INTERNATIONAL STANDARD

ISO 15876-1

Second edition
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Plastics piping systems for hot and cold water installations — Polybutene (PB) —

Part 1: General

Systèmes de canalisations en plastique pour les installations d'eau chaude et froide — Polybutène (PB) —

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 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

ISO 15876-1 was prepared by the European Committee Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in collaboration with ISO 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 accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15876-1:2003), which has been technically revised with the following changes:

— introduction of polybutene random copolymer (PB-R) and renaming existing polybutene (PB) into polybutene homopolymer (PB-H);

— revision of specifications for conditioning of samples.

It also incorporates the Amendment ISO 15876-1:2003/Amd 1:2007.

A list of all parts in the ISO 15876 series can be found on the ISO website.

Introduction

The System Standard ISO 15876, of which this document is Part 1, specifies the requirements for a piping system when made from polybutene (PB). 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 15876 (all parts):

— ISO 15876 (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 of the piping systems are specified in ISO 15876-2 and ISO 15876-3. Characteristics for fitness for purpose (mainly for joints) are covered in ISO 15876-5. ISO/TS 15876-7 gives guidance for the assessment of conformity.

This document specifies the general aspects of the plastics piping system.

At the date of publication of this standard, System Standards for piping systems of other plastics materials used for the same application include ISO 15874, ISO 15875, ISO 15876, ISO 15877, ISO 21003 and ISO 22391.

Plastics piping systems for hot and cold water installations — Polybutene (PB) —

Part 1: General

1 Scope

This document specifies the general aspects of polybutene-1 (PB-1) 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).

The designation polybutene is used together with the abbreviation PB throughout this document.

This document covers a range of service conditions (application classes) and design pressure and pipe dimension classes. Values of T_D, T_{max} and T_{mal} in excess of those in Table 1 do not apply.

NOTE 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.

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

In conjunction with the other parts of ISO 15876, this document is applicable to PB pipes, fittings, their joints and to joints with components of other plastics and non-plastics materials intended to be used for hot and cold water installations.

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

ISO 15876-3, *Plastics piping system for hot and cold water installations — Polybutene (PB) — Part 3: Fittings*

ISO 15876-5, *Plastics piping system for hot and cold water installations — Polybutene (PB) — Part 5: Fitness for purpose of the system*

3 Terms and definitions, symbols and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1 Geometrical terms and definitions

3.1.1.1
nominal size
DN
numerical designation of the size of a component, which is a convenient round number, approximately equal to the manufacturing dimensions in millimetres (mm)

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

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

3.1.1.4
outside diameter (at any point)
d_e
measured outside diameter through the cross-section at any point of a pipe or spigot end of a fitting, rounded up to the nearest 0,1 mm

3.1.1.5
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 $\pi (\approx 3,142)$ rounded up to the nearest 0,1 mm

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

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

3.1.1.8
mean inside diameter of socket
d_{sm}
arithmetical mean of two measured inside diameters perpendicular to each other at the midpoint of the socket length

3.1.1.9
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

3.1.1.10
nominal wall thickness
e_n
numerical designation of the wall thickness of a component, approximately equal to the manufacturing dimension in millimetres (mm)

3.1.1.11
wall thickness (at any point)
e
measured wall thickness at any point around the circumference of a component, rounded up to the nearest 0,1 mm

3.1.1.12
minimum wall thickness (at any point)
e_{min}
minimum wall thickness at any point around the circumference of a component, as specified

3.1.1.13
maximum wall thickness (at any point)
e_{max}
maximum wall thickness at any point around the circumference of a component, as specified

3.1.1.14
tolerance
permitted variation of the specified value of a quantity expressed as the difference between the permitted maximum and permitted minimum value

3.1.1.15
pipe series
S
dimensionless number for pipe designation conforming to ISO 4065

Note 1 to entry: According to ISO 15876 (all parts), the pipe series S is used as a means for selecting pipe sizes for practical purposes (see ISO 15876-2).

3.1.1.16
calculated pipe value
S_{calc}
value for a specific pipe calculated according to the following equation, rounded up to the nearest 0,1 mm:

$$S_{calc} = \frac{d_n - e_n}{2e_n}$$

where

d_n is the nominal outside diameter, in millimetres;

e_n is the nominal wall thickness, expressed in millimetres.

3.1.2 Terms and definitions related to service conditions

3.1.2.1
design pressure
p_D
highest pressure related to the circumstances for which the system has been designed and is intended to be used

Note 1 to entry: The design pressure (p_D) is equal to the maximum design pressure (MDP), as specified in EN 806-1.

3.1.2.2
hydrostatic stress
σ
stress, expressed in megapascals, induced in the wall of a pipe when a pressure is applied using water as a medium

Note 1 to entry: Hydrostatic stress 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.

3.1.2.3
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

3.1.2.4
maximum design temperature
T_{max}
highest design temperature, T_D, occurring for short periods only

3.1.2.5
malfunction temperature
T_{mal}
highest temperature that can be reached when the control limits are exceeded

3.1.2.6
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.

3.1.2.7
treated water for heating installations
water, intended for heating installations, which contains additives which have no detrimental effect on the system

3.1.3 Terms and definitions related to material characteristics

3.1.3.1
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

3.1.3.2
design stress
σ_D
allowable stress, in megapascals (MPa) in the pipe material, σ_{DP}, or in the plastics fitting material, σ_{DF}, for a given application or set of service conditions, respectively

Note 1 to entry: See also ISO 15876-2:2016, Annex A.

3.1.3.3
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}

3.1.3.4
own reprocessable material
material prepared from rejected unused pipes and fittings, including trimmings from the production of pipes and fittings, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation or material specification is known

3.1.3.5
pipes with barrier layer
plastics 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) and where the design stress requirements are totally met by the base polymer (PB)

Note 1 to entry: Such pipes typically have an outside (barrier) layer of maximum 0,4 mm thickness, including any adhesive. Pipes with an outside layer greater than 0,4 mm are considered as multilayer pipes (see Reference [9]), with the outside layer then being the first of multiple layers rather than having only barrier function.

3.2 Symbols

C	overall service (design) coefficient
d_e	outside diameter (at any point)
d_{em}	mean outside diameter
$d_{em,min}$	minimum mean outside diameter
$d_{em,max}$	maximum mean outside diameter
d_n	nominal outside diameter
d_{sm}	mean inside diameter of socket
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
t	time
σ	hydrostatic stress
σ_{cold}	design stress at 20 °C
σ_D	design stress
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
σ_P	hydrostatic stress values of plastics pipe material
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
PB	polybutene
PB-H	polybutene homopolymer
PB-R	polybutene random copolymer
S	pipe series

4 Classification of service conditions

The performance requirements for piping systems conforming to ISO 15876 (all parts) are specified for four different application classes shown in Table 1.

NOTE Each class is related to a typical field of application and for a design period of 50 years. The classification is taken from ISO 10508. The fields of application are given as a guideline and are not obligatory. Class 3 (low temperature underfloor heating) given in ISO 10508 does not apply to ISO 15876 (all parts).

