International Standard

ISO 4437-2

Second edition
2024-02

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

Part 2: Pipes

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

Partie 2: Tubes

Reference number
ISO 4437-2:2024(en)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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.

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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, 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 4437-2:2014), 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;

— requirements for the compound for identification stripes have been updated;

— the nominal outside diameter range of the pipe 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 pipes.

Requirements and test methods for materials and components, other than pipes, are specified in ISO 4437-1, ISO 4437-3 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 2: Pipes

1 Scope

This document specifies the characteristics of pipes made from polyethylene (PE) 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 4437-3, 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 MOPs and gives requirements concerning colours.

This document is applicable to three types of pipes:

— PE pipes (outside diameter, d_n) including any identification stripes;

— PE pipes with co-extruded layers on either or both the outside and/or inside of the pipe (total outside diameter, d_n) as specified in Annex A, where all PE layers have the same MRS rating;

— PE pipes (outside diameter, d_n) with a peelable and contiguous thermoplastics additional layer on the outside of the pipe ("coated pipe") as specified in Annex B.

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 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 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*

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

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 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

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 4437-5, *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 9969, *Thermoplastics pipes — Determination of ring stiffness*

ISO 11922-1:2018, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

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

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 13968, *Plastics piping and ducting systems — Thermoplastics pipes — Determination of ring flexibility*

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

ISO 18489, *Polyethylene (PE) materials for piping systems — Determination of resistance to slow crack growth under cyclic loading — Cracked Round Bar 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 (mm).

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 and valve body 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
wall thickness tolerance
T_y
permitted difference between the *wall thickness at any point* (3.1.8) and the *nominal wall thickness* (3.1.7)

Note 1 to entry: $e_n \leq e \leq e_n + T_y$.

3.1.12
standard dimension ratio
SDR
numerical designation of a *pipe series* (3.1.13), 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)

3.1.13
pipe series
S
number for pipe designation

Note 1 to entry: The relationship between the pipe series, *S*, and the *standard dimension ratio (SDR)* (3.1.12) 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 material from rejected unused products or trimmings capable of being reclaimed 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 [14], [15] and [16].

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
fusion compatibility
ability of two similar or dissimilar polyethylene *compounds* (3.2.1) to be fused together to form a joint

3.5.2
squeeze-off
restriction of the gas flow to an acceptable rate through mechanical compression of the pipe

Note 1 to entry: See Annex C.