (see Figure 42).

Dimensions in millimetres

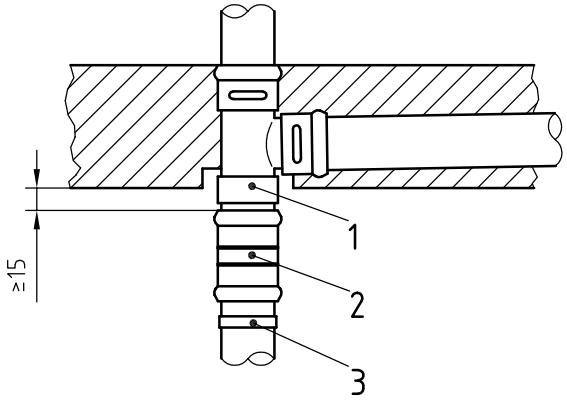


Key

1 ring of expanded polystyrene
2 formwork for the concrete

Figure 40 — How to arrange expanded polystyrene ring on spigot or pipe in the formwork

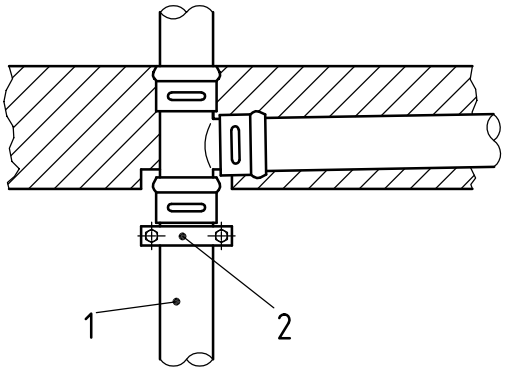
Dimensions in millimetres



a) For non-rigidly jointed systems

Key

1 extension of the spigot end
2 slip coupling
3 solvent cemented or fused ring to secure slip coupling

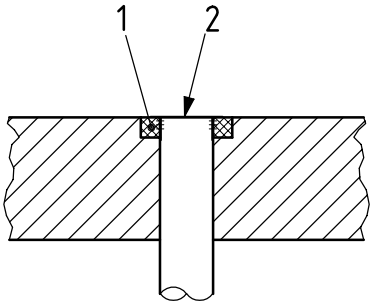


b) For PE and PP rigidly jointed systems

Key

1 anchor bracket
2 pipe with socket

Figure 41 — How to continue the installation under the concrete ceiling
(polystyrene ring and formwork removed)



Key

1 ring of expanded polystyrene
2 plug

Figure 42 — How to end a pipe against the upper part of the formwork
(formwork removed)

7.1.2.12 When installation of partly concreted-in pipe systems is carried out under winter conditions, in order to avoid damage caused by subsequent freezing of water in the pipework, ensure that melted ice/snow does not flow into installed pipes and fittings. This precaution is not applicable to PE systems.

7.1.3 Inserting systems into post-heated concrete

7.1.3.1 For post-heating at a maximum temperature of 50 °C, use only systems with wall thicknesses thicker than or equal to S 16,7 (which excludes any PVC-U system and S-20 PP systems). For temperatures between 50 °C and 70 °C, use only PE and PP components conforming to Table 5.

Attention is drawn to any relevant local and/or national regulations. Carefully follow the manufacturer's instructions, with special attention to distances of support centres, and take the following precautions in addition to those of 7.1.2.

7.1.3.2 Do not let the temperature in the concrete at the location of the pipework rise above 50 °C or above 70 °C, whichever is relevant (see Table 5).

7.1.3.3 After finishing the heating treatment, let the pipework cool down slowly.

7.2 Foaming of thermoplastics systems

This subclause only applies to systems when they are prefabricated in factories.

NOTE Do not foam on site these systems unless allowed by national and/or local regulations.

Take care to insure that pipes and fittings stay in initial position during the foaming operation.

Under certain circumstances, when higher temperatures than allowed for the material may occur, it may be necessary to cool the pipework, e.g. by means of cold water, in which case anchor the components to prevent displacement.

7.3 Prevention of additional stresses in pipework

Avoid misalignment of the pipework. When filling up the space between a hole in a wall and the pipe passing through that wall, take care not to push the pipe out of line.

8 Jointing to other materials or other constructions

8.1 General

Any joint of a thermoplastic component with components made of dissimilar materials shall conform to functional requirements as given in the relevant associated system standard.

In all cases, follow the manufacturer's instructions for ensuring a leaktight and trouble-free joint.

8.2 Solvent-cement joints

In the case of solvent cementing of dissimilar plastics materials, use only components having dimensions and tolerances on outside diameter very close to those of the other material components, and those types of solvent adhesive that are compatible with both types of plastic and thus only applicable to jointing PVC-U, ABS, PVC-C and SAN + PVC components.

8.3 Ring seal joints

In the case of jointing a ring seal socket made of a given basic thermoplastics material, use only components made from other materials having tolerances on the outside diameter of their spigot smaller than or equal to

those of the basic material and having the socket lengths in accordance with the requirements for the other material.

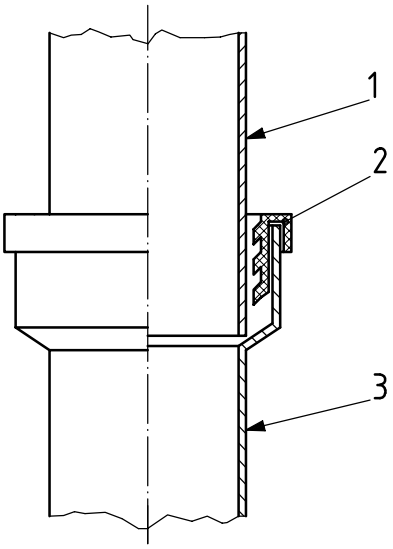
EXAMPLE A PE ring seal socket is permitted to be jointed to a PVC-U spigot (provided socket and spigot length compatibility), but not a PVC-U socket to a PE spigot, because PE tolerances on d_e are larger than PVC-U tolerances on d_e.

NOTE Due to the possible change of the materials at extreme temperature attention is also drawn to the need for the selection of correct size, composition and hardness of ring seals for jointing dissimilar plastics materials.

8.4 Jointing to non-thermoplastics components

Carefully follow the manufacturer's instructions.

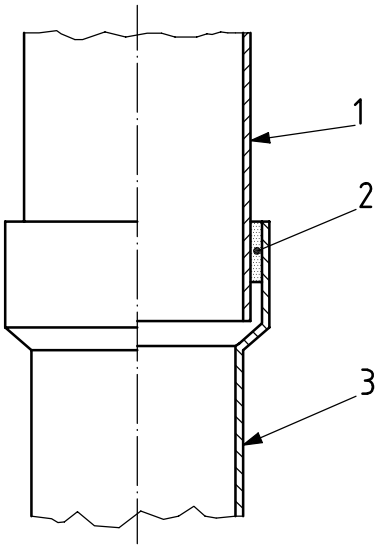
Figures 43 to 46 are given as examples and do not cover the entire range of products that are available for the connection of thermoplastics pipes to pipes of non-thermoplastics materials (cast iron, brass, vitrified clay, vitreous china, etc.), but the most common only.



Key

1 other material
2 special flexible seal
3 thermoplastics

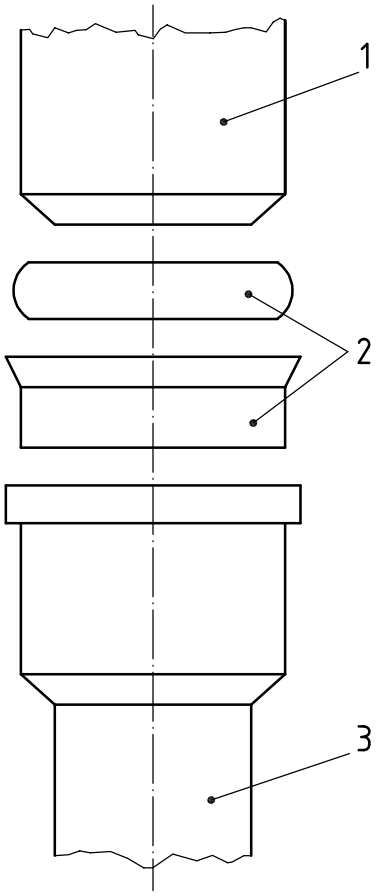
Figure 43 — Typical joint from spigot of other material



Key

1 other material
2 mastic
3 thermoplastics

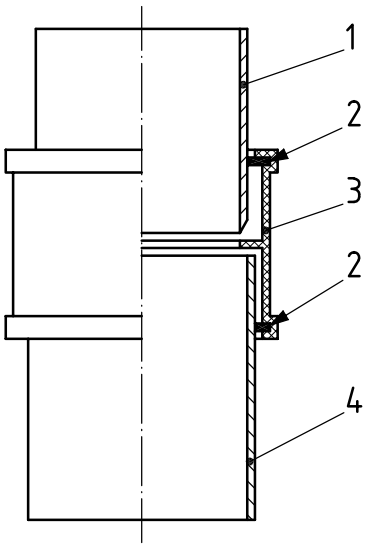
Figure 44 — Alternative joint from spigot of other material



Key

1 thermoplastics
2 double seal
3 metal material

Figure 45 — Typical joint from socket of metal



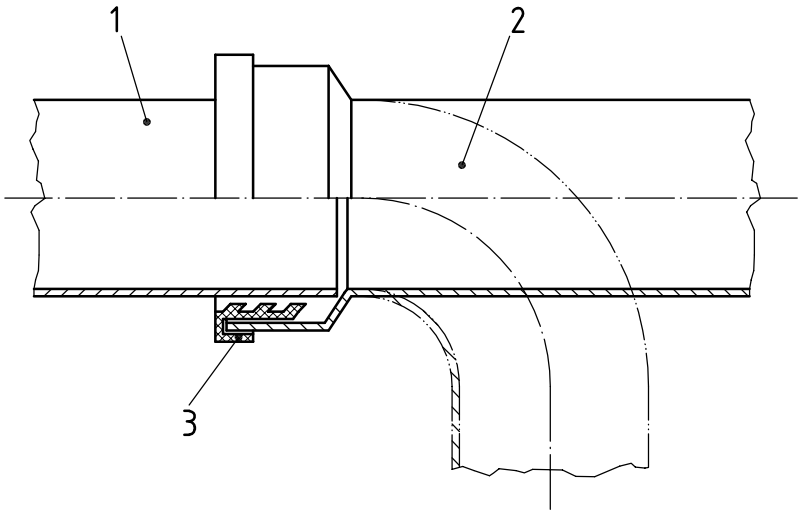
Key

1 thermoplastics
2 ring seal
3 plastics coupling
4 other material

Figure 46 — Typical joint from thermoplastics pipe spigot to pipe spigot of other material

8.5 Adaptors

Manufacturers provide special adaptors for connecting thermoplastics pipes to components made from other materials (see Figure 47 as an example), including other plastics. In selecting the required adaptor, ensure that the recommended fitting will fulfil the performance requirements of the relevant associated system standards and accommodate the thermal movement; alternatively, fit an expansion socket in close proximity.



Key

1 vitreous china pan
2 thermoplastics bent or straight connector
3 special flexible seal

Figure 47 — Typical joint from W.C. pan spigot of vitreous china

9 Environmental aspects

Attention is drawn to any relevant local and/or national regulations concerning the environmental aspects of noise and airtightness.

10 Fire resistance of pipework

Attention is drawn to any relevant local and/or national regulations. If a fire stop is designed as a fixed point in a pipework, take account of that situation.

11 Testing and inspection of installations

11.1 Testing

Follow the general recommendations as given in EN 12056-5. When using the smoke test, take care that distillates from burning hydrocarbon are not likely to cause any damage to the thermoplastics components (see Clause 13).

11.2 General inspection

Ensure compliance with the following recommendations:

a) correct insertion at expansion joints;

b) anchor and guide brackets are correctly placed and fixed;

c) fire regulations or requirements are given due consideration;

d) general drainage codes of practice and local and/or national regulations are given due consideration.

12 Maintenance and cleaning of installations

12.1 General

12.1.1 It is recommended that care be taken in the use of chemical descaling agents, which are often of a corrosive nature, and that materials used in the pipe system be clearly identified before treatment to ensure that the internal surfaces are not subjected to damaging chemical attack (see ISO/TR 10358).

12.1.2 It is recommended that hand-operated rods for removing blockages in discharge pipes be capable of passing through the systems without damaging the internal surfaces of pipes and fittings.

12.1.3 When using the mechanized rodding equipment, it is recommended that the pipework to be cleaned be thoroughly examined beforehand to enable selection of the appropriate cleaning attachments.

12.1.4 If it is desired to paint the pipework, do not use strong solvent-based paints. Favour paints which can accommodate the thermal movement of the components.

12.2 Cleaning and descaling techniques

Conventional cleaning and descaling techniques as described in EN 12056-5 can be applied to thermoplastics networks. Nevertheless, take special care when using a kinetic ram for the following reasons.

A kinetic ram can be usefully employed for the removal of obstructions in branch pipes provided its function and its limitations are properly understood. The function of the gun is based on the principle that the impact of compressed air against a column of water behind a blockage will create a shock wave which is transmitted to the obstruction to dislodge and remove it.

A stubborn blockage can, however, produce a “blow-back” of the gun and injure the operator, or damage pipework and appliances not designed to withstand the pressure applied. Where there are open branches on the system, waste matter may be forced out of the openings and damage wall and ceiling decoration. It is recommended that the use of the gun on thermoplastics discharge installations be generally restricted to the removal of blockages consisting of compacted soft materials, e.g. grease, soap residue and saturated paper.

13 Chemical resistance of thermoplastics materials

Thermoplastics are resistant to the effects of a large number of chemicals including alkalis and most acids but are attacked by some chemicals, most of which are organic solvents. Restricted use in industrial installations is permissible for many chemically contaminated waste waters, subject to limiting values for time and temperature, equivalent to those of domestic washing machines if the manufacturer's instructions do not specify other limiting values of time and temperature. ISO/TR 10358 provides guidance on chemical resistance of thermoplastics.

Annex A
(informative)

Recommendations for installation in buried conditions

A.1 General

This annex covers the application area BD for pipework buried in the ground within the building structure, where the existence of hot water discharge temperature in addition to the external forces from surroundings is usual.

As specified in the relevant associated system standard, pipes and fittings used in the application area BD shall be those of nominal outside diameter equal to or greater than 75 mm which are designed for this application and marked accordingly. Typical fittings in this application area are bends, branches and reducers.

NOTE The following pipe series are designed for the application area BD.

In ISO standards, BD application is not covered, consequently, for this application the reference standards are European standards:

— from standard EN 1329-1 (PVC-U): series S 20 or thicker;

— from standard EN 1451-1 (PP): series S 16 or thicker;

— from standard EN 1455-1 (ABS): series S 16,7 or thicker;

— from standard EN 1519-1 (PE): series S 16 or thicker;

— from standard EN 1565-1 (SAN + PVC): series S 16,7 or thicker;

— from standard EN 1566-1 (PVC-C): series S 16,7 or thicker.

PVC-U structured-wall pipes conforming to EN 1453-1 are not designed for BD application area.

Attention is drawn to local and/or national regulations concerning the foundation stability and the embedment construction, e.g. when the trench is built in close proximity to foundations.

Adopt effective means of preventing the entry of gravel, rodents or gas. When designing the pipework, take due note of the proximity of underground gas services.

For the pipe length permitted for each expansion socket, L_F, do not exceed the values given in Table A.1, and keep at the bottom of each expansion socket an expansion gap, E, as recommended in Table A.1.

Table A.1 — Recommended length between fixed points, and recommended expansion gap at each socket, for buried installations

Material	Type S socket		Type N or M socket		Type L socket	
	L_F m	E mm	L_F m	E mm	L_F m	E mm
ABS	$\leqslant 6$	$\geqslant 10$	$\leqslant 9$	$\geqslant 10$	[a]	[a]
PE	(no type S for PE)		$\leqslant 6$	$\geqslant 15$	$\leqslant 15$	$\geqslant 40$
PP	(no type S for PP)		$\leqslant 9$	$\geqslant 10$	[a]	[a]
PVC-C	$\leqslant 6$	$\geqslant 10$	$\leqslant 9$	$\geqslant 10$	[a]	[a]
PVC-U	$\leqslant 6$	$\geqslant 10$	$\leqslant 9$	$\geqslant 10$	[a]	[a]
SAN + PVC	(no type S for SAN + PVC)		$\leqslant 9$	$\geqslant 10$	[a]	[a]

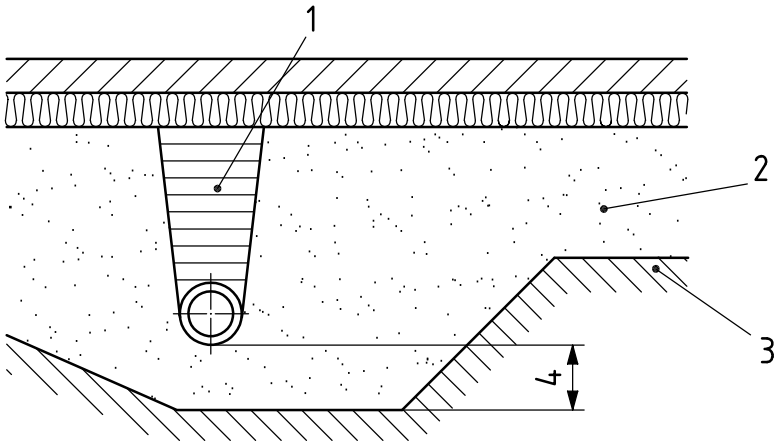
[a] Type L sockets are used for BD application area with PE systems only.

A.2 Installation for BD application

Install the pipework on a bedding zone keeping below the pipework a layer of gravel or compacted sand with a thickness, c, in the range of 100 mm to 150 mm. It is recommended not to use heavy compaction equipment when back-filling the zone over the pipe, but to use light compaction equipment only (see zone X in Figure A.1).

If presence of ground water may be expected, the use of gravel is preferable.

Attention is drawn to any relevant local and/or national regulations.



Key

1 zone X
2 gravel or compacted sand
3 native soil
4 bedding, c, where 100 mm $\leqslant c \leqslant$ 150 mm

Figure A.1 — Typical example for installation in sand or gravel

A.3 Differential movement — Flexible joints

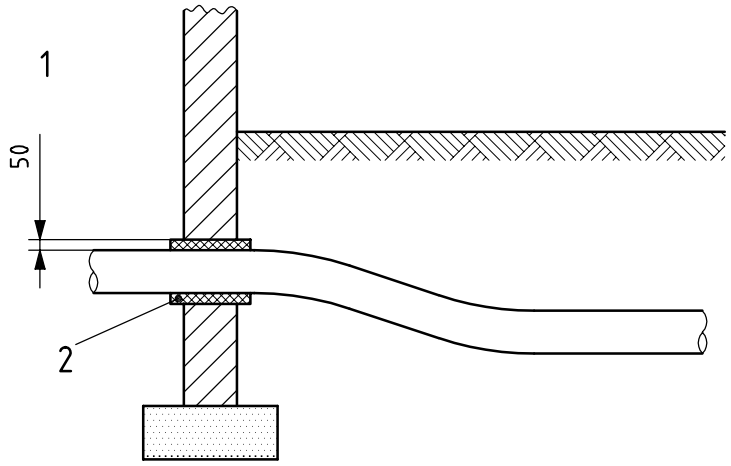
Differential movement in a drain will occur when there is a change in either loading conditions or in the mode of support between successive pipes. Inspection chambers, manholes and other structures generally will be subject to settlement behaviour different from that of the pipes associated with them.

For PE systems, follow the manufacturer's instructions, and see Figure A.2 as an example.

For systems made of other thermoplastics, arrange to accommodate subsequent differential settlement by means of flexible joints. To considerably reduce the risk of shear fracture provide a flexible joint located in or as close as practicable to the face of the structure. If a “rocker” pipe is used, it is recommended that the length between the two flexible joints (see Figure A.3) not exceed 0,6 m. Where considerable differential settlement is anticipated, several “rocker” pipes may be laid, and if necessary, the gradient may be increased locally to reduce the likelihood of a back fall developing. In each case, the maximum deviation at each joint should not exceed that recommended by the manufacturer.

Attention is drawn to any relevant local and/or national regulations.

Dimensions in millimetres

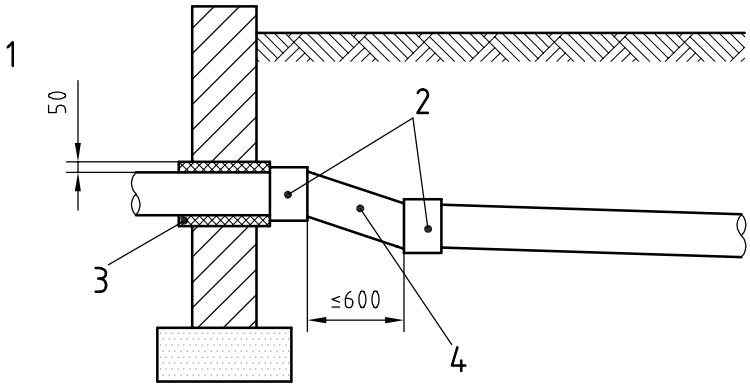


Key

1 inside of structure
2 sleeve of soft material

Figure A.2 — Typical example for installation of PE system through a rigid structure

Dimensions in millimetres



Key

1 inside of structure
2 flexible joints
3 sleeve of soft material
4 rocker pipe

Figure A.3 — Typical example for installation with flexible joints

Bibliography

[1] ISO 2553, *Welded, brazed and soldered joints — Symbolic representation on drawings*

[2] ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

[3] ISO 8283-2, *Plastics pipes and fittings — Dimensions of sockets and spigots for discharge systems inside buildings — Part 2: Polyethylene (PE)*

[4] ISO 14617-3, *Graphical symbols for diagrams — Part 3: Connections and related devices*

[5] ISO 14617-15, *Graphical symbols for diagrams — Part 15: Installation diagrams and network maps*

[6] EN 1329-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes, fittings and the system*

[7] EN 1451-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polypropylene (PP) — Part 1: Specifications for pipes, fittings and the system*

[8] EN 1453-1, *Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes and the system*

[9] EN 1455-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Acrylonitrile-butadiene-styrene (ABS) — Part 1: Requirements for pipes, fittings and the system*

[10] EN 1519-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Polyethylene (PE) — Part 1: Specifications for pipes, fittings and the system*

[11] EN 1565-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Styrene copolymer blends (SAN + PVC) — Part 1: Specifications for pipes, fittings and the system*

[12] EN 1566-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure — Chlorinated poly(vinyl chloride) (PVC-C) — Part 1: Specifications for pipes, fittings and the system*

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