INTERNATIONAL STANDARD

ISO 15874-1

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

Part 1: General

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

Partie 1: Généralités

Reference number
ISO 15874-1:2013(E)

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 15874-1 was prepared by Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in collaboration with Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, and 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 15874-1:2003 and ISO 15874-1:2003/Amd 1:2007), which has been technically revised. In 5.1, the material PP-RCT has been included.

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*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 5: Fitness for purpose of the system*

— *Part 7: Guidance for the assessment of conformity* [Technical specification]

1) 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 CEN/TR 12108 [1].

Introduction

This part of ISO 15874 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.

Regarding potential undesirable effects on the quality of water intended for human consumption, caused by the product covered by ISO 15874

— no information is provided as to whether the product can be used without restriction, and

— 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 ISO 15874-2 and ISO 15874-3. Characteristics for fitness of purpose (mainly for joints) are covered in ISO 15874-5. ISO/TS 15874-7 gives guidance for the assessment of conformity.

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

At the date of publication of this part of ISO 15874, the following system International Standards for piping systems of other plastics materials used for the same application are

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

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

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

ISO 22391, Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT)

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

Part 1: General

1 Scope

This part of 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).

It covers a range of service conditions (classes of application), design pressures and pipe dimension classes. Values of T_D, T_{max} and T_{mal} in excess of those in Table 1 of this part of ISO 15874 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 part of ISO 15874.

In conjunction with the other parts of ISO 15874, this part of ISO 15874 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

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15874-2:2013, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes*

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

ISO 472, *Plastics — Vocabulary*

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

ISO 4065, *Thermoplastics pipes — Universal wall thickness table*

3 Terms and definitions, symbols and abbreviated terms

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

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 π ($\approx$ 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 the 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 15874 the pipe series S is used as a means for selecting pipe sizes for practical purposes (see ISO 15874-2).

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 (pD) is equal to the maximum design pressure (MDP), as specified in EN 806-1 [3].

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. 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, TD, 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, σDP, or in the plastics fitting material, σDF, for a given application or set of service conditions, respectively

Note 1 to entry: See also Annex A of ISO 15874-2:2013.

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 predicted limit, 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 (PP)

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 References [5] to [8]), 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 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 predicted limit

MDP maximum design pressure

PP polypropylene

S pipe series

4 Classification of service conditions

The performance requirements for piping systems conforming to 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 [4]. The fields of application are given as a guideline and are not obligatory. Class 3 (low temperature underfloor heating) given in ISO 10508 [4] does not apply to 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 a design pressure, p_D, of 4 bar[2)], 6 bar, 8 bar or 10 bar, as applicable.

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.

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

[a] A country may select either class 1 or class 2 to conform to its national regulations.

[b] 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 International Standard does not apply.

5 Material

5.1 General

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

This part of ISO 15874 is applicable to four 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)

— Polypropylene random copolymer with modified crystallinity PP-RCT (also known as type 4)

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;

PP-RCT 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.

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.

6 System performance requirement

Pipes conforming to ISO 15874-2 and fittings conforming to ISO 15874-3, or other types of fittings used, when jointed together, shall be in accordance with ISO 15874-5.

Pipes and fittings shall have the same application class for use 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.

Bibliography

[1] CEN/TR 12108, *Plastics piping systems — Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption*

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

[3] ISO 10508, *Thermoplastics pipes and fittings for hot and cold water systems*

[4] ISO 21003-1, *Multilayer piping systems for hot ands cold water installations inside buildings — Part 1: General*

[5] ISO 21003-2, *Multilayer piping systems for hot and cold water installations inside buildings — Part 2: Pipes*

[6] ISO 21003-3, *Multilayer piping systems for hot and cold water installations inside buildings — Part 3: Fittings*

[7] ISO 21003-5, *Multilayer piping systems for hot and cold water installations inside buildings — Part 5: Fitness for purpose of the system*

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