BRITISH STANDARD

BS EN ISO
15874-1:2003

# Plastics piping systems for hot and cold water installations — Polypropylene (PP) —

## Part 1: General

The European Standard EN ISO 15874-1:2003 has the status of a British Standard

ICS 23.040.01; 91.140.60



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British Standards

# National foreword

This British Standard is the official English language version of EN ISO 15874-1:2003. It is identical with ISO 15874-1:2003.

The UK participation in its preparation was entrusted by Technical Committee PRI/88, Plastics piping systems, to Subcommittee PRI/88/2, Plastics piping systems for pressure applications, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

**Additional information**

The UK voted against the acceptance of this standard at the CEN Formal Vote, and PRI 88/2 will maintain BS 7291-1:2001[1)], BS 7291-2:2001[2)] and BS 7291-3:2001[3)] and strongly recommends the continued use of polybutylene (PB) and crosslinked polyethylene (PE-X) piping systems certified to BS 7291-2 or BS 7291-3, Class S, for the following reasons.

a) Attention is drawn to the statement in the Scope of BS EN ISO 15874-1 relating to the exclusion from it of piping systems having service conditions in excess of those quoted in Table 1. Central heating systems in the UK fall into this category. BS 7291-1 states the service conditions for UK systems where the maximum system service temperature for sealed central heating systems, designated as Class S, is 105 ºC and the system malfunction temperature is 114 ºC. Both these temperatures are significantly in excess of those specified in Table 1 and these UK systems are therefore not covered by this standard.

1) BS 7291-1:2001, *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Part 1: General requirements.*
2) BS 7291-2:2001, *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Part 2: Specification for polybutylene (PB) pipes and associated fittings.*
3) BS 7291-3:2001, *Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings — Part 3: Specification for cross-linked polyethylene (PE-X) pipes and associated fittings.*

**Amendments issued since publication**

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b) In addition to the above:

1) The normal maximum operating cold water supply pressure in the UK is 12.5 bar[4] which some categories of piping systems in the BS EN ISO 15874 series of standards do not meet.

2) The BS EN ISO 15874 series of standards does not specifically describe push fit joints, which are the predominant jointing method in the UK.

3) There is a disparity between the malfunction temperature quoted in Table 1 (100 °C) and the malfunction temperatures applicable to boilers (110 °C) conforming to BS EN 297:1994[5], BS EN 483:2000[6] and BS EN 625:1996[7]. Consequently piping systems could be subjected to temperatures in service for which they have not been tested.

4) The unique and traditional practice in the UK is to use products certified to BS 7291-2 or BS 7291-3, Class S, for all applications, as defined in BS 7291-1. This is recognized in the national annex to BS EN 12828[8], which recommends the use of systems suitable for the maximum temperatures and pressures for their intended application specified in BS 7291-1.

Updated versions of BS 7291-1, BS 7291-2 and BS 7291-3 are being prepared, which maintain these traditional UK operating conditions, and measures are being taken to address this issue in appropriate harmonized European Standards.

**Cross-references**

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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**Summary of pages**

This document comprises a front cover, an inside front cover, page i, a blank page, the EN title page, pages 2 to 13 and a back cover.

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[4] 1 bar = 100 kPa.
[5] BS EN 297:1994, *Gas-fired central heating boilers — Type $B_{11}$ and $B_{11BS}$ boilers fitted with atmospheric burners of nominal heat input not exceeding 70 kW.*
[6] BS EN 483:2000, *Gas-fired central heating boilers — Type C boilers of nominal heat input not exceeding 70 kW.*
[7] BS EN 625:1996, *Gas-fired central heating boilers — Specific requirements for the domestic hot water operation of combination boilers of nominal heat input not exceeding 70 kW.*
[8] BS EN 12828, *Heating systems in buildings — Design for water-based heating systems.*

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EUROPEAN STANDARD

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# EN ISO 15874-1

December 2003

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English version

# Plastics piping systems for hot and cold water installations - Polypropylene (PP) - Part 1: General (ISO 15874-1:2003)

Systèmes de canalisations en plastique pour les installations d'eau chaude et froide - Polypropylène (PP) - Partie 1: Généralités (ISO 15874-1:2003)

Kunststoff-Rohrleitungssysteme für die Warm- und Kaltwasserinstallation - Polypropylen (PP) - Teil 1: Allgemeines (ISO 15874-1:2003)

This European Standard was approved by CEN on 14 March 2003.

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# Foreword

This document (EN ISO 15874-1:2003) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN, in collaboration with Technical Committee ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by December 2005.

NOTE 1 This draft was submitted for CEN enquiry as prEN 12202-1:1995.

This standard is part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work undertaken in ISO/TC 138 “Plastics pipes, fittings and valves for the transport of fluids”, which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and recommended practices for installation.

EN ISO 15874 consists of the following Parts [1)], under the general title *Plastics piping systems for hot and cold water installations – Polypropylene (PP)*

Part 1: General (the present standard)

Part 2: Pipes

Part 3: Fittings

Part 5: Fitness for purpose of the system

Part 7: *Guidance for the assessment of conformity* is intended to be published as CEN ISO/TS 15874-7

This Part 1 of EN ISO 15874 includes a Bibliography.

At the date of publication of this standard, System Standards for piping systems of other plastics materials used for the same application are the following:

EN ISO 15875:2003*, Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*

EN ISO 15876:2003, *Plastics piping systems for hot and cold water installations — Polybutylene (PB)*

EN ISO 15877:2003, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C)*

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1) This System Standard does not incorporate a Part 4 *Ancillary equipment* or a Part 6: *Guidance for installation.* For ancillary equipment separate standards can apply. Guidance on installation of plastics piping systems made from different materials intended to be used for hot and cold water installations is given by ENV 12108.

For pipes and fittings which have conformed to the relevant national standard before 1st November 2003, as shown by the manufacturer or by a certification body, the national standard may continue to apply until 30th November 2005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

# Introduction

The System Standard, of which this is Part 1, specifies the requirements for a piping system and its components when made from polypropylene (PP). 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 EN ISO 15874;

1) This standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

2) 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 components of the piping system are specified in Part 2 and Part 3 of EN ISO 15874:2003. Characteristics for fitness of purpose (mainly for joints) are covered in Part 5. Part 7 (CEN ISO/TS 15874-7) gives guidance for the assessment of conformity.

This Part of EN ISO 15874 specifies the general aspects of the plastics piping system.

# 1 Scope

This Part of EN ISO 15874 specifies the general aspects of polypropylene (PP) 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 standard covers a range of service conditions (classes of application), design pressures and pipe dimension classes.

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 standard.

In conjunction with the other Parts of EN ISO 15874 it is applicable to PP 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

This Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 15874-2:2003, *Plastics piping system for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes (ISO 15874-2:2003)*

EN ISO 15874-3:2003, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 3: Fittings (ISO 15874-3:2003)*

ISO 472:1999, *Plastics — Vocabulary*

ISO 1043-1:2001, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

# 3 Terms and definitions, symbols and abbreviated terms

For the purposes of this standard, the following terms and definitions, symbols and abbreviated terms apply.

## 3.1 Terms and definitions

In addition to the terms and definitions given below, the terms and definitions given in ISO 472:1999 and ISO 1043-1:2001 apply.

### 3.1.1 Geometrical terms and definitions

#### 3.1.1.1 Nominal size

**3.1.1.1.1**
**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)

**3.1.1.1.2**
**nominal size DN/OD**
nominal size, related to outside diameter

**3.1.1.2**
**nominal outside diameter** ($d_n$)
specified diameter, in millimetres, assigned to a nominal size DN/OD

**3.1.1.3**
**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

**3.1.1.4**
**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 $\pi$ ($\approx$ 3,142) rounded up to the nearest 0,1 mm

**3.1.1.5**
**minimum mean outside diameter** ($d_{em,min}$)
minimum value of the mean outside diameter as specified for a given nominal size

**3.1.1.6**
**maximum mean outside diameter** ($d_{em,max}$)
maximum value of the mean outside diameter as specified for a given nominal size

**3.1.1.7**
**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

**3.1.1.8**
**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

**3.1.1.9**
**nominal wall thickness** ($e_n$)
numerical designation of the wall thickness of a component, approximately equal to the manufacturing dimension in millimetres (mm)

**3.1.1.10**
**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

**3.1.1.11**
**minimum wall thickness (at any point)** ($e_{min}$)
minimum wall thickness at any point around the circumference of a component, as specified

**3.1.1.12**
**maximum wall thickness at any point** ($e_{max}$)
maximum wall thickness at any point around the circumference of a component, as specified

**3.1.1.13**
**tolerance**
permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value

**3.1.1.14**
**pipe series** (S)
dimensionless number for pipe designation conforming to ISO 4065

NOTE According to EN ISO 15874 the pipe series S is used as a means for selecting pipe sizes for practical purposes (see EN ISO 15874-2).

**3.1.1.15**
**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 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** ($\sigma$)
stress, expressed in megapascals, induced in the wall of a pipe when a pressure is applied using water as a medium. It is calculated using the following approximate equation:

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

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 ($T_D$)**
a 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 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** (LCL)
quantity, expressed in megapascals (MPa), which can be considered as a material property, representing the 97,5 % lower confidence limit of the predicted average long-term hydrostatic strength at the given temperature, $T$, and time, $t$

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

NOTE See also Annex A of EN ISO 15874-2:2003.

**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, LCL

**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 (PP)

## 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 |
| $\sigma$ | hydrostatic stress |
| $\sigma_{cold}$ | design stress at 20 °C |
| $\sigma_D$ | design stress |
| $\sigma_{DF}$ | design stress of plastics fitting material |
| $\sigma_{DP}$ | design stress of pipe material |
| $\sigma_F$ | hydrostatic stress values of plastics fitting material |
| $\sigma_P$ | hydrostatic stress values of plastics pipe material |
| $\sigma_{LCL}$ | lower confidence limit of long-term hydrostatic strength |

### 3.3 Abbreviated terms

| | |
|---|---|
| DN | nominal size |
| DN/OD | nominal size, outside diameter related |
| LCL | lower confidence limit |
| MDP | maximum design pressure |
| PP | polypropylene |
| S | pipe series |

## 4 Classification of service conditions

The performance requirements for piping systems conforming to EN ISO 15874 are specified for four different application classes and are shown in Table 1.

NOTE 1 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 EN ISO 15874.

For any application the parties concerned shall agree the selection of the applicable class conforming to Table 1. Each application class shall be combined with an operating pressure, $p_D$, of 4 bar [2)], 6 bar, 8 bar or 10 bar, as applicable.

2) 1 bar = $10^5$ N/m$^2$ = 0,1 MPa

**Table 1 — Classification of service conditions**

| Application class | Design temperature, $T_D$ °C | Time[2] at $T_D$ years | $T_{max}$ °C | Time at $T_{max}$ years | $T_{mal}$ °C | Time at $T_{mal}$ h | Typical field of application |
|---|---|---|---|---|---|---|---|
| 1 [1] | 60 | 49 | 80 | 1 | 95 | 100 | Hot water supply (60 °C) |
| 2 [1] | 70 | 49 | 80 | 1 | 95 | 100 | Hot water supply (70 °C) |
| 4 [2] | 20<br>Followed by<br>40<br>Followed by<br>60<br>Followed by (see next column) | 2,5<br><br>20<br><br>25 | 70<br>Followed by (see next column) | 2,5 | 100 | 100 | Underfloor heating and low temperature radiators |
| 5 [2] | 20<br>Followed by<br>60<br>Followed by<br>80<br>Followed by (see next column) | 14<br><br>25<br><br>10 | 90<br>Followed by (see next column) | 1 | 100 | 100 | High temperature radiators |

1) A country may select either class 1 or class 2 to conform to its national regulations.

2) Where more than one design temperature appears for any class, the times should be aggregated (e.g. the design temperature profile for 50 years for class 5 is: 20 °C for 14 years followed by 60 °C for 25 years, 80 °C for 10 years, 90 °C for 1 year and 100 °C for 100 h).

NOTE For values of $T_D$, $T_{max}$ and $T_{mal}$ in excess of those in this table, this standard does not apply.

All systems which satisfy the conditions specified in table 1 shall also be suitable for the conveyance of cold water for a period of 50 years at a temperature of 20 °C and a design pressure of 10 bar.

All heating installations shall only use water or treated water as the transfer fluid.

NOTE 2 The manufacturer of plastics pipes and fittings should give guidance on the type of treatment required and on aspects of applications such as oxygen permeation.

# 5 Material

## 5.1 General

The material from which the pipes and fittings are made shall be polypropylene (PP) which shall conform to EN ISO 15874-2 and EN ISO 15874-3 as applicable.

This standard is applicable to three types of polypropylene, as follows:

Polypropylene homopolymer PP-H (also known as type 1)

Polypropylene block copolymer PP-B (also known as type 2)

Polypropylene random copolymer PP-R (also known as type 3)

where

PP-H comprises all polypropylene homopolymers;

PP-B comprises thermoplastic propylene "block" copolymers having not more than 50 % of another olefinic monomer (or monomers), having no functional group other than the olefinic group, copolymerized with propylene;

PP-R comprises thermoplastic propylene random copolymers having not more than 50 % of another olefinic monomer (or monomers), having no functional group other than the olefinic group, copolymerized with propylene;

## 5.2 Influence on water intended for human consumption

All plastics and non-plastics materials for components of the PP piping system, when in permanent or temporary contact with water which is intended for human consumption, shall not adversely affect the quality of the drinking water.

NOTE European standards on test methods for the assessment of migration, odour and flavour and for microbiological assessment are under preparation.

## 5.3 Reprocessable material

The use of the manufacturer's own reprocessable material obtained during the production and works testing of products conforming to this standard is permitted in addition to the use of virgin material. Reprocessable material obtained from external sources and recyclable material shall not be used.

# Bibliography

[1] EN 806-1:2000, *Specifications for installations inside buildings conveying water for human consumption — Part 1: General*

[2] ISO 4065:1996, *Thermoplastics pipes — Universal wall thickness table*

[3] ENV 12108:2001, *Plastics piping systems — Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption*

[4] EN ISO 15874-5:2003, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 5: Fitness for purpose of the system*

[5] CEN ISO/TS 15874-7:2003, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 7: Guidance for the assessment of conformity*

[6] ISO 10508:1995, *Thermoplastics pipes and fittings for hot and cold water systems*

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