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

Part 1: General

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

Partie 1: Généralités

Reference number
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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).

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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 15875-1:2003), which has been technically revised. It also incorporates the Amendment ISO 15875-1:2003/Amd. 1:2007.

The main changes are as follows:

— the definition and description of the term piping system has been updated.

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 when pipes are 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 the ISO 15875 series:

— the ISO 15875 series provides no information concerning potential restrictions on the use of the product in any of the Member States of the EU or EFTA;

Requirements and test methods for material and components of the piping systems are specified in ISO 15875-2 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 general aspects of the plastics piping system.

This document is intended to be used only in conjunction with the other parts of the ISO 15875 series, which are applicable to PE-X pipes, fittings and their joints including joints with components made of other plastics and non-plastics materials intended to be used for hot and cold water installations.

NOTE Test results obtained from a specific piping system test (according ISO 15875-5) cannot be transferred to other combinations of pipes and fittings.

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

— ISO 15874,

— ISO 15875,

— ISO 15876,

— ISO 15877,

— ISO 21003, and

— ISO 22391.

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

Part 1: General

1 Scope

This document specifies the general aspects of 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 Table 1).

This document also specifies the basis for the test parameters for the test methods referred to in the ISO 15875 series.

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

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 472, *Plastics — Vocabulary*

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

ISO 15875-2, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — 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 system for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 5: Fitness for purpose of the system*

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 472, ISO 1043-1 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/

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3.1.1 General terms

3.1.1.1
piping system
specified combination of pipes and fittings as well as its jointing, intended to be used together and tested as such according to ISO 15875-2, ISO 15875-3 and ISO 15875-5

Note 1 to entry: For the purposes of this document, the term "piping system" does not include valves.

3.1.2 Geometrical terms

3.1.2.1
nominal size
DN/OD
alphanumeric designation of size for components of a pipework system, which is used for reference purposes

Note 1 to entry: Nominal size comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the outside diameter of the end connections.

Note 2 to entry: The number following the letters DN does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

Note 3 to entry: ln those standards which use the DN designation system, any relationship between DN and component dimensions should be given, e.g. DN/OD.

3.1.2.2
nominal outside diameter
d_n
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.2.3
outside diameter (at any point)
d_e
measured outer diameter through its cross section at any point of a pipe or spigot end of a fitting, rounded up to the nearest 0,1 mm

3.1.2.4
mean outside diameter
d_{em}
measured length of the outer circumference of a pipe or spigot end of a fitting in any cross section divided by π (≈ 3,142) rounded up to the nearest 0,1 mm

3.1.2.5
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, approximately equal to the manufacturing dimension in millimetres

3.1.2.6
pipe series
S
dimensionless number for pipe designation conforming to ISO 4065

Note 1 to entry: Within the ISO 15875 series, the pipe series, S, is used as a means for selecting pipe sizes for practical purposes (see ISO 15875-2).

3.1.2.7
dimension class
set of dimensions following a certain structure like the Renard series, or traditional dimensions with longstanding use (e.g. copper based sizes)

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3.1.2.8
calculated pipe value
S_{calc}
value for a specific pipe calculated for design purposes according to the following equation, rounded up to the nearest 0,1

$$S_{calc} = \frac{d_{em} - e_{min}}{2e_{min}}$$

where

d_{em} is the mean outside diameter, in millimetres;
e_{min} is the minimal wall thickness, expressed in millimetres

Note 1 to entry: Rounding to the nearest standardised pipe series (S) is made by rounding the value down the nearest lower (more critical) S pipe series value.

Note 2 to entry: For design only, S_{calc} is based on the nominal outside diameter (d_n) and the nominal wall thickness (e_n), as defined in ISO 4065.[1]

3.1.3 Terms related to service conditions

3.1.3.1
application class
class related to a typical field of application and a design period of 50 years

Note 1 to entry: The classifications are taken from ISO 10508.[2]

3.1.3.2
design pressure
p_D
highest pressure related to the circumstances for which the system has been designed in bars (bar)

Note 1 to entry: The design pressure shall be 4 bar, 6 bar, 8 bar and/or 10 bar.

Note 2 to entry: 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

Note 3 to entry: The design pressure, p_D, is equal to the maximum design pressure, MDP, as specified in EN 806-1.[9]

3.1.3.3
hydrostatic stress
σ
stress, in megapascals, induced in the wall of a pipe when a pressure is applied using water as a medium

Note 1 to entry: It is calculated using the following approximate formula:

$$\sigma = p \times \frac{(d_{em} - e_{min})}{2e_{min}}$$

where

p is the applied pressure, in megapascals;
d_{em} is the mean outside diameter of the pipe, in millimetres;
e_{min} is the minimum wall thickness, in millimetres.

Note 2 to entry: σ_P is the stress/temperature/time specific value for the pipe.

Note 3 to entry: σ_F is the stress/temperature/time specific value for the plastic fitting.

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3.1.3.4
design temperature
T_D
temperature or a combination of temperatures of the conveyed water, dependent on the service conditions for which the system has been designed

3.1.3.5
maximum design temperature
T_{max}
highest design temperature, T_D, occurring for short periods only

3.1.3.6
malfunction temperature
T_{mal}
highest temperature that can be reached when the control limits are exceeded for short periods only

3.1.3.7
cold water temperature
T_{cold}
temperature of conveyed cold water of up to approximately 25 °C

Note 1 to entry: For design purposes, 20 °C is used.

3.1.4 Terms related to material characteristics

3.1.4.1
lower confidence limit of the predicted hydrostatic strength
σ_{LPL}
quantity, in megapascals (MPa), with the dimensions of stress, which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at the given temperature, *T*, and time, *t*

3.1.4.2
design stress
σ_D
allowable stress, in megapascals (MPa), in the pipe material for a given application or service condition, respectively

Note 1 to entry: See also ISO 15875-2:2025, Annex B and ISO 15875-3:2025, Clause 8.

Note 2 to entry: σ_{DP} is the design stress specific for the pipe material.

Note 3 to entry: σ_{DF} is the design stress specific for the plastic fitting material.

3.1.4.3
maximum calculated pipe value
$S_{calc,max}$
maximum value of the calculated pipe series value ($S_{calc,\ max}$) of a pipe or fitting for a specific application class or service condition and design stress is the smaller value (rounded up to the nearest 0,01) of

$$\text{either } \frac{\sigma_{cold}}{p_D = 10\ bar} \text{ or } \frac{\sigma_D}{p_D}$$

Note 1 to entry: The minimum service life and application of any hot and cold piping system in for PE-X piping systems is 10 bar at 20 °C for a 50 year lifetime (σ_{cold}).

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3.1.4.4
virgin material
plastics material in the form of pellets, granules, powder, etc. that has not been subjected to use or processing other than required for its initial manufacture

Note 1 to entry: the addition of additives such as stabilizers and pigments to plastics material that has not been subjected to use or processing does not change the denomination of virgin (plastics) material

3.1.4.5
reworked material
plastics material from rejected unused products or trimmings that have been manufactured and retained within plants owned and operated by the same legal entity

Deprecated term: own reprocessed material

3.1.4.6
recyclate
plastics material resulting from the recycling of pre-consumer (unused products, excluding reworked (plastic) material) and post-consumer (from used products, that have fulfilled their intended purpose or that can no longer be used) plastics products

3.2 Symbols

d_e	outside diameter (at any point)
d_{em}	mean outside diameter
d_n	nominal outside diameter
e	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
t	time
σ	hydrostatic stress
σ_{cold}	design stress at 20 °C
σ_D	design stress

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σ_{DF} design stress of plastics fitting material

σ_{DP} design stress of plastics pipe material

σ_{F} hydrostatic stress values of plastics fitting material taken from the reference line for the applicable time and temperature

σ_{P} hydrostatic stress values of plastics pipe material taken from the reference line for the applicable time and temperature

σ_{LPL} lower confidence limit of the predicted hydrostatic strength

3.3 Abbreviated terms

DN nominal size

DN/OD nominal size, outside diameter related

LPL lower confidence limit of predicted strength

MDP maximum design pressure

PE-X crosslinked polyethylene

S pipe series

4 PE-X piping systems

4.1 General

Crosslinked polyethylene (PE-X) piping systems conforming to the ISO 15875 series shall consist exclusively of components (pipe, fittings) conforming with the applicable part of the series, intended for the same service condition.

The ISO 15875 series is intended for PE-X piping systems consisting of mono layer PE-X pipes. PE-X pipes with additional layers on the outside of the pipe wall with a maximum total layer thickness of 0,40 mm are also covered by the ISO 15875 series, providing that these additional layers are not intended as stress designed layers and the base inner PE-X pipe meets the $S_{calc,max}$ requirements. The overall final pipe dimensions (including additional layers) meet the requirements for pipe dimensions as stated in ISO 15875-2. Such additional layers for barrier pipes may comprise of a barrier layer, adhesive layer and outer layer or any other non-stress designed layer.

NOTE 1 Pipes with a total outer layer thickness greater than 0,40 mm or with more than one stress designed layer are covered by the ISO 21003 series.

NOTE 2 Pipe constructions of PE-X pipes and PE-X pipes with additional outer layers are further defined in ISO 15875-2:2025, Annex A.

The supplier of the PE-X piping system shall check the fitness for purpose of the complete system in accordance with ISO 15875-5, with each specific combination of pipes and fittings for each intended service condition.

Pipes and fittings shall have the same application class for their use together as a system. For combinations of pipes and fittings having different design pressures (4 bar, 6 bar, 8 bar or 10 bar), the design pressure of the system shall be defined by the lowest design pressure rating.

NOTE 3 The test results obtained from a specific piping system test according ISO 15875-5 cannot be transferred to other combinations of pipes and fittings.

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