International Standard

ISO 15875-2

Second edition
2025-10

Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) —

Part 2: Pipes

Systèmes de canalisations en plastique pour les installations d'eau chaude et froide — Polyéthylène réticulé (PE-X) —

Partie 2: Tubes

Reference number
ISO 15875-2:2025(en)

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Published in Switzerland

Contents

Page

Foreword ..... **v**

Introduction ..... **vii**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions and symbols **2**
3.1 Terms and definitions 2
3.2 Symbols 4

4 Generic requirements, instructions and explanations **5**
4.1 Designation PE-X 5
4.2 Application classes, design pressures and pipe dimension classes restrictions 5
4.3 Application classes — Responsibility of the purchaser or specifier 5
4.4 Use of the parts of the ISO 15875 series 5
4.5 PE-X pipes provided with a thin barrier layer 5
4.6 Completeness of tests 5
4.7 Test result interchangeability restriction 5

5 Material **6**
5.1 Pipe material 6
5.2 Evaluation of σ_{LPL}-curves 6
5.3 Reference lines 7
5.4 Influence on water intended for human consumption 9
5.5 Barrier layer material 9
5.5.1 General 9
5.5.2 Thermal stability of the barrier layer material 9
5.5.3 Thermal stability of the adhesive layer material 9
5.5.4 Thermal stability of the outer layer material 9

6 General characteristics **10**
6.1 Pipe construction 10
6.2 Appearance 10
6.3 Opacity 10
6.4 Oxygen permeability 10

7 Geometrical characteristics **10**
7.1 Pipes without barrier layer(s) - General 10
7.2 Pipes without barrier layer - Dimensions of pipes 11
7.2.1 Outside diameters 11
7.2.2 Wall thicknesses and their tolerances 11
7.3 Pipes with barrier layer — Dimensions of pipes 14
7.3.1 General 14
7.3.2 Option I - Dimensional integration of the barrier layer 14
7.3.3 Option II - Barrier layer on top 14

8 Mechanical characteristics **15**

9 Physical and chemical characteristics **16**

10 Performance requirements **17**

11 Marking **17**
11.1 General requirements 17
11.2 Minimum required marking 17

Annex A (normative) **Pipe construction** **18**

Annex B (normative) **Derivation of $S_{calc,max}$ values** **21**

Annex C (normative) **Proof of the thermal stability of the barrier layer material resp. adhesive layer material resp. outer layer material — Test procedure** **23**

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Bibliography **26**

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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 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.

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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 2, *Plastics pipes and fittings for water supplies,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15875-2:2003), which has been technically revised. It also incorporates the Amendments ISO 15875-2:2003/Amd 1:2007 and ISO 15875-2:2003/Amd 2:2020.

The main changes are as follows:

— the normative references have been updated;

— a new Clause 4 "Generic requirements, instructions and explanations" has been added and subsequent clauses have been renumbered;

— pipe material has been specified more precisely;

— Formula (2) for the 110 °C reference curve has been added;

— a new subclause 5.3 "Reference lines" has been added;

— a new subclause 5.5 "Barrier layer material" has been added;

— a new subclause 5.5.1 "General" has been added;

— a new subclause 5.5.2 "Thermal stability of the barrier layer material" with requirements on the thermal stability of the material has been added;

— a new subclause 5.5.3 "Thermal stability of the adhesive layer material" with requirements on the thermal stability of the material has been added;

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— a new subclause 5.5.4 "Thermal stability of the outer layer material" with requirements on the thermal stability of the material has been added;

— a new subclause 6.4 "Oxygen permeability" has been added;

— in subclause 7.2, the diameter range has been extended up to 250 mm;

— a new subclause 7.3 "Pipes with barrier layer - Dimensions of pipes" has been added;

— Clause 8, Table 12, mechanical characteristics of pipes, characteristic: resistance to internal pressure, new test parameters have been added: 20 °C / 22 hours and 95 °C / 2 500 hours;

— in Clause 9, a requirement defining the point in time at which the minimum degree of crosslinking is to be reached has been added;

— in Table 13, a new crosslinking method has been added: PE-Xe - UV light initiated crosslinking;

— a new Annex A "Pipe construction" has been added;

— Annex B (formerly Annex A) "Derivation of $S_{\mathrm{calc,max}}$ values" has been changed from informative to normative;

— a new Annex C for the proof of the thermal stability of materials has been added;

— editorial modifications have been made to facilitate the readability of the document and to bring it in line with the ISO/IEC Directives Part 2.

A list of all parts in the ISO 15875 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.

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Introduction

The ISO 15875 series specifies the requirements for a piping system consisting of pipe, fitting and the jointing made of it, when the pipe is made from crosslinked polyethylene (PE-X). The ISO 15875 series consists of ISO 15875-1, ISO 15875-2, ISO 15875-3 and ISO 15875-5, and covers the requirements and related test methods for all components used in the system (e. g. pipes and fittings). In addition, the ISO 15875 series includes requirements and related test methods to verify the performance and compatibility of the jointing of components.

The piping system is intended to be used for hot and cold water installations.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by ISO 15875 (all parts):

— ISO 15875 (all parts) provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

— it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

Requirements and test methods for material and components, other than pipes, are specified in ISO 15875-1 and ISO 15875-3. Characteristics for fitness for purpose (mainly for joints) are covered in ISO 15875-5. ISO/TS 15875-7 gives guidance for the assessment of conformity.

This document specifies the characteristics of pipes.

At the date of publication of this document, standards for piping systems of other plastics materials used for the same application include:

— the ISO 15874 series,

— the ISO 15875 series,

— the ISO 15876 series,

— the ISO 15877 series,

— the ISO 21003 series, and

— the ISO 22391 series.

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Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) —

Part 2: Pipes

1 Scope

This document specifies the characteristics of pipes for crosslinked polyethylene (PE-X) piping systems intended to be used for hot and cold water installations within buildings for the conveyance of water whether or not intended for human consumption (domestic systems), and for heating systems, under design pressures and temperatures according to the class of application (see ISO 15875-1:2025, Table 1).

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

It is applicable to PE-X pipes with and without barrier layer.

This document is applicable to PE-X pipes for hot and cold water installations, which are intended to be connected to fittings conforming to ISO 15875-3, whereby the joints conform to the requirements of ISO 15875-5.

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 527-1:2019, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2:2025, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

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

ISO 2578:1993, *Plastics — Determination of time-temperature limits after prolonged exposure to heat*

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

ISO 6259-1:2015, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

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

ISO 10147, *Pipes and fittings made of crosslinked polyethylene (PE-X) — Estimation of the degree of crosslinking by determination of the gel content*

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

ISO 13760, *Plastics pipes for the conveyance of fluids under pressure — Miner's rule — Calculation method for cumulative damage*

ISO 15875-1:2025, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 1: General*

ISO 15876-2, *Plastics piping systems for hot and cold water installations — Polybutene (PB) — Part 2: Pipes*

ISO 15875-3, *Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) - Part 3: Fittings*

ISO 15875-5, *Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) -Part 5: Fitness for purpose of the system*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15875-1 and the following apply.

ISO and IEC maintain terminological 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/

3.1.1
barrier layer material
functional layer material which provides the specific property as a barrier layer to reduce the permeation of light or a specific medium or gas (e.g. oxygen) into the conveyed fluid and which is linked to the intended application of the pipe

Note 1 to entry: Barrier layer materials are materials/layers which do not contribute to the stress bearing properties of the pipe.

Note 2 to entry: PE-X pipes with a barrier layer embedded between two stress designed PE-X layers are not covered by this document. For these pipes, the ISO 21003 series applies.

Note 3 to entry: In accordance with 7.3.1, the total layer thickness of the additional outer layers (including barrier layer, adhesive layer, outer layer and other non-stress designed layers) shall not be larger than 0,40 mm. For pipes with a total layer thickness of the additional outer layers greater than 0,40 mm, the ISO 21003 series applies.

3.1.2
adhesive layer material
functional embedded layer material which provides adhesion between two pipe layer materials

Note 1 to entry: Adhesive layer materials are materials/layers which do not contribute to the stress bearing properties of the pipe.

Note 2 to entry: PE-X pipes with an adhesive layer embedded between two stress designed PE-X layers are not covered by this document. For these pipes, the ISO 21003 series applies.

Note 3 to entry: In accordance with 7.3.1, the total layer thickness of the additional outer layers (including barrier layer, adhesive layer, outer layer and other non-stress designed layers) shall not be larger than 0,40 mm. For pipes with a total layer thickness of the additional outer layers larger than 0,40 mm the ISO 21003 series apply.

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3.1.3
outer layer material
pipe layer material exposed to the outer environment intended for protection, identification by colour or coverage of other pipe layers

Note 1 to entry: Outer layer materials are materials/layers which do not contribute to the stress bearing properties of the pipe.

Note 2 to entry: Multiple outer layers can be applied to the pipes on the outer diameter side of the pipe wall (with or without barrier or adhesive layers). The total thickness of all combined additional outer layers shall be not more than 0,40 mm.

Note 3 to entry: PE-X pipes with embedded between two stress designed PE-X layers are not covered by this document, for these the ISO 21003 series apply

Note 4 to entry: In accordance with 7.3.1, the total layer thickness of the additional outer layers (including barrier layer, adhesive layer, outer layer and other non-stress designed layers) shall not be larger than 0,40 mm. For pipes with a total layer thickness of the additional outer layers greater than 0,40 mm, the ISO 21003 series applies.

3.1.4
pipes with barrier layer
plastics pipes provided with a thin additional outer barrier layer (e.g. to prevent or greatly diminish the diffusion of gases and the transmission of light through the pipe wall), where the PE-X base pipe exclusive of any addition of additional (outer) layers meets the design stress requirements of this document.

Note 1 to entry: Such pipes typically have an outside (barrier) layer of maximum 0,40 mm thickness, including any adhesive. Pipes with an outer layer greater than 0,40 mm are considered as multilayer pipes (see ISO 23001-1), with the outer layer then being the first of multiple layers rather than having only barrier function.

3.1.5
tolerance
permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value

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

3.1.7
maximum mean outside diameter
$d_{em,max}$
maximum value for the mean outside diameter as specified for a given nominal size

3.1.8
out-of-roundness
ovality
difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross–sectional plane of a pipe or spigot end of a fitting, or the difference between the measured maximum inside diameter and the measured minimum inside diameter in the same cross–sectional plane of a socket end of a fitting

3.1.9
wall thickness (at any point)
e
measured thickness of the pipe/fitting wall at any point around the circumference of a component, rounded up to the nearest 0,1 mm

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3.1.10
minimum wall thickness (at any point)
e_{min}
minimum thickness of the pipe/fitting wall at any point around the circumference of a component, as specified

3.1.11
maximum wall thickness (at any point)
e_{max}
maximum thickness of the pipe/fitting wall at any point around the circumference of a component, as specified

3.1.12
design stress for cold water application
σ_{cold}
stress value for the intended use of a 20 °C / 50 years lifetime (cold water) application

3.1.13
overall service (design) coefficient
C
overall coefficient with a value greater than one, 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 of the predicted hydrostatic strength, σ_{LPL}

3.2 Symbols

C	overall service (design) coefficient
d_{em}	mean outside diameter
$d_{em,min}$	minimum mean outside diameter
$d_{em,max}$	maximum mean outside diameter
d_n	nominal outside diameter
e	wall thickness at any point
e_{max}	maximum wall thickness at any point
e_{min}	minimum wall thickness at any point
e_n	nominal wall thickness
p	internal hydrostatic pressure
p_D	design pressure
S_{calc}	calculated pipe value
$S_{calc,max}$	maximum calculated pipe value
T	temperature
T_{cold}	cold water temperature
T_D	design temperature
T_{mal}	malfunction temperature
T_{max}	maximum design temperature

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t time

σ hydrostatic stress

σ_{cold} design stress at 20 °C

σ_{D} design stress

σ_{DP} design stress of plastics pipe material

4 Generic requirements, instructions and explanations

4.1 Designation PE-X

The designation crosslinked polyethylene is used together with the abbreviation PE-X throughout this document.

4.2 Application classes, design pressures and pipe dimension classes restrictions

ISO 15875-1 covers a range of application classes, design pressures and pipe dimension classes. This document does not apply to values of design temperature (T_D), maximum temperature (T_{max}) and malfunction temperature (T_{mal}) and service times in excess of those defined in ISO 15875-1.

4.3 Application classes — Responsibility of the purchaser or specifier

It is the responsibility of the purchaser or specifier to make the appropriate selections from these application classes (see ISO 15875-1), taking into account particular requirements and any relevant national regulations and installation practices or codes.

4.4 Use of the parts of the ISO 15875 series

This document is intended to be used only in conjunction with all the other parts of the ISO 15875 series.

NOTE This document is applicable to PE-X pipes for hot and cold water installations, which are intended to be connected to fittings conforming to ISO 15875-3, whereby the joints conform to the requirements of ISO 15875-5.

4.5 PE-X pipes provided with a thin barrier layer

In the case of PE-X pipes provided with a thin barrier layer, e.g. to prevent or greatly diminish the diffusion of gases and the transmission of light through the pipe wall, the design stress requirements are totally met by the base PE-X pipe.

4.6 Completeness of tests

In order to conform with this document, all requirements of this document shall be met.

4.7 Test result interchangeability restriction

The test results for a specific combination of a pipe and a fitting, obtained from a piping system test according to ISO 15875-5, cannot be transferred to other combinations of pipes and fittings.

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