INTERNATIONAL STANDARD

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Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply —

Part 3: **Fittings**

Systèmes de canalisations en plastique — Tubes et raccords en polyéthylène (PE) destinés à l'alimentation en eau

Partie 3: Raccords

Reference number
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Contents

Page

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.

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 4427-3 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

ISO 4427 consists of the following parts, under the general title *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 5: Fitness for purpose of the system*

Introduction

ISO 4427, the system standard, specifies the requirements for a piping system and its components when made from polyethylene (PE). The piping system is intended to be used for water supply intended for human consumption, including the conveyance of raw water prior to treatment and that of water for general purposes.

In respect of potential adverse effects on the quality of water intended for human consumption caused by the products covered by ISO 4427:

a) ISO 4427 provides no information as to whether the products may be used without restriction;

b) existing national regulations concerning the use and/or the characteristics of these products are in force.

NOTE Guidance for assessment of conformity can be found in Bibliographical references [8] and [9].

Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply —

Part 3: Fittings

1 Scope

This part of ISO 4427 specifies the general aspects of fittings made from polyethylene (PE) for piping systems intended for the conveyance of water for human consumption, including raw water prior to treatment and water for general purposes.

It also specifies the test parameters for the test methods to which it refers.

In conjunction with the other parts of ISO 4427, it is applicable to PE fittings, their joints, to joints with components of PE and to joints with mechanical fittings of other materials, intended to be used under the following conditions:

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

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

NOTE 1 For applications operating at constant temperatures greater than 20 °C and up to 40 °C, see ISO 4427-1:2007, Annex A.

NOTE 2 ISO 4427 covers a range of maximum operating pressures and gives requirements concerning colours and additives. 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 guidance or regulations and installation practices or codes.

It is applicable to fittings of the following types:

— fusion fittings — electrofusion fittings, butt fusion fittings and socket fusion fittings (see Annex A);

— fabricated fittings (see Annex B);

— mechanical fittings;

— flanged fittings.

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

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 1133:2005, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics* [2)]

ISO 1167-1, *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 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 4427-1:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 1: General*

ISO 4427-2:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 2: Pipes*

ISO 4427-5, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — 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*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)* [3)]

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

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2) Under revision.

3) To be published. (Revision of ISO 11357-6:2002)

ISO 14236, *Plastics pipes and fittings — Mechanical-joint compression fittings for use with polyethylene pressure pipes in water supply systems*

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

EN 681-2:2000, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers*

3 Terms, definitions, symbols and abbreviated terms

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

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 produce a fusion 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 part of ISO 4427

3.6
mechanical fitting
fitting used for assembling a polyethylene (PE) pipe to another PE pipe or any other element of the piping system

NOTE 1 The mechanical fitting can be supplied for field assembly or pre-assembled by the manufacturer and generally includes a compression part to provide pressure integrity, leaktightness and resistance to end loads. A support sleeve inserted into the pipe bore provides a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces.

NOTE 2 The metallic parts of the fitting can be assembled to metallic pipes by using screw threads, compression joints, welded or flanged connections including PE flanges. The fitting can allow either a dismountable or permanently assembled joint. In some cases, the supporting ring can also act as a grip ring.

3.7
voltage regulation
control of energy supplied during the fusion process of an electrofusion fitting by means of the voltage parameter

3.8
intensity regulation
control of energy supplied during the fusion process of an electrofusion fitting by means of the current parameter

4 Material

4.1 PE compound

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

4.2 Material for non-polyethylene parts

4.2.1 General

The materials and constituent elements used in making the fitting (including elastomers, greases 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) taking account of the service environment and operating conditions.

The requirements for the level of material performance for non-polyethylene parts shall be at least as stringent as that of the PE compound for the piping system.

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

4.2.2 Metal parts

All parts susceptible to corrosion shall be adequately protected.

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

4.2.3 Elastomers

Elastomeric materials used for the manufacture of seals shall conform to EN 681-1 or EN 681-2, as applicable.

4.2.4 Other materials

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

5 General characteristics

5.1 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 part of ISO 4427.

5.2 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.

5.3 Colour

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

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

5.4 Electrical characteristics for electrofusion fittings

The electrical protection to be provided by the system depends on the voltage and the current strength used and on the characteristics of the electricity power.

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

NOTE 1 This type of fitting is a part of an electrical system as defined in IEC 60335-1, IEC 60364-1 and IEC 60449. Protection against direct contacts with active parts (live conductors) is required for conformity with IEC 60529. This protection is a function of the work site conditions.

NOTE 2 See Annex C for examples of typical electrofusion terminal connectors.

The surface finish of the terminal pins shall allow a minimum contact resistance in order to satisfy the resistance tolerance requirements (nominal value ± 10 %).

5.5 Appearance of factory-made joints

The following requirements apply only to joints and fittings made or assembled in the factory.

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.

Any melt exudation shall not cause wire movement in electrofusion fittings leading 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 or spigots.

5.6 Effect on water quality

Attention is drawn to the requirements of national regulations (see also the Introduction). See ISO 4427-1:2007, Clause 5.

6 Geometrical characteristics

6.1 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.

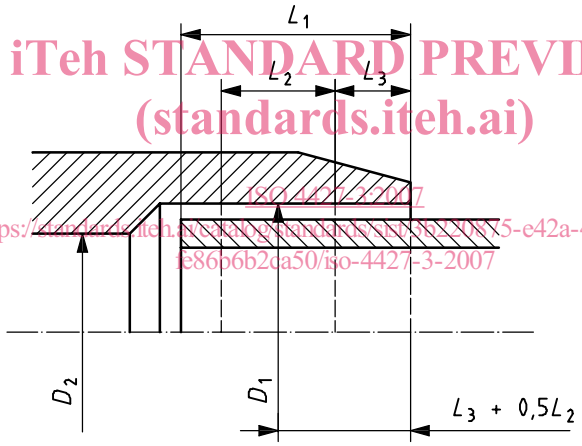
6.2 Dimensions of electrofusion sockets

6.2.1 Diameters and lengths of electrofusion sockets

When measured in accordance with 6.1, the diameters and lengths of electrofusion sockets (see Figure 1) shall be in accordance with Table 1.

The mean inside diameter of the fitting in the middle of the fusion zone, D_1, shown in Figure 1, shall not be less than d_n. The manufacturer shall declare the actual maximum and minimum values of D_1 and L_1 for determining suitability for clamping and joint assembly.

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



Key

D_1 mean inside diameter in fusion zone [a]
D_2 bore that is minimum diameter of flow channel through body of fitting [b]
L_1 depth of penetration of pipe or male end of spigot fitting [c]
L_2 heated length within socket [d]
L_3 distance between mouth of fitting and start of fusion zone [e]

[a] D_1 is measured in a plane parallel to the plane of the mouth at a distance of $L_3 + 0{,}5L_2$.
[b] $D_2 \geqslant (d_n - 2e_{min})$.
[c] In the case of a coupling without a stop, it is not greater than half the total length of the fitting.
[d] As declared by the manufacturer to be the nominal length of the fusion zone.
[e] As declared by the manufacturer to be the nominal unheated entrance length of the fitting. L_3 shall be $\geqslant$ 5 mm.

Figure 1 — Dimensions of electrofusion sockets