International Standard

ISO 4437-3

Second edition
2024-02

Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) —

Part 3: Fittings

Systèmes de canalisations en plastique pour la distribution de combustibles gazeux — Polyéthylène (PE) —

Partie 3: Raccords

Reference number
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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4, *Plastics pipes and fittings for the supply of gaseous fuels*.

This second edition cancels and replaces the first edition (ISO 4437-3:2014), which has been technically revised.

The main changes are as follows:

— PE 100-RC type materials with enhanced resistance to slow crack growth (SCG) have been added;

— the nominal diameter range of the electrofusion socket fittings and spigot end fittings has been increased to 800 mm;

— the PE 80 20 °C/100 h control point has been changed to 10 MPa with a note to advise that 9 MPa is applicable if the ISO 9080 data set for a material indicates that a lower value is applicable;

— test methods have been updated and new methods have been added for PE 100-RC materials.

A list of all parts in the ISO 4437 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 4437 series specifies the requirements for a piping system and its components made from polyethylene (PE) compounds, which is intended to be used for the supply of gaseous fuels.

This document covers the characteristics of fittings.

Requirements and test methods for materials and components, other than fittings, are specified in ISO 4437-1, ISO 4437-2 and ISO 4437-4.

Characteristics for fitness for purpose of the system are covered in ISO 4437-5.

Recommended practice for design, handling and installation is given in ISO/TS 10839.

Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) —

Part 3: Fittings

1 Scope

This document specifies the characteristics of fusion fittings made from polyethylene (PE) as well as of mechanical fittings for piping systems in the field of the supply of gaseous fuels.

It also specifies the test parameters for the test methods referred to in this document.

In conjunction with ISO 4437-1, ISO 4437-2, ISO 4437-4 and ISO 4437-5, this document is applicable to PE pipes, fittings and valves, their joints, and joints with components of PE and other materials intended to be used under the following conditions:

a) a maximum operating pressure (MOP), up to and including 10 bar[1)], at a reference temperature of 20 °C for design purposes;

b) an operating temperature between −20 °C and 40 °C.

For operating temperatures between 20 °C and 40 °C, derating coefficients are defined in ISO 4437-5.

The ISO 4437 series covers a range of maximum operating pressures and gives requirements concerning colours.

It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

This document is applicable for fittings of the following types:

— electrofusion socket fittings;

— electrofusion saddle fittings;

— spigot end fittings (for butt fusion using heated tools and electrofusion socket fusion);

— socket fusion fittings;

— mechanical fittings.

NOTE 1 The fittings can be, for example, in the form of couplers, saddles, equal and reduced tees, reducers, elbows, bends or end caps.

NOTE 2 Fabricated fittings are normally not used for gas applications except for larger dimensions or in the absence of other solutions. Guidance can be found in ISO 4427-3:2019, Annex B.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1167-1:2006, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 4437-1, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 1: General*

ISO 4437-2:2024, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 2: Pipes*

ISO 4437-5, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 12176-5, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 5: Two-dimensional data coding of components and data exchange format for PE piping systems*

ISO 13950, *Plastics pipes and fittings — Automatic recognition systems for electrofusion joints*

ISO 13951, *Plastics piping systems — Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading*

ISO 13953, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 13954, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm*

ISO 13955, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies*

ISO 13956, *Plastics pipes and fittings — Decohesion test of polyethylene (PE) saddle fusion joints — Evaluation of ductility of fusion joint interface by tear test*

ISO 13957, *Plastics pipes and fittings — Polyethylene (PE) tapping tees — Test method for impact resistance*

ISO 16010, *Elastomeric seals — Material requirements for seals used in pipes and fittings carrying gaseous fuels and hydrocarbon fluids*

ISO 17778, *Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships*

ISO 17885, *Plastics piping systems — Mechanical fittings for pressure piping systems — Specifications*

ISO 18488, *Polyethylene (PE) materials for piping systems — Determination of Strain Hardening Modulus in relation to slow crack growth — Test method*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms related to geometry

3.1.1
nominal size
DN/OD
numerical designation of the size of a component related to the outside diameter

Note 1 to entry: It is a convenient round number approximately equal to the manufacturing dimension in millimetres (mm). It is not applicable to components designated by thread size.

3.1.2
nominal outside diameter
d_n
specified outside diameter assigned to a *nominal size* (3.1.1)

Note 1 to entry: Nominal outside diameter is expressed in millimetres.

3.1.3
mean outside diameter
d_{em}
value of the measurement of the outer circumference of the pipe or spigot end of a fitting in any cross-section divided by π (= 3,142), rounded to the next greater 0,1 mm

3.1.4
minimum mean outside diameter
$d_{em,min}$
minimum value for the *mean outside diameter* (3.1.3) as specified for a given *nominal size* (3.1.1)

3.1.5
maximum mean outside diameter
$d_{em,max}$
maximum value for the *mean outside diameter* (3.1.3) as specified for a given *nominal size* (3.1.1)

3.1.6
out-of-roundness
ovality
difference between the maximum and the minimum outside diameters in the same cross-section of a pipe or spigot

3.1.7
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, which is a convenient round number, approximately equal to the manufacturing dimension in millimetres (mm)

Note 1 to entry: For thermoplastics components conforming to the ISO 4437 series, the value of the nominal wall thickness, e_n, is identical to the specified *minimum wall thickness at any point* (3.1.9).

3.1.8
wall thickness at any point
e
wall thickness at any point around the circumference of a component rounded to the next greater 0,1 mm

Note 1 to entry: The symbol for the wall thickness of a fitting or valve at any point is *E*.

3.1.9
minimum wall thickness at any point
e_{min}
minimum value for the *wall thickness at any point* (3.1.8) around the circumference of a component

3.1.10
tolerance
permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value

3.1.11
standard dimension ratio
SDR
numerical designation of a *pipe series* (3.1.12), which is a convenient round number, approximately equal to the dimension ratio of the *nominal outside diameter* (3.1.2) and the *nominal wall thickness* (3.1.7)

3.1.12
pipe series
S
number for pipe designation

Note 1 to entry: The relationship between the pipe series, *S*, and the *standard dimension ratio (SDR)* (3.1.11) is given by the following formula, as specified in ISO 4065.

$$S = \frac{SDR - 1}{2}$$

3.2 Terms related to material

3.2.1
compound
homogenous extruded mixture of *base polymer* (3.2.4) (polyethylene) and additives (i.e. anti-oxidants, pigments, carbon black, UV-stabilizers and others) at a dosage level necessary for the processing and use of components

3.2.2
virgin material
compound (3.2.1) in a form such as granules that has not been subjected to use or processing other than that required for its manufacture and to which no reworked or recyclable materials have been added

3.2.3
reworked material
plastics materials from rejected unused products or trimmings that have been manufactured and retained within plants owned and operated by the same legal entity

3.2.4
base polymer
polymer produced by the material supplier for the manufacture of the *compound* (3.2.1)

3.3 Terms related to material characteristics

3.3.1
lower confidence limit of the predicted hydrostatic strength
σ_{LPL}
quantity, with the dimensions of stress, which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at temperature θ and time t

Note 1 to entry: It is expressed in megapascals (MPa).

3.3.2
minimum required strength
MRS
value of the *lower confidence limit of the predicted hydrostatic strength* (3.3.1) at 20 °C and 50 years, rounded down to the next smaller value of the R10 series or R20 series

Note 1 to entry: Only *compounds* (3.2.1) with an MRS of 8 MPa or 10 MPa are specified in this document.

Note 2 to entry: The R10 series and the R20 series conform to ISO 3.

Note 3 to entry: It is expressed in megapascals (MPa).

[SOURCE: ISO 12162:2009, 3.3, modified — Note 1 to entry has been removed and replaced with new Notes 1 to 3 to entry.]

3.3.3
design coefficient
C
coefficient with a value greater than 1 which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower confidence limit

3.3.4
melt mass-flow rate
MFR
value relating to the viscosity of the molten material at a specified temperature and load

Note 1 to entry: It is expressed in grams per 10 minutes (g/10 min).

3.4 Terms related to service conditions

3.4.1
gaseous fuel
fuel which is in gaseous state at a temperature of 15 °C at atmospheric pressure

Note 1 to entry: There are proposals to inject gases from renewable sources in natural gas networks, e.g. hydrogen (H_2). This is the subject of ongoing research.

3.4.2
maximum operating pressure
MOP
maximum effective pressure of the fluid in the piping system which is allowed in continuous use

Note 1 to entry: It is expressed in bar. It takes into account the physical and the mechanical characteristics of the components of a piping system. It is calculated using the following formula:

$$MOP = \frac{20 \times MRS}{C \times (SDR - 1)}$$

Note 2 to entry: Research on long-term performance prediction of polyethylene gas distribution systems shows a possible service life of at least 100 years; see References [13], [14] and [15].

3.4.3
reference temperature
temperature for which the piping system is designed

Note 1 to entry: It is used as the base for further calculation when designing a piping system or parts of a piping system for operating temperatures different from the reference temperature (see ISO 4437-5).

3.5 Terms related to joints

3.5.1
electrofusion socket fitting
polyethylene (PE) fitting which contains one or more integrated heating elements that are capable of transforming electrical energy into heat to realize a fusion joint with a spigot end or a pipe

3.5.2
electrofusion saddle fitting
polyethylene (PE) fitting which contains one or more integrated heating elements that are capable of transforming electrical energy into heat to realize a fusion joint onto a pipe

3.5.3
tapping tee
electrofusion saddle fitting (3.5.2) that contains a cutter to tap through the wall of the main pipe and remains in the body of this fitting

3.5.4
branch saddle
electrofusion saddle fitting (3.5.2) that requires an ancillary cutting tool for drilling a hole in the adjoining main pipe

3.5.5
spigot end fitting
polyethylene (PE) fitting where the outside diameter of the spigot end is equal to the *nominal outside diameter* (3.1.2) of the corresponding pipe

3.5.6
socket fusion fitting
polyethylene (PE) fitting designed to accept the insertion of a pipe or spigot end to realize a fusion joint between mating surfaces using the socket fusion process

3.5.7
mechanical fitting
fitting for assembling plastics pipes with each other or with a metal pipe or fitting, that includes one or more compression zones to provide pressure integrity, leak tightness and resistance to end loads

[SOURCE: ISO 17885:2021, 3.1.1]

4 Symbols and abbreviated terms

4.1 Symbols

For the purposes of this document, the following symbols apply.

A_d percentage of decohesion (area)

C design coefficient

c_1 outside diameter of the terminal shroud

c_2 diameter of the contact area of the terminal

c_3 internal diameter of the terminal shroud

c_4 maximum overall diameter of the base of the contact area

d_{em} mean outside diameter

$d_{em,max}$ maximum mean outside diameter

$d_{em,min}$ minimum mean outside diameter

d_n nominal outside diameter

d_1 mean inside diameter in the fusion zone

d_2 bore, i.e. the minimum diameter of the flow channel through the body of the fitting

d_3 mean outside diameter of fusion end piece

d_4 mean inside mouth diameter of the socket

d_5 mean inside root diameter of the socket

E wall thickness (at any point) of a fitting or valve body

E_1 fusion face wall thickness

e wall thickness at any point

e_{min} minimum wall thickness at any point

e_n nominal wall thickness

$<G_p>$ strain hardening modulus

H height of the saddle, which comprises the distance from the top of the main pipe to the top of the tapping tee or saddle

H_1 height of service pipe, which comprises the distance from the axis of the main pipe to the axis of the service pipe

H_2 height of service pipe, which comprises the distance from the top of the main pipe to the axis of the service pipe

h internal depth of the terminal shroud

h_1 distance between the upper part of the terminal shroud and the contact area

h_2 height of the contact area

L_d percentage of decohesion (length)

L_1 depth of penetration of the pipe or male end of a spigot fitting

L_2 heated length within a socket as declared by the manufacturer to be the nominal length of the fusion zone

L_3 distance between the mouth of the fitting and the start of the fusion zone as declared by the manufacturer to be the nominal unheated entrance length of the fitting

L_4 cut-back length of fusion end piece

L_5 tubular length of fusion end piece

L_6 heated length of the fitting, i.e. the length of penetration of the heated tool into the socket

L_7 insertion depth, i.e. the depth of the heated pipe end into the socket

L_8 heated length of pipe, i.e. the depth of penetration of the pipe end into the heated tool

L_9 reference socket length, i.e. the theoretical minimum socket length used for the purpose of calculation

L_{10} actual length of the socket, i.e. the length from mouth to shoulder, if any

S pipe series

t time

W width of the tapping tee, which comprises the distance between the axis of the main pipe and the plane of the mouth of the service tee

θ temperature

σ_{LPL} lower confidence limit of the predicted hydrostatic strength

4.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

DN/OD nominal size, outside diameter-related

LPL lower predicted limit

MFR melt mass-flow rate

MOP maximum operating pressure

MRS minimum required strength

PE polyethylene

RC raised crack resistance

RCP rapid crack propagation

SDR standard dimension ratio

SHT strain hardening test

5 Material

5.1 PE compound for fittings

The stress-bearing PE parts of injection moulded fittings or compression moulded plates, for example the main body of the fitting, shall only be made from virgin material conforming to ISO 4437-1. The stress-bearing PE parts of fittings made from pipe shall conform to ISO 4437-2.

Other materials may be used for non-stress-bearing parts, e.g. clamps for electrofusion saddle fittings that only maintain a function during installation.

A fitting can only be designated as a PE 100-RC fitting if:

— it is produced from PE 100-RC materials which fulfil the requirements of ISO 4437-1:2024, Tables 1 and 2, and are declared as PE 100-RC by the raw material producer; and

— it fulfils the requirements of Table 4 of this document for PE 100-RC.

5.2 Material for non-polyethylene parts

5.2.1 General

All components shall conform to the relevant International Standards. Alternative standards may be applied in cases where International Standards do not exist. In all cases, fitness for purpose of the system of the components shall be demonstrated.

The materials and the constituent elements used in making the fitting (including elastomers and any metal parts used) shall be as resistant to the external and internal environments as the other elements of the piping system. They shall have an expected lifetime at least equal to that of the PE pipes conforming to ISO 4437-2 with which they are intended to be used under the following conditions:

a) during storage;

b) under the effect of the gas conveyed therein;

c) with respect to the service environment and operating conditions.

The requirements for the level of material performance of non-polyethylene parts shall be at least as stringent as that of the PE compound for the piping system. Reworked materials shall not be used for stress-bearing parts.

Non-stress-bearing fitting parts may be made from other materials, e.g. clamps for electrofusion saddle fittings that only maintain a function during installation.

Other materials used in fittings in contact with the PE pipe shall not adversely affect pipe performance or initiate stress cracking.

5.2.2 Metal parts

All metal parts susceptible to corrosion shall be adequately protected, providing this is necessary for the durability and function of the system.

When dissimilar metallic materials are used, steps shall be taken to avoid the possibility of galvanic corrosion.

5.2.3 Sealing materials

Elastomeric seals shall conform to ISO 16010.

Other sealing materials are permitted if proven suitable for gas supply systems.

5.2.4 Other materials

Greases or lubricants shall not exude onto fusion areas and shall not affect the long-term performance of fitting materials.

6 General characteristics

6.1 Appearance

When viewed without magnification, the internal and external surfaces of fittings shall be clean, and shall have no scoring, cavities or other surface defects to an extent that would prevent conformity to this document.

No component of the fitting shall show any signs of damage, scratches, pitting, bubbles, blisters, inclusions or cracks to an extent that would prevent conformity of the fittings to the requirements of this document.

6.2 Colour

The colour of the PE parts of the fitting shall be either black, yellow or orange in accordance with ISO 4437-1.

6.3 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe or other component, electrical coils and/or seals are not displaced.

Tapping tees may be provided with upper and lower end stops for the drill, or other means of indicating the drill position according to the manufacturer's instructions.

Tapping tees may be provided with a means to prevent uncontrolled gas release during tapping.

6.4 Appearance of factory-made joints

The internal and external surfaces of the pipe and fitting after fusion jointing, examined visually without magnification, shall be free from melt exudation outside the confines of the fitting, apart from that which may be declared acceptable by the fitting manufacturer or used deliberately as a fusion marker.

Any melt exudation shall not cause wire movement in electrofusion fittings such that it leads to short-circuiting when jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes.

6.5 Electrical characteristics for electrofusion fittings

The electrical protection that shall be provided by the fusion process depends on the voltage and the current used and on the characteristics of the electricity power source.

For voltages greater than 25 V, direct human contact with energized parts shall not be possible when the fitting is in the fusion cycle during assembly in accordance with the instructions of the manufacturers of the fittings and of the assembly equipment, as applicable.

NOTE 1 Electrofusion fittings are part of an electrical circuit when connected to the control units. Definitions of electrical circuits and applicable protections are found in the relevant IEC standards.

The tolerance on the electrical resistance of the fitting at 23 °C shall be stated by the manufacturer. The resistance shall be between nominal resistance (−10 %) and nominal resistance [(+10 %) + 0,1 Ω].

NOTE 2 0,1 Ω is the assumed value of the contact resistance.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements.

NOTE 3 See Annex B for examples of typical electrofusion terminal connections.

7 Geometrical characteristics

7.1 Measurement of dimensions

The dimensions of the fitting shall be measured in accordance with ISO 3126 and rounded to the next 0,1 mm. In case of dispute, the measurement shall be made at least 24 h after manufacture and after being conditioned for at least 4 h at (23 ± 2) °C.

Additionally, for spigot end fittings provided with temporary supports, dimensional measurement shall be performed at least 1 h after removal of the supports.

Indirect measurement at the stage of production is allowed at shorter time periods, provided that evidence is shown of correlation.

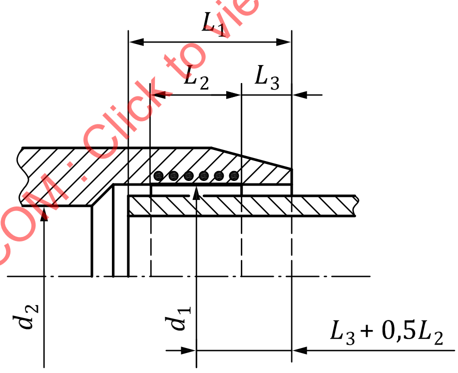
7.2 Dimensions of electrofusion socket fittings

7.2.1 Diameters and lengths of electrofusion sockets

For electrofusion sockets (see Figure 1) having a nominal diameter as given in Table 1, the socket diameter and lengths shall be given by the manufacturer and shall conform to Table 1 with the following conditions:

a) $L_3 \geq 5$ mm;

b) $d_2 \geq d_n - 2e_{min}$



Key

d_1 mean inside diameter in the fusion zone measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0,5L_2$ from that face

d_2 bore, i.e. the minimum diameter of the flow channel through the body of the fitting

L_1 depth of penetration of the pipe or male end of a spigot fitting; in case of a coupling without stop, it is not greater than half the total length of the fitting

L_2 heated length within a socket as declared by the manufacturer to be the nominal length of the fusion zone

L_3 distance between the mouth of the fitting and the start of the fusion zone as declared by the manufacturer to be the nominal unheated entrance length of the fitting

Figure 1 — Dimensions of electrofusion socket fittings

Table 1 — Dimensions of electrofusion socket fittings (see Figure 1)

Dimensions in millimetres

Nominal diameter d_n	Depth of penetration $L_{1,min}$	$L_{1,max}$ [a]	Fusion zone $L_{2,min}$
16	25	41	10
20	25	41	10
25	25	41	10
32	25	44	10
40	25	49	10
50	28	55	10
63	31	63	11
75	35	70	12
90	40	79	13
110	53	82	15
125	58	87	16
140	62	92	18
160	68	98	20
180	74	105	21
200	80	112	23
225	88	120	26
250	95	129	33
280	104	139	35
315	115	150	39
355	127	164	42
400	140	179	47
450	155	195	51
500	170	212	56
560	188	235	61
630	209	255	67
710	220	280	74
800	230	300	82

[a] An extended L_1 value may be agreed between the end user and the manufacturer. In this case, compatibility of such fittings is not given with components with a tubular length of spigots $L_{2,min}$ according to Table 3.

The mean inside diameter of the fitting in the middle of the fusion zone (see d_1 in Figure 1) shall not be less than d_n.

In the case of a fitting having sockets of differing nominal diameters, each one shall conform to the requirements for the nominal diameter of the corresponding component.

Information for non-metric series is given in Annex E.

7.2.2 Wall thicknesses

In order to prevent stress concentrations, any changes in wall thickness of the fitting body shall be gradual.

a) The wall thickness at any point of the fitting body, E, shall be greater than or equal to e_{min} for the corresponding pipe at any part of the fitting located at a distance beyond a maximum of 2/3 L_1 from all entrance faces, if the fitting and the corresponding pipe are made from a polyethylene having the same MRS.

   If the fitting is produced from a polyethylene having an MRS that is different from that of the corresponding pipe, the relation between the wall thickness of the fitting, E, and the pipe, e_{min}, shall be in accordance with Table 2.

b) In the case of a wall thickness design different from that according to a), fittings and associated fusion joints shall additionally meet the performance requirements given in 8.4.

Table 2 — Relation between fitting wall thickness, E, and pipe wall thickness, e_{min}

Pipe and fitting material		Relationship
Pipe	**Fitting**	
PE 80	PE 100 or PE 100-RC	$E \geq 0{,}8\ e_{min}$
PE 100 or PE 100-RC	PE 80	$E \geq 1{,}25\ e_{min}$

7.2.3 Out-of-roundness of the bore of a fitting (at any point)

When a fitting leaves the site of the manufacturer, the out-of-roundness of the bore of a fitting at any point shall not exceed 0,015 d_n.

7.2.4 Spigots

For fittings that contain spigot outlets (e.g. electrofusion equal tee with a spigot branch), the dimensions of the spigot shall conform to 7.4.

For technical and design reasons, the shape of the minimum bore cross-section area can be different from that of spigot fittings as given in 7.4.

7.2.5 Other dimensions

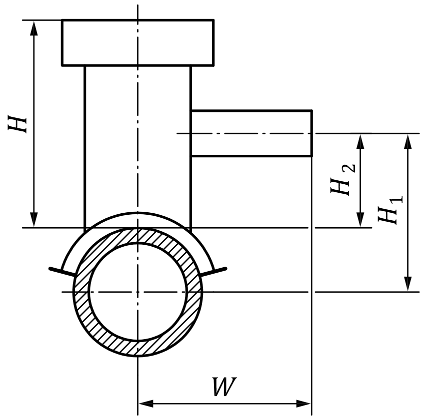
The dimensional characteristics appropriate to each manufacturer, such as the overall dimensions or mounting dimensions, shall be specified in a technical file.

In the case of a coupling without an internal stop or with a removable centre register, the geometry of the fitting shall allow the penetration of the pipe through the fitting.

7.3 Dimensions of electrofusion saddle fittings

Outlets from tapping tees and branch saddles shall have spigots in accordance with 7.4 or an electrofusion socket in accordance with 7.2. The manufacturer shall specify the overall dimensions of the fitting in a technical file. These dimensions shall include the main pipe and outlet dimensions, maximum height of the saddle, and for tapping tees the height of the service pipe, H_1 or H_2 (see Figure 2).

For technical and design reasons, the minimum bore diameter d_2 may be different from that of spigot fittings as given in 7.4.



Key

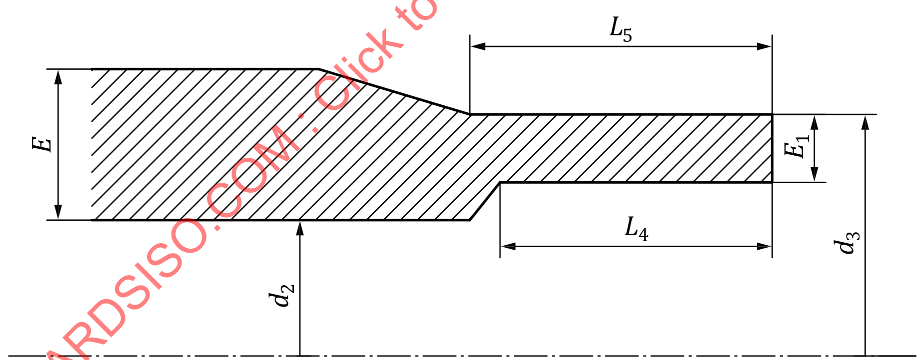
H	height of the saddle, which comprises the distance from the top of the main pipe to the top of the tapping tee or saddle
H_1	height of service pipe, which comprises the distance from the axis of the main pipe to the axis of the service pipe
H_2	height of service pipe, which comprises the distance from the top of the main pipe to the axis of the service pipe
W	width of the tapping tee, which comprises the distance between the axis of the main pipe and the plane of the mouth of the service tee

Figure 2 — Dimensions of tapping tees (electrofusion saddle fittings)

7.4 Dimensions of spigot end fittings

7.4.1 Diameters and lengths

The dimensions of spigot end fittings (see Figure 3) shall conform to the values given in Table 3.



Key

d_2	bore, i.e. the minimum diameter of the flow channel through the body of the fitting [a]
d_3	mean outside diameter of fusion end piece [b]
E	wall thickness at any point of the fitting body [c]
E_1	fusion face wall thickness [d]
L_4	cut-back length of fusion end piece [e]
L_5	tubular length of fusion end piece [f]
a	The measurement of this diameter does not include the fusion pad (if present).
b	d_3 is measured in any plane parallel to the plane of the entrance face at a distance not greater than L_5 (tubular length) from the plane of the entrance face.
c	See 7.4.3.

[d] E_1 is measured at any point at a maximum distance of L_4 (cut-back length) from the entrance face and shall be equal to the pipe wall thickness and tolerance to which it is intended to be butt-fused, as specified in ISO 4437-2. E_1 is at least 3 mm.

[e] L_4 comprises the initial depth of the spigot end necessary for butt fusion or reweld and can be obtained by joining a length of pipe to the spigot end of the fitting, provided that the wall thickness of the pipe is equal to E_1 for its entire length.

[f] L_5 comprises the initial length of the fusion end piece and shall allow the following (in any combination): the use of clamps required in the case of butt fusion, assembly with an electrofusion fitting, the use of a mechanical scraper.

Figure 3 — Dimensions of spigot end fittings

Table 3 — Diameters and lengths of spigot end fittings

Dimensions in millimetres

Nominal diameter d_n	Mean outside diameter of the fusion end		Out-of-roundness (maximum)	Minimum bore $d_{2,min}$	Cut-back length $L_{4,min}$	Tubular length [b] $L_{5,min}$
	$d_{3,min}$	$d_{3,max}$ [a]				
16	16,0	16,3	0,3	9	25	41
20	20,0	20,3	0,3	13	25	41
25	25,0	25,3	0,4	18	25	41
32	32,0	32,3	0,5	25	25	44
40	40,0	40,4	0,6	31	25	49
50	50,0	50,4	0,8	39	25	55
63	63,0	63,4	0,9	49	25	63
75	75,0	75,5	1,2	59	25	70
90	90,0	90,6	1,4	71	28	79
110	110,0	110,7	1,7	87	32	82
125	125,0	125,8	1,9	99	35	87
140	140,0	140,9	2,1	111	38	92
160	160,0	161,0	2,4	127	42	98
180	180,0	181,1	2,7	143	46	105
200	200,0	201,2	3,0	159	50	112
225	225,0	226,4	3,4	179	55	120
250	250,0	251,5	3,8	199	60	129
280	280,0	281,7	4,2	223	75	139
315	315,0	316,9	4,8	251	75	150
355	355,0	357,2	5,4	283	75	164
400	400,0	402,4	6,0	319	75	179
450	450,0	452,7	6,8	359	100	195
500	500,0	503,0	7,5	399	100	212
560	560,0	563,4	8,4	447	100	235

[a] The tolerance grades conform to ISO 11922-1:2018, Grade B.

[b] Spigot end fittings may have a shorter tubular length L_5 for factory assemblies in association with appropriate electrofusion fittings.

Table 3 *(continued)*

Nominal diameter d_n	Mean outside diameter of the fusion end		Out-of-roundness (maximum)	Minimum bore $d_{2,min}$	Cut-back length $L_{4,min}$	Tubular length [b] $L_{5,min}$
	$d_{3,min}$	$d_{3,max}$ [a]				
630	630,0	633,8	9,5	503	100	255
710	710,0	714,3	10,6	567	125	280
800	800,0	804,8	12,0	639	125	280

[a] The tolerance grades conform to ISO 11922-1:2018, Grade B.

[b] Spigot end fittings may have a shorter tubular length L_5 for factory assemblies in association with appropriate electrofusion fittings.

7.4.2 Wall thickness of the fusion end

The fusion face wall thickness of the fusion end, E_1, shall be at least equal to the minimum wall thickness of the pipe with a minimum value of 3 mm.

A thickness reduction (e.g. a chamfered edge) is permitted between the plane of the entrance face and a plane parallel to it, located at a distance not greater than (0,01 d_n + 1 mm).

The permissible tolerance of the wall thickness value, E_1, at any point shall conform to the tolerance given in ISO 4437-2:2024, Table 2, for the same wall thickness.

7.4.3 Wall thickness of the fitting body

The wall thickness of the fitting body measured at any point, E, shall be at least equal to the nominal wall thickness, e_n, of the pipe.

Any changes in wall thickness inside the body of the fitting shall be gradual in order to prevent stress concentrations.

7.4.4 Other dimensions

The dimensional characteristics appropriate to each manufacturer, such as overall dimensions or clamping requirements, shall be stated in a technical file.

7.5 Dimensions of socket fusion fittings

The dimensions of socket fusion fittings shall conform to Annex A.

7.6 Design and dimensions of mechanical fittings

7.6.1 General

Mechanical fittings shall conform to ISO 17885 for application in gas supply systems. They shall be capable of assembly onto a PE pipe conforming to ISO 4437-2, using instructions provided by the manufacturer.

If the insertion depth of the mechanical fitting does not allow for assembly with a spigot end according to this document, this shall be mentioned in the manufacturer's instructions.

The fittings shall not be assembled by thread cutting the PE pipe.

The fitting and tools should be designed to avoid any damage that can affect the performance of the assembly.

A stiffener can be used if required to provide a permanent support for a PE pipe to prevent creep in the pipe wall under radial compressive forces (see ISO 17885:2021, Annex B).

The fitting can allow either a dismountable or permanently assembled joint.

7.6.2 Mechanical fittings with polyethylene spigot ends

Polyethylene spigot ends shall conform to 7.4.

7.6.3 Mechanical fittings with polyethylene electrofusion sockets

Electrofusion sockets shall conform to 7.2.

7.6.4 Threads

Threads on metal ends shall conform to ISO 7-1 or ISO 228-1, as applicable.

8 Mechanical characteristics

8.1 General

Fittings shall be tested using pipes which conform to ISO 4437-2.

Jointed pipe and fitting test pieces shall be assembled in accordance with the technical instructions of the manufacturer. They shall take into account the manufacturing and assembly tolerances, and the extreme conditions of utilization described in ISO 4437-5.

8.2 Requirements

Each assembly shall be prepared from components (pipes and fittings) of the same pressure class.

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 4.

When tested in accordance with the test methods as specified in Table 4 using the indicated parameters, the fittings shall have mechanical characteristics conforming to the requirements given in Table 4 as applicable to the following types of fitting:

— (A) electrofusion socket fitting and socket fusion fitting;

— (B) electrofusion saddle fitting;

— (C) spigot end fitting.

For mechanical fittings, the requirements of ISO 17885 shall apply.

For testing mechanical fittings in accordance with ISO 17885, the nominal pressure is determined by the MOP declared by the manufacturer multiplied by 1,6.

Table 4 — Mechanical characteristics

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 100 h)	No failure during the test period of any test piece	End caps	Type A of ISO 1167-1:2006	ISO 1167-1:2006 and ISO 1167-4
		Orientation	Free	
		Conditioning time at test temperature	Shall conform to ISO 1167-1:2006	
		Number of test pieces [a]	3	
		Type of test [b]	Water internal and water external to the test piece (“water-in-water”)	
		Circumferential (hoop) stress [c] in pipe for: PE 80 PE 100 and PE 100-RC	 10,0 MPa [m] 12,0 MPa	
		Test period	≥ 100 h	
		Test temperature	20 °C	
Hydrostatic strength (80 °C, 165 h)	No failure during the test period of any test piece	End caps	Type A of ISO 1167-1:2006	ISO 1167-1:2006 and ISO 1167-4
		Orientation	Free	
		Conditioning time at test temperature	Shall conform to ISO 1167-1:2006	
		Number of test pieces [a]	3	
		Type of test [b]	Water internal and water external to the test piece (“water-in-water”)	
		Circumferential (hoop) stress [c] in pipe for: PE 80 PE 100 and PE 100-RC	 4,5 MPa 5,4 MPa	
		Test period [d]	≥ 165 h	
		Test temperature	80 °C	
Hydrostatic strength (80 °C, 1 000 h)	No failure during the test period of any test piece	End caps	Type A of ISO 1167-1:2006	ISO 1167-1:2006 and ISO 1167-4
		Orientation	Free	
		Conditioning time	Shall conform to ISO 1167-1:2006	
		Number of test pieces [a]	3	
		Type of test [b]	Water internal and water external to the test piece (“water-in-water”)	
		Circumferential (hoop) stress [c] in pipe for: PE 80 PE 100 and PE 100-RC	 4,0 MPa 5,0 MPa	
		Test period	≥ 1 000 h	
		Test temperature	80 °C	

Table 4 *(continued)*

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
Resistance to SCG for PE 100-RC Strain-hardening test (SHT) [l]	$<G_p>$ ≥ 50,0 MPa	Test sample [k]	Compression moulded sheet made from regrind from fitting body	ISO 18488
		Test temperature	80 °C	
		Thickness	300 µm	
		Test speed	Shall conform to ISO 18488	
		Number of test pieces	Shall conform to ISO 18488	
Decohesive resistance (A)	Length of initiation rupture ≤ $1/3L_2$ in brittle failure [e]	Test temperature	23 °C	ISO 13954 [g h]
		Test speed	25 mm/min	
		Number of test pieces [a, f]	Shall conform to ISO 13954	
		Test temperature	23 °C	ISO 13955 [g, h]
		Test speed	100 mm/min	
		Number of test pieces [a]	Shall conform to ISO 13955	
Evaluation of ductility of fusion joint interface (B)	Surface of rupture L_d ≤ 50 % and A_d ≤ 25 % [i] brittle failure	Test temperature	23 °C	ISO 13956 [g]
		Number of test pieces [a, f]	Shall conform to ISO 13956	
Tensile strength for butt fusion (C) [j]	Test to failure: — ductile: pass — brittle: fail	Test temperature	23 °C	ISO 13953
		Number of test pieces [a, f]	Shall conform to ISO 13953	
Impact resistance (B) Tapping tees	No failure, no leakage	Test temperature	0 °C	ISO 13957
		Test pressure	25 mbar	
		Falling height	2 m	
		Mass of the striker	2,5 kg	
		Number of test pieces [a]	1	
Pressure drop (B)	Air flow rate (value indicated by the manufacturer)	Test medium	Air source	ISO 17778
		Test pressure	25 mbar	
		Pressure drop: for d_n ≤ 63 mm for d_n > 63 mm	 0,5 mbar 0,1 mbar	
		Number of test pieces [a]	1	

Table 4 *(continued)*

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	

[a] The number of test pieces given indicates the number required to establish a value for the characteristic described in this table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. Guidance on assessment of conformity can be found in CEN/TS 1555-7.[11]

[b] Alternatively, for d_n > 450 mm, the test may be carried out in air. In case of dispute, the water-in-water test shall be used. For fitting type (B) d_n > 450 mm, alternative testing is allowed (e.g. pressurization through saddle outlet).

[c] The test pressure shall be calculated using the design SDR of the fitting.

[d] Only brittle failures shall be taken into account. If a ductile failure occurs before 165 h, the test can be repeated according to Table 5.

[e] Longest length of brittle failure in any of the test samples.

[f] The test sample can be mechanically reduced in wall thickness for the testing purpose of large diameter fittings by keeping a minimum of 15 mm wall thickness of each component.

[g] For type A and type B fittings, alternatively the strip-bend test in accordance with ISO 21751 may be used.

[h] In case of dispute, ISO 13954 shall apply.

[i] In case of use of the strip-bend test in accordance with ISO 21751, only the L_d requirement of ≤ 50 % shall be considered.

[j] Applicable to d_n 90 mm and above.

[k] The sample for the SHT shall be taken across the fitting wall or the whole circumference in case of small diameter. The outer surface shall be scraped to remove any contamination present before regrinding.

[l] This test only applies to PE 100-RC materials.

[m] If the predicted value at (20 °C, 100 h) in accordance with ISO 9080 for a PE 80 material is less than 10,0 MPa, the control point stress value 9,0 MPa at (20 °C, 100 h) can be used.

Table 5 — Test parameters for the retest of the hydrostatic strength at 80 °C

PE 80		PE 100 and PE 100-RC	
Stress MPa	Minimum test period h	Stress MPa	Minimum test period h
4,5	165	5,4	165
4,4	233	5,3	256
4,3	331	5,2	399
4,2	474	5,1	629
4,1	685	5,0	1 000
4,0	1 000	—	—

8.3 Modifications of the fitting

In the event of modification of the fitting or jointing parameters, the manufacturer shall ensure that the joint conforms to the requirements given in this document.

NOTE Guidance on assessment of conformity depending on the modification can be found in CEN/TS 1555-7.[11]

8.4 Performance requirements

Where 7.2.2 b) applies, electrofusion socket fittings shall, additionally, be in accordance with Table 6.

Table 6 — Performance requirements

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
Short-term internal pressure resistance	The failure pressure shall be greater than the pressure equivalent to 2 × MRS, calculated for the thickest-walled pipe for which the fitting has been designed.	Test piece	See Annex C	Annex C
		End caps	Type A of ISO 1167-1:2006	
		Orientation	Free	
		Conditioning time at the test temperature	According to Annex C	
		Type of test	Water internal and water external to the test piece ("water-in-water")	
		Minimum pressure: [a] PE 80 pipe, SDR 11 PE 100 pipe, SDR 11 PE 100-RC pipe, SDR 11	 32 bar 40 bar 40 bar	
		Pressure increase rate	According to Annex C	
		Test temperature	According to Annex C	
Resistance to tensile load	No leakage or failure of the fusion joint after 25 % elongation of the test piece	Test temperature	23 °C	Annex D

[a] Examples for SDR11 only. Other SDR pipes will have different pressures.

NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

9 Physical characteristics

9.1 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 7.

9.2 Requirements

When tested in accordance with the test methods as specified in Table 7 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 7.

Table 7 — Physical characteristics

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
Oxidation induction time (thermal stability)	≥ 10 min	Test temperature	210 °C [b]	ISO 11357-6
		Number of test pieces [a]	3	
		Test environment	Oxygen	
		Specimen mass	(15 ± 2) mg	
Melt mass-flow rate (MFR)	After processing maximum deviation of ±20 % of the value measured on the batch used to manufacture the fitting [c]	Loading mass	5 kg	ISO 1133-1
		Test temperature	190 °C	
		Time	10 min	
		Number of test pieces [a]	Shall conform to ISO 1133-1	

[a] The number of test pieces given indicates the number required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. Guidance on assessment of conformity can be found in CEN/TS 1555-7.[11].

[b] Alternatively, the test may be carried out at 200 °C with a minimum requirement of ≥ 20 min. In case of dispute, testing at 210 °C is applicable. The sample thickness is free and not in accordance with ISO 11357-6.

[c] Value as measured on the fitting relative to the value measured on the compound used. The value given by the material supplier can be used, but in case of dispute, the measurement on granules shall be carried out by the fitting manufacturer.

10 Performance requirements

When fittings conforming to this document are assembled to each other or to components conforming to other parts of the ISO 4437 series, the joints shall conform to ISO 4437-5.

11 Technical information

The manufacturer of the fittings shall ensure the availability of technical information, which shall include:

a) field of application (e.g. gas);

b) temperature limits for processing during installation;

c) maximum operating pressure (MOP) as declared by the manufacturer;

d) applicable SDR fusion range of pipe;

e) maximum allowed out-of-roundness (ovality) of the pipe at installation;

f) assembly instructions (for socket fittings, saddle fittings, tapping tees, etc.) including the tools required and an explanation of the traceability coding;

g) fusion instructions.

12 Marking

12.1 General

12.1.1 Unless otherwise stated in Table 8, the marking elements shall be printed or formed directly on the fitting in such a way that after storage, weathering, handling and installation, legibility is maintained during the use of the fitting.

NOTE The manufacturer is not responsible for marking being illegible due to actions caused during installation and use such as painting, scratching, covering of the components or using detergents, etc. on the components unless agreed or specified by the manufacturer.

12.1.2 Marking shall not initiate cracks or other types of defects which adversely influence the performance of the fitting.

12.1.3 If printing is used, the colour of the printed information shall differ from the basic colour of the fitting.

12.1.4 The size of the marking shall be such that it is legible without magnification.

12.1.5 There shall be no marking over the minimum tubular length of spigot end fittings.

12.2 Minimum required marking of fittings

The minimum required marking shall conform to Table 8.

Table 8 — Minimum required marking

Aspects	Mark or symbol
Reference to the ISO 4437 series [a] Manufacturer's name and/or trademark	ISO 4437 Name or symbol
Nominal outside diameter(s) of pipe, d_n	e.g. 110
Designation Design application series (i.e. design SDR) Applicable SDR fusion range of pipe [a] Manufacturer's information [c] Intended use [a, b]	e.g. PE 100 PE 100-RC [a] e.g. SDR 11 e.g. SDR 11 to SDR 26 e.g. GAS

[a] This information may be printed on a label associated with the fitting or on an individual bag.

[b] Information on abbreviated terms is given in CEN/TR 15438[12] and/or in national rules.

[c] For providing traceability, the following details shall be given:

— the production period, year and month, in figures or in code;

— a name or code for the production site if the manufacturer is producing the same product at different sites.

NOTE ISO 12176-4 and ISO 12176-5 provide coded information about traceability.

12.3 Additional marking

Additional information relative to the fusion conditions (e.g. fusion and cooling time) and to the assembly torque, only for mechanical fittings, may appear on a label, which may be attached to a fitting or may be separate from the fitting.

12.4 Fusion system recognition

Fusion fittings should have a system, whether numerical, electromechanical or self-regulatory as described in ISO 13950 or ISO 12176-5, for recognizing the fusion parameters to facilitate the fusion process.

When automatic recognitions systems for electrofusion fittings are used, they shall be in accordance with ISO 13950 and/or ISO 12176-5.

13 Delivery conditions

The fittings shall be packaged in bulk or individually protected where necessary in order to prevent deterioration. Whenever possible, they shall be placed in individual bags, cardboard boxes or cartons.

Constituents of fitting packaging shall not create contamination which can prevent normal jointing.

The cartons and/or individual bags shall bear at least one label with the manufacturer’s name, type and dimensions of the part, number of units in the box, and any special storage conditions and storage time limits if any.

It is recommended that fittings are stored in their original packing until ready for installation.

Annex A
(normative)

Socket fusion fittings

The dimensions of socket fusion fittings (Figure A.1) shall conform to Tables A.1 and A.2. The diameter at the root shall not be greater than the diameter at the mouth.

Table A.1 — Socket dimensions for fittings — nominal sizes 16 to 63 inclusive

Dimensions in millimetres

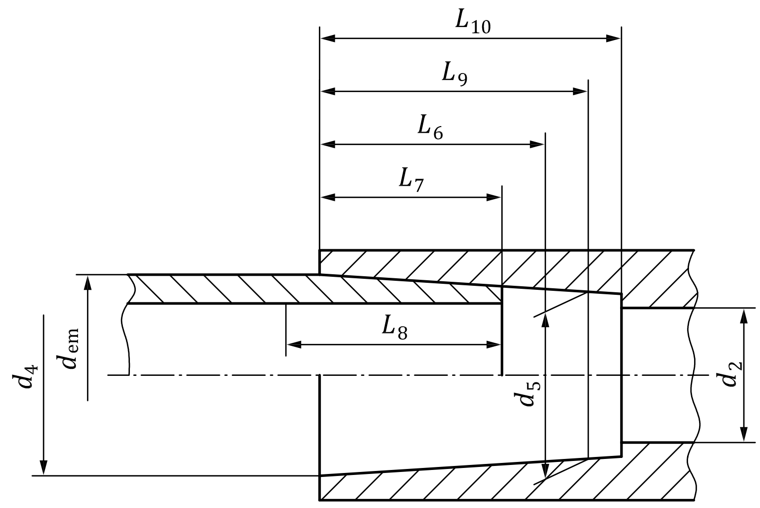
Nominal size DN/OD	Nominal inside diameter of socket	Mean inside diameter of socket				Out-of-roundness	Min. bore	Socket reference length	Heated socket length		Penetration of pipe into socket	
		Mouth		Root					$(L_9 - 2,5)$	(L_9)	$(L_9 - 3,5)$	$(L_9 - 1)$
		$d_{4,min}$	$d_{4,max}$	$d_{5,min}$	$d_{5,max}$	max.	d_2	$L_{9,min}$	$L_{6,min}$	$L_{6,max}$	$L_{7,min}$	$L_{7,max}$
16	16	15,2	15,5	15,1	15,4	0,4	9	13,3	10,8	13,3	9,8	12,3
20	20	19,2	19,5	19,0	19,3	0,4	13	14,5	12,0	14,5	11,0	13,5
25	25	24,1	24,5	23,9	24,3	0,4	18	16,0	13,5	16,0	12,5	15,0
32	32	31,1	31,5	30,9	31,3	0,5	25	18,1	15,6	18,1	14,6	17,1
40	40	39,0	39,4	38,8	39,2	0,5	31	20,5	18,0	20,5	17,0	19,5
50	50	48,9	49,4	48,7	49,2	0,6	39	23,5	21,0	23,5	20,0	22,5
63	63	62,0[a]	62,4[a]	61,6	62,1	0,6	49	27,4	24,9	27,4	23,9	26,4

[a] Where re-rounding clamps are used, the maximum diameter of 62,4 mm can be increased by 0,1 mm to 62,5 mm. Conversely, where a peeling technique is used, the minimum diameter of 62,0 mm can be reduced by 0,1 mm to 61,9 mm.

Table A.2 — Socket dimensions for fittings — nominal sizes 75 to 125 inclusive

Dimensions in millimetres

Nominal size DN/OD	Nominal inside diameter of socket	Mean inside diameter of socket				Out-of-roundness	Min. bore	Socket reference length	Heated socket length		Penetration of pipe into socket	
		Mouth		Root					(L_9-4)	(L_9)	(L_9-5)	(L_9-1)
	d_n	$d_{4,min}$	$d_{4,max}$	$d_{5,min}$	$d_{5,max}$		d_2	$L_{9,min}$	$L_{6,min}$	$L_{6,max}$	$L_{7,min}$	$L_{7,max}$
75	75	74,3	74,8	73,0	73,5	0,7	59	30	26	30	25	29
90	90	89,3	89,9	87,9	88,5	1,0	71	33	29	33	28	32
110	110	109,4	110,0	107,7	108,3	1,0	87	37	33	37	32	36
125	125	124,4	125,0	122,6	123,2	1,0	99	40	36	40	35	39



Key

d_2 bore, i.e. the minimum diameter of the flow channel through the body of the fitting

d_4 mean inside mouth diameter of the socket, i.e. the mean diameter of the circle at the intersection of the extension of the socket with the plane of the socket mouth

d_5 mean inside root diameter of the socket, i.e. the mean diameter of the circle in a plane parallel to the plane of the mouth and separated from it by a distance of L_9 which is the reference length of the socket

L_6 heated length of the fitting, i.e. the length of penetration of the heated tool into the socket

L_7 insertion depth, i.e. the depth of the heated pipe end into the socket

L_8 heated length of pipe, i.e. the depth of penetration of the pipe end into the heated tool

L_9 reference socket length, i.e. the theoretical minimum socket length used for the purpose of calculation

L_{10} actual length of the socket, i.e. the length from mouth to shoulder, if any

d_{em} mean outside diameter of the pipe

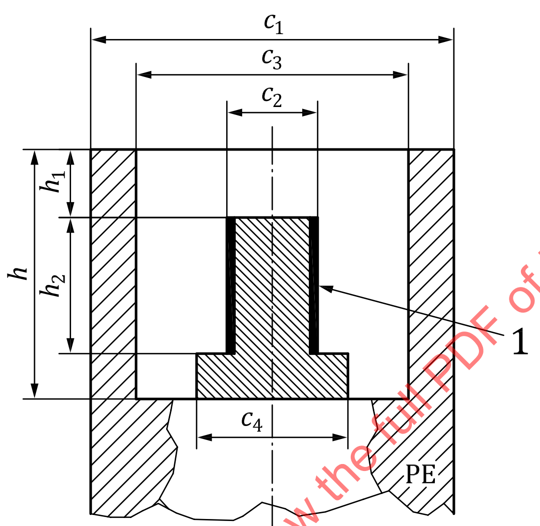
Figure A.1 — Socket and pipe — symbols for dimensions

Annex B
(informative)

Examples of typical terminal connections for electrofusion fittings

B.1 Figures B.1 and B.2 illustrate examples of terminal connections suitable for use with voltages ≤ 48 V (types A and B).

Dimensions in millimetres



Key

1	contact area	
c_1	outside diameter of the terminal shroud	$c_1 \geq 11{,}8$
c_2	diameter of the contact area of the terminal	$c_2 = 4{,}00 \pm 0{,}1$
c_3	internal diameter of the terminal shroud	$c_3 = 9{,}5 \pm 1{,}0$
c_4	maximum overall diameter of the base of the contact area	$c_4 \leq 6{,}0$
h	internal depth of the terminal shroud	$h \geq 12{,}0$
h_1	distance between the upper part of the terminal shroud and the contact area	$h_1 = 3{,}2 \pm 0{,}5$
h_2	height of the contact area	$h_2 \geq 7$ $h_2 \leq h - h_1$.

Figure B.1 — Typical type A connection