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Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) —

Part 3: Fittings

Systèmes de canalisations en plastique destinés à l'alimentation en eau et aux branchements et collecteurs d'assainissement sous pression — Polyéthylène (PE) —

Partie 3: Raccords

Reference number
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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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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, fitting and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

This second edition cancels and replaces the first edition (ISO 4427-3:2007), which has been technically revised.

The main changes compared to the previous edition are:

— Update of the normative references;

— Technical consistency with ISO 4437-3 (see Reference [1] in the Bibliography).

A list of all parts in the ISO 4427 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 4427 series of standards are a set of system standards that specify the requirements for a piping system and its components when made from polyethylene (PE). The piping system is intended to be used in buried or above ground applications, for the conveyance of water for human consumption, raw water prior to treatment, drainage and sewerage under pressure, vacuum sewer systems, and water for other purposes.

In respect of potential adverse effects on the quality of water intended for human consumption caused by the products covered by the ISO 4427 series, it does not provide information on the restriction on the use of products.

NOTE Guidance for assessment of conformity can be found in Reference [2] in the Bibliography.

Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) —

Part 3: Fittings

1 Scope

This document specifies the fittings made from polyethylene (PE) for buried or above ground applications, intended for the conveyance of water for human consumption, raw water prior to treatment, drainage and sewerage under pressure, vacuum sewer systems, and water for other purposes.

NOTE 1 The intended uses include sea outfalls, laid in water and connection between pipes suspended below bridges.

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

In conjunction with the other parts of the ISO 4427 series, this document is applicable to PE fittings, to joints with components of PE or other materials, intended to be used under the following conditions:

a) a maximum allowable operating pressure (PFA) up to and including 25 bar[1)];

b) an operating temperature of 20 °C as the reference temperature.

NOTE 2 For other operating temperatures, guidance is given in ISO 4427-1:2019, Annex A.

This document covers a range of maximum allowable operating pressures and gives requirements concerning colours.

NOTE 3 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and installation practices or codes.

This document is applicable to fittings of the following types:

1. fusion fittings;
    a. electrofusion fittings;
    b. spigot end fittings (for butt fusion using heated tools and electrofusion socket fusion);
    c. socket fusion fittings (see Annex A);
2. mechanical fittings;
    a. compression fittings;
    b. flanged fittings;
3. fabricated fittings (see 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 1167-3, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 3: Preparation of components*

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 4427-1, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 1: General*

ISO 4427-2, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 2: Pipes*

ISO 4427-5, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

ISO 4433-1, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 1: Immersion test method*

ISO 4433-2, *Thermoplastics pipes — Resistance to liquid chemicals — Classification — Part 2: Polyolefin pipes*

ISO 9624, *Thermoplastics pipes for fluids under pressure — Mating dimensions of flange adapters and loose backing flanges Thermoplastics pipes for fluids under pressure — Mating dimensions of flange adapters and loose backing flanges*

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

ISO 12176-1, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*

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

EN 681-1:1996, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4427-1 and the following apply.

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

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

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

3.1
electrofusion socket fitting
polyethylene (PE) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realize a fusion joint with a spigot end or pipe

3.2
electrofusion saddle fitting
polyethylene (PE) fitting which contains one or more integral heating elements that are capable of transforming electrical energy into heat to realize a fusion joint onto a pipe

3.2.1
tapping tee
electrofusion saddle fitting (top-loading or wraparound) which contains an integral cutter used for cutting through the wall of the main pipe, which remains in the body of the tapping tee after installation

3.2.2
branch saddle
electrofusion saddle fitting (top-loading or wraparound) which requires an ancillary cutting tool for drilling the hole in the adjoining main pipe

3.3
spigot end fitting
polyethylene (PE) fitting where the outside diameter of the spigot length is equal to the nominal outside diameter, d_n, of the corresponding pipe

3.4
socket fusion fitting
polyethylene (PE) fitting where the socket mouth is designed to be fusion-jointed with a spigot end or a pipe using heated tools

3.5
fabricated fitting
fitting produced from pipe conforming to ISO 4427-2 and/or from injection-moulded fittings in accordance with this document

3.6
mechanical fitting
fitting, that generally includes a compression part to provide pressure integrity, leaktightness and resistance to end loads, for assembling polyethylene (PE) pipe to another PE pipe or any other element of the piping system

Note 1 to entry: The fitting can create a radial compressive force (compression fitting) or an axial compressive force (flange connection).

Note 2 to entry: A pipe-supporting sleeve providing a permanent support for a polyethylene (PE) pipe to prevent creep in the pipe wall under radial compressive forces, can be applicable. In some cases, the supporting sleeve contributes to end load resistance.

Note 3 to entry: The fitting can allow either a dismountable or permanently assembled joint.

Note 4 to entry: The mechanical fitting can be supplied for field assembly or pre-assembled by the manufacturer.

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 4427-1 apply.

5 Material

5.1 PE compound

The PE compound from which the fittings are made shall be in accordance with ISO 4427-1.

The stress bearing PE parts of injection moulded fittings shall only be made from virgin material.

Non-stress bearing PE parts shall be made from virgin material or own reprocessed material from a compound with the same MRS or a mixture of both materials.

NOTE Since PE 40 is not commonly used for pressure applications, it is the intention of ISO/TC 138/SC 2 to withdraw all references to this compound at the next revision of the ISO 4427 series (all parts).

5.2 Material for non-polyethylene parts

5.2.1 General

The materials and constituent elements used in making the fitting (including elastomers and any metal parts) shall be as resistant to the external and internal environments as the other elements of the piping system and shall have a life expectancy under the following conditions at least equal to that of the PE pipe conforming to ISO 4427-2 with which they are intended to be used:

a) during storage;

b) under the effect of the fluids being conveyed;

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

Other materials used in fittings and in contact with the PE pipe (e.g. greases) shall not adversely affect the pipe performance or initiate stress cracking.

5.2.2 Metal parts

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

When dissimilar metallic parts are used which may be in contact with moisture, appropriate actions shall be taken to avoid galvanic corrosion.

5.2.3 Elastomers

Elastomeric materials used for the manufacture of seals shall conform to EN 681-1.

5.2.4 Other materials

Greases or lubricants shall not exude on to the fusion areas and shall not affect the long-term performance of the pipes and fittings nor have any adverse effect on the quality of the water.

6 General characteristics

6.1 Appearance

When viewed without magnification, the internal and external surfaces of the fitting shall be smooth, clean and free from scoring, cavities and other surface defects such as would prevent conformity of the fitting to this document.

6.2 Design

The design of the fitting shall be such that, when assembling the fitting onto the pipe or other components in accordance with the manufacturer's recommendations, the electrical coils and/or seals are not displaced.

6.3 Colour

The PE part of fitting shall be either black or blue. For fabricated fittings, the colour characteristics of pipes shall be in accordance with ISO 4427-2.

The blue colour is intended for the conveyance of water for human consumption only.

For above-ground installations, all components other than black should be protected from direct UV light.

6.4 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 The fitting during the fusion process is part of an electrical system as defined in EN 60335–1, HD 60364–1, and IEC 60449 (References [3], [4] and [5] in the Bibliography).

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 C for the examples of typical electrofusion terminal connections.

6.5 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 as a fusion marker.

There shall be no wire movement leading to short circuiting when the electrofusion fittings are jointed in accordance with the manufacturer's instructions. There shall be no excessive creasing of the internal surfaces of the adjoining pipes or spigots.

6.6 Effect on water quality

For fittings to be used in contact with water intended for human consumption, see ISO 4427-1.

7 Geometrical characteristics

7.1 Measurement of dimensions

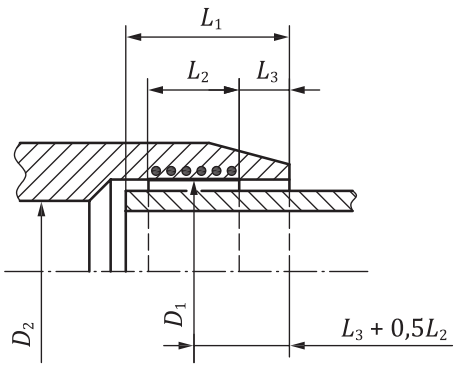
The dimensions of the fittings shall be measured in accordance with ISO 3126. In case of dispute, the measurement of dimensions shall be made not less than 24 h after manufacture and after conditioning for at least 4 h at (23 ± 2) °C.

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

When measured in accordance with 7.1, the diameters and lengths of electrofusion sockets (see Figure 1) shall be in accordance with Table 1.



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 $L_3 + 0{,}5L_2$

D_2 bore, which is the minimum diameter of the flow channel through the body of the fitting where $D_2 \geq (d_n - 2e_{min})$

L_1 "design penetration depth" 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 where L_3 shall be ≥ 5 mm

Figure 1 — Dimensions of electrofusion sockets

Table 1 — Electrofusion socket dimensions

Dimensions in millimetres

Nominal diameter of the fitting	Depth of penetration		Fusion zone
d_n	$L_{1,min}$	$L_{1,max}$	$L_{2,min}$
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

The mean inside diameter of the fitting in the middle of the fusion zone (see D_1 in Figure 1) shall be not less than d_n.

The manufacturer shall declare the actual minimum and maximum values of D_1 and determine their suitability for joint assembly and check the fitness for purpose of the fitting by testing in accordance with ISO 4427-5.

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.

7.2.2 Wall thickness

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

a) The wall thickness of the body of the fitting at any point, 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 $2L_1/3$ from all entrance faces if the fitting and the corresponding pipe are made from a polyethylene having the same MRS.