INTERNATIONAL STANDARD

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

Part 1: General

Systèmes de canalisations en matières plastiques pour la distribution de combustibles gazeux — Polyéthylène (PE) —
Partie 1: Généralités

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 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is 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 first edition of ISO 4437-1 together with the first editions of ISO 4437-2, ISO 4437-3 and ISO 4437-5 cancel and replace ISO 4437:2007, ISO 8085-1:2001, ISO 8085-2:2001 and ISO 8085-3:2001, of which they constitute a technical revision.

ISO 4437 consists of the following parts, under the general title *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE)*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 4: Valves*

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

Introduction

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

Requirements and test methods for components of the piping system are specified in ISO 4437-2, ISO 4437-3, and ISO 4437-4.

Characteristics for fitness for purpose of the system are covered in ISO 4437-5. Recommended practice for installation is given in ISO/TS 10839.[1]

This part of ISO 4437 covers the general aspects of the plastics piping system.

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

Part 1: General

1 Scope

This part of ISO 4437 specifies the general properties of polyethylene (PE) compounds for the manufacture of pipes and fittings intended to be used for the supply of gaseous fuels.

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

In conjunction with ISO 4437-2, ISO 4437-3, ISO 4437-4, and ISO 4437-5, it 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) the maximum operating pressure (MOP), is based on the design stress determined from the compound minimum required strength (MRS) divided by the *C* factor, and taking into account rapid crack propagation (RCP) requirements;

b) a temperature of 20 °C as reference temperature for the design basis.

NOTE 1 For other operating temperatures, guidance is given in ISO 4437-5:2014.

NOTE 2 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.

2 Normative references

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

ISO 472, *Plastics — Vocabulary*

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

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, *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 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method*

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

ISO 4437-2:2014, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 2: Pipes*

ISO 4437-3:2014, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 3: Fittings*

ISO 4437-4:—[1], *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves*

ISO 4437-5:2014, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

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

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

ISO 6964, *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, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 11413:2008, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

ISO 11414:2009, *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, designation and design coefficient*

ISO 13477, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Small-scale steady-state test (S4 test)*

ISO 13478, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Full-scale test (FST)*

ISO 13479, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes*

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 15512, *Plastics — Determination of water content*

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*

1) To be published. (Revision of ISO 10933:1997)

3 Terms and definitions

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

3.1 Geometrical definitions

3.1.1
nominal size
DN/OD
numerical designation of the size of a component, other than a component designated by thread size, which is a convenient round number approximately equal to the manufacturing dimension in millimetres (mm) and related to the outside diameter

3.1.2
nominal outside diameter
d_n
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.3
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

3.1.4
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

3.1.5
minimum mean outside diameter
$d_{em,min}$
minimum value for the mean outside diameter as specified for a given nominal size

3.1.6
maximum mean outside diameter
$d_{em,max}$
maximum value for the mean outside diameter as specified for a given nominal size

3.1.7
out-of-roundness
ovality
difference between the maximum and the minimum outside diameters in the same cross-section of a pipe or spigot

3.1.8
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 different parts of ISO 4437, the value of the nominal wall thickness, e_n, is identical to the specified minimum wall thickness at any point, e_{min}.

3.1.9
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 the fittings and valves body at any point is E.

3.1.10
minimum wall thickness at any point
e_{min}
minimum value for the wall thickness at any point around the circumference of a component, as specified

3.1.11
maximum wall thickness at any point
e_{max}
maximum value for the wall thickness at any point around the circumference of a component, as specified

3.1.12
mean wall thickness
e_m
arithmetical mean of a number of measurements of the wall thickness, regularly spaced around the circumference and in the same cross-section of a component, including the measured minimum and the measured maximum values of the wall thickness in that cross-section

3.1.13
tolerance
permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value

3.1.14
wall thickness tolerance
t_y
permitted difference between the wall thickness at any point, e, and the nominal wall thickness, e_n

Note 1 to entry: $e_n \leq e \leq e_n + t_y$

3.1.15
standard dimension ratio
SDR
numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter, d_n, and the nominal wall thickness, e_n

3.1.16
pipe series
S
dimensionless number for pipe designation conforming to ISO 4065[2]

Note 1 to entry: The relationship between the pipe series S and the standard dimension ratio (SDR) is given by the following equation as specified in ISO 4065.[2]

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

3.2 Material definitions

3.2.1
virgin material
material 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 reprocessable or recyclable materials have been added

3.2.2
own reprocessable material
material prepared from clean, rejected, and unused pipes, fittings, or valves, including trimmings from the production of pipes, fittings, or valves, that is reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer in the production of components by, for example, injection-moulding or extrusion

3.2.3
compound
homogenous extruded mixture of base polymer (PE) 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 conforming to the requirements of this International Standard

3.3 Definitions 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 a temperature θ and time t

Note 1 to entry: It is expressed in megapascals.

3.3.2
minimum required strength
MRS
value of σ_{LPL} at 20 °C and 50 years, rounded down to the next smaller value of the R10 series when σ_{LPL} is below 10 MPa, or to the next lower value of the R20 series when σ_{LPL} is 10 MPa or greater

Note 1 to entry: The R10 series conforms to ISO 3[3] and the R20 series conforms to ISO 497.[4]

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
design stress
σ_S
allowable stress for a given application at 20 °C, that is derived from the MRS by dividing it by the design coefficient C, i.e.

$$\sigma_s = \frac{\text{MRS}}{C}$$

Note 1 to entry: It is expressed in megapascals.

3.3.5
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 min (g/10 min).