INTERNATIONAL STANDARD

ISO 4427-1

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

Part 1: General

Systèmes de canalisations en plastique — Tubes et raccords en polyéthylène (PE) destinés à l'alimentation en eau —
Partie 1: Généralités

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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.

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 4427-1 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*.

This first edition, together with ISO 4427-2, cancels and replaces ISO 4427:1996, of which it constitutes a technical revision.

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 [9] and [10].

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

Part 1: General

1 Scope

This part of ISO 4427 specifies the general aspects of polyethylene (PE) piping systems (mains and service pipes) 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 pipes, fittings, their joints and to mechanical joints with components 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 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.

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 3:1973, *Preferred numbers — Series of preferred numbers*

ISO 472, *Plastics — Vocabulary*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

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

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^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 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method*

ISO 4065:1996, *Thermoplastics pipes — Universal wall thickness table*

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

ISO 4427-3:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 3: Fittings*

ISO 4427-5:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 5: Fitness for purpose of the system*

ISO 6259-1:1997, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 6259-3:1997, *Thermoplastics pipes — Determination of tensile properties — Part 3: Polyolefin pipes*

ISO 6964:1986, *Polyolefin pipes and fittings — Determination of carbon black content by calcination and pyrolysis — Test method and basic specification*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

ISO 11357-6:2002, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time*

ISO 11414, *Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion*

ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification and designation — Overall service (design) coefficient*

ISO 13479:1997, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes (notch test)*

ISO 13761:1996, *Plastics pipes and fittings — Pressure reduction factors for polyethylene pipeline systems for use at temperatures above 20 °C*

ISO 13953:2001, *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 16871, *Plastics piping and ducting systems — Plastics pipes and fittings — Method for exposure to direct (natural) weathering*

ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

EN 12099, *Plastics piping systems — Polyethylene piping materials and components — Determination of volatile content*

ISO 15512, *Plastics — Determination of water content*

Guidelines for drinking water quality, Volume 1: Recommendations, WHO, Geneva, 1984

EC Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, *Official Journal of the European Communities*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3, ISO 472 and ISO 1043-1, and the following, apply.

3.1.1 Geometrical characteristics

3.1.1.1
nominal size
DN
numerical designation of the size of a component, other than a component designated by a thread size, which is a convenient round number approximately equal to the manufacturing dimension in millimetres (mm)

3.1.1.2
nominal size
DN/OD
nominal size, related to the outside diameter

3.1.1.3
nominal outside diameter
d_n
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.1.4
outside diameter at any point
d_e
value of the measurement of the outside diameter through its cross-section at any point of the pipe rounded to the next greater 0,1 mm

3.1.1.5
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

3.1.1.6
minimum mean outside diameter
$d_{em\ min}$
minimum value of the outside diameter as specified for a given nominal size

3.1.1.7
maximum mean outside diameter
$d_{em\ max}$
maximum value of the outside diameter as specified for a given nominal size

3.1.1.8
out-of-roundness
ovality
difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-section of the pipe or spigot end of a fitting

3.1.1.9
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

3.1.1.10
wall thickness at any point
e
value of the measurement of the wall thickness at any point around the circumference of a component

3.1.1.11
minimum wall thickness at any point
e_{min}
minimum value of the wall thickness at any point around the circumference of a component as specified

3.1.1.12
maximum wall thickness at any point
e_{max}
maximum value of the wall thickness at any point around the circumference of a component as specified

3.1.1.13
mean wall thickness
e_m
arithmetic mean of a number of measurements regularly spaced around the circumference of the component in the same cross-section of the component, including the measured minimum and the measured maximum values of the wall thickness

3.1.1.14
pipe series
S
dimensionless number for pipe designation conforming to ISO 4065

NOTE The relationship between the pipe series, S, and the standard dimension ratio, SDR, is given by the following equation from ISO 4065:

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

3.1.1.15
standard dimension ratio
SDR
ratio of the nominal outside diameter, d_n, of a pipe to its nominal wall thickness, e_n

3.1.1.16
tolerance
permissible variation of the specified value of a quantity expressed as the difference between the permissible maximum and permissible minimum values

3.1.2 Related to service conditions

3.1.2.1
nominal pressure
PN
numerical designation used for reference purposes related to the mechanical characteristics of the component of a piping system

NOTE For plastic piping systems conveying water, it corresponds to the maximum continuous operating pressure, expressed in bar, which can be sustained with water at 20 °C, based on the minimum design coefficient.

3.1.2.2
maximum operating pressure
MOP
maximum effective pressure of the fluid in the piping system, expressed in bar, which is allowed in continuous use

It takes into account the physical and the mechanical characteristics of the components of a piping system

NOTE It is calculated using the following equation:

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

3.1.2.3
allowable operating pressure
PFA
maximum hydrostatic pressure that a component is capable of withstanding continuously in service

3.1.3 Related to material characteristics

3.1.3.1
lower confidence limit of the predicted hydrostatic strength at 20 °C for 50 years
σ_{LPL}
quantity, with the dimensions of stress expressed in megapascals, which can be considered as a property of the material, and which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at 20 °C for 50 years with internal water pressure

3.1.3.2
minimum required strength
MRS
value of σ_{LPL} rounded down to the next smaller value of the R10 series or R20 series, depending on the value of σ_{LPL}

NOTE R10 and R20 series are the Renard number series according to ISO 3 and ISO 497.

3.1.3.3
design stress
σ_{S}
allowable stress, expressed in megapascals, for a given application derived by dividing MRS by the coefficient C and rounding to the next lower value in the R20 series

NOTE It is expressed as

$$\sigma_{\mathrm{S}} = \frac{\mathrm{MRS}}{C}$$