INTERNATIONAL STANDARD

ISO 15876-2

Second edition
2017-01

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

Part 2: Pipes

Systèmes de canalisations en plastique pour les installations d'eau chaude et froide — Polybutène (PB) —
Partie 2: Tubes

Reference number
ISO 15876-2:2017(E)

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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 15876-2 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 15876-2:2003), 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 15876-2:2003/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 2, 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, other than pipes, are specified in ISO 15876-1 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 characteristics of pipes.

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 2: Pipes

1 Scope

This document specifies the characteristics of pipes for 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 appropriate to the class of application (see ISO 15876-1).

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

This document covers a range of service conditions (application classes), design pressures and pipe dimension classes. For values of T_D, T_{max} and T_{mal} in excess of those in ISO 15876-1, this document does not apply.

NOTE 1 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, their joints and to joints with components of PB, other plastics and non-plastics materials intended to be used for hot and cold water installations.

It is applicable to pipes with or without (a) barrier layer(s).

NOTE 2 In the case of plastics pipes provided with a thin barrier layer, e.g. to prevent or greatly diminish the diffusion of gases and the transmission of light into or through the pipe wall, the design stress requirements are totally met by the base polymer (PB).

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

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 15876-1:2003, *Plastics piping systems for hot and cold water installations — Polybutene (PB) — Part 1: General*

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

ISO 15876-5, *Plastics piping systems 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 15876-1 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

4 Pipe material

4.1 General

The pipe material from which the pipe is made shall comply with ISO 15876-1.

After extrusion or moulding, PB undergoes a crystalline phase transition (usually called ageing) before it develops its final properties. The minimum required transition time depends on temperature and product characteristics. The same final material performance is obtained once completion of crystalline phase transition is achieved, irrespective of transition conditions. For quality control purposes, therefore, test specimens shall be taken immediately after processing and be conditioned in accordance with recommendations obtained from the compound supplier prior to testing.

The crystalline phase transition is dependent on time and temperature. For guidance a minimum time of five days for PB-H and one day for PB-R should be allowed at 23 °C, unless accelerated ageing is performed.

NOTE The crystalline phase transition can be considerably accelerated upon applying higher hydrostatic pressure of approx. 1 kbar to 2 kbar. Accelerated ageing at higher pressure can be accepted if test results can be proven reproducible and equal to those obtained at atmospheric pressure.

Because of the slow crystallization, transformation and shrinkage which takes places after PB-H and PB-R plastics are cooled from the melt, physical testing should be delayed after extrusion or moulding until this morphological transition is complete.

4.2 Evaluation of σ_{LPL}-curves

The pipe material shall be evaluated in accordance with ISO 9080 or equivalent where internal pressure tests are made in accordance with ISO 1167-1 and ISO 1167-2 to find the σ_{LPL}-values. The σ_{LPL}-value thus determined shall at least be as high as the corresponding values of the reference curves given in Figure 1 or Figure 2.

NOTE One equivalent way of evaluation is to calculate the σ_{LPL}-value for each temperature (e.g. 20 °C, 60 °C to 70 °C and 95 °C) individually.

The reference curves in Figure 1 in the temperature range of 10 °C to 110 °C for PB-H and in Figure 2 in the temperature range of 10 °C to 95 °C for PB-R are derived from the following formulae:

First branch (i.e. the left-hand portion of the lines as shown in Figure 1 and Figure 2)

for PB-H:

$$\log t = -430,866 - \frac{125\,010 \cdot \lg \sigma}{T} + \frac{173\,892,7}{T} + 290,056\,9 \cdot \log \sigma \quad (1)$$

for PB-R:

$$\log t = -367,8019 - \frac{104\,096,6 \cdot \lg \sigma}{T} + \frac{145\,940,231}{T} + 245,536 \cdot \log \sigma \quad (2)$$

Second branch (i. e. the right-hand portion of the lines as shown in Figure 1)

for PB-H:

$$\log t = -129,895 - \frac{37\,262,7 \cdot \lg \sigma}{T} + \frac{52\ 556,48}{T} + 88,567\,35 \cdot \log \sigma \quad (3)$$

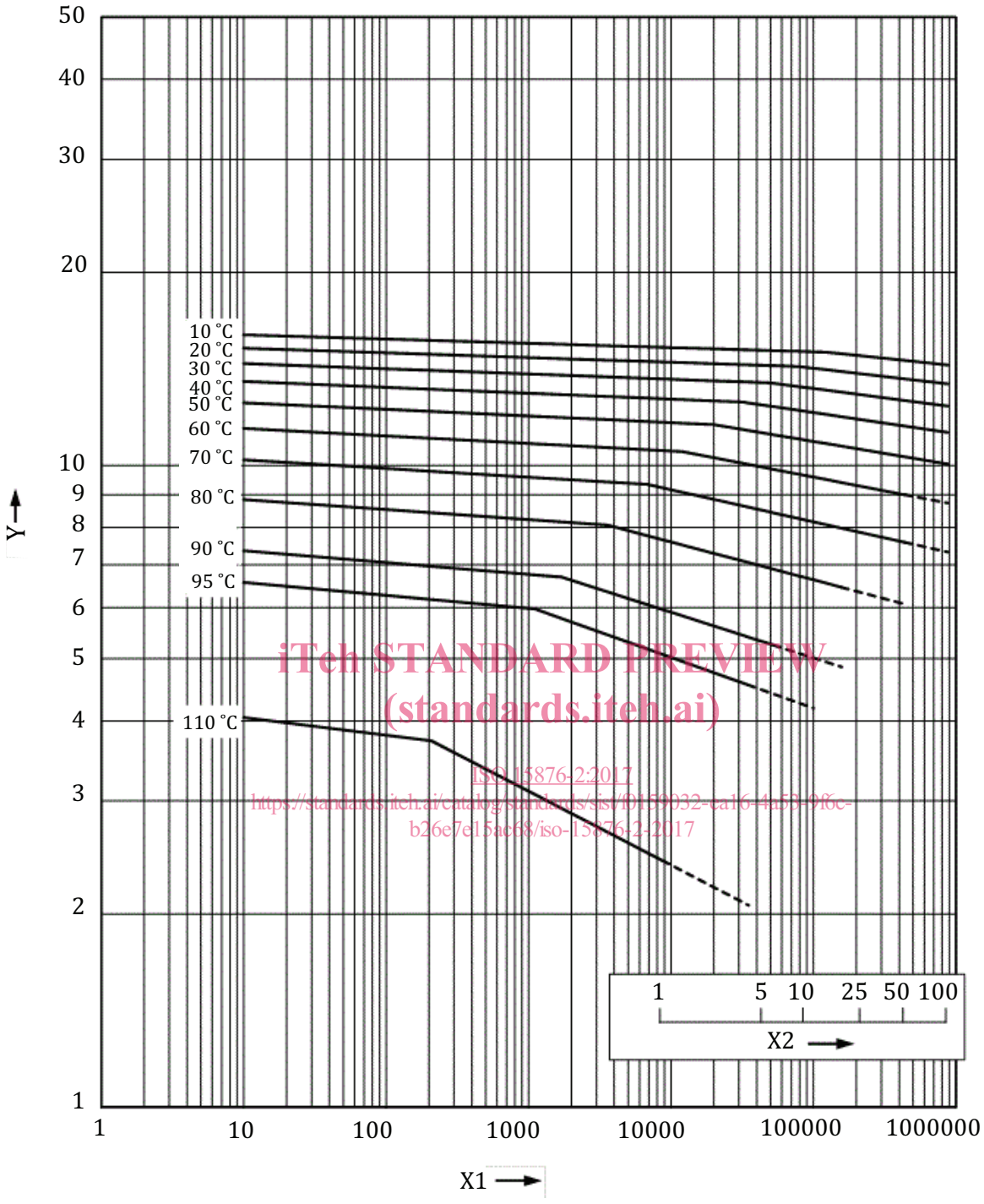
To demonstrate conformance to the reference lines, pipe samples shall be tested at following temperatures and at various hoop stresses such that, at each of the temperatures given, at least three failure times fall in each of the following time intervals:

— temperatures 20 °C; 60 °C to 70 °C; 95 °C;

— time intervals 10 h to 100 h, 100 h to 1 000 h, 1 000 h to 8 760 h and above 8 760 h.

In tests lasting more than 8 760 h, once failure is reached at a stress and time at least on or above the reference line, any time after that may be considered as the failure time. Testing should be carried out in accordance with ISO 1167-1 and ISO 1167-2.

Conformance with the reference lines should be demonstrated by plotting the individual experimental results on the graph. At least 97,5 % of them should lie on or above the reference line.



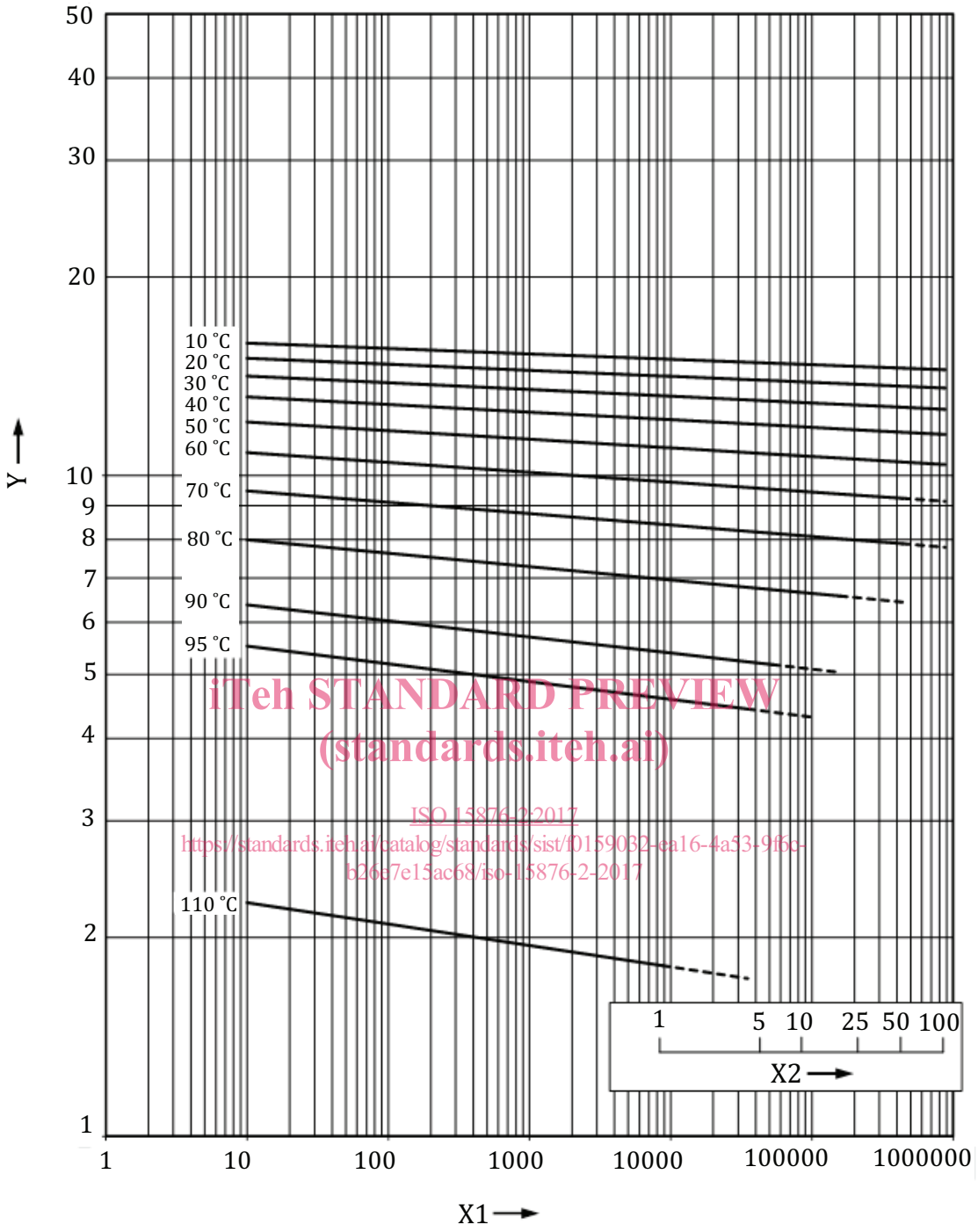
Key

X1 time, t_1, to fracture, in hours

X2 time, t_2, to fracture, in years

Y hoop stress, σ, in megapascal

Figure 1 — Reference curves for expected strength of polybutene homopolymer (PB-H)



Key

X1 time, t_1, to fracture, in hours

X2 time, t_2, to fracture, in years

Y hoop stress, σ, in megapascal

Figure 2 — Reference curves for expected strength of polybutene random copolymer (PB-R)

4.3 Influence on water intended for human consumption

The material shall conform to ISO 15876-1.