INTERNATIONAL STANDARD

ISO 15874-3

Second edition
2013-02-15

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

Part 3: **Fittings**

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

Partie 3: Raccords

Reference number
ISO 15874-3:2013(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.

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 15874-3 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 15874-3:2003 and ISO 15874-3:2003/Amd 1:2007), which has been technically revised.

The following material has been revised:

— in 4.1.1, Table 1, the material PP-RCT has been included;

— in 6.2.1, Figure 1 has been simplified, and in Tables 3 and 4, the socket length and socket dimensions of socket fusion fittings have been adjusted;

— in 6.2.2, Table 5, the socket dimensions for electrofusion fittings have been extended to 160 mm; and

— in 7.4, Tables 6, 7 and 8, values have been adjusted.

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 materials and components, other than fittings, are specified in ISO 15874-1 and ISO 15874-2. Characteristics for fitness for 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 characteristics of the fittings.

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 3: Fittings

1 Scope

This part of ISO 15874 specifies the characteristics of fittings for 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 ISO 15874-1:2013, Table 1).

It covers a range of service conditions (application classes) and design pressure classes. For values of T_D, T_{max} and T_{mal} in excess of those in Table 1 of ISO 15874-1:2013 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 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 fittings made from PP and to fittings made from other materials which are intended to be fitted to pipes conforming to ISO 15874-2 for hot and cold water installations, whereby the joints conform to the requirements of ISO 15874-5.

This part of ISO 15874 is applicable to fittings of the following types:

— socket fusion fittings;

— electro fusion fittings;

— mechanical fittings;

— fittings with incorporated inserts.

It is also applicable to fittings made from alternative materials which when fitted to pipes conforming to ISO 15874-2, conform to the requirements of ISO 15874-5.

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 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

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

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.*

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 1167-3 *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 3: Preparation of components*

ISO 1167-4 *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*

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 15874-1:2013, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 1: General*

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

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

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber.*

EN 681-2, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers.*

EN 1254-3, *Copper and copper alloys — Plumbing fittings — Part 3: Fittings with compression ends for use with plastics pipes.*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels.*

EN 10226-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Taper external threads and parallel internal treads — Dimensions, tolerances and designation.*

3 Terms and definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions, symbols and abbreviations given in ISO 15874-1 and the following apply

3.1
fitting
component of a piping system, which connects two or more pipes and/or fittings together, without any further function

3.2 Mechanical fittings

3.2.1
compression fitting
fitting in which the joint is made by the compression of a ring or sleeve on the outside wall of the pipe with or without additional sealing elements and with internal support

3.2.2
crimped fitting
fitting in which the joint is made by crimping of the fitting and/or a ring on the outside wall of the pipe by means of a special tool

3.2.3
flanged fitting
fitting in which the pipe connection consists of two mating flanges which are mechanically pressed together and sealed by the compression of an elastomeric sealing element between them

3.2.4
flat seat union fitting
fitting in which the pipe connection consists primarily of two components, at least one of which normally incorporates a flat sealing surface, which are mechanically pressed together by means of screwed nut or similar and sealed by the compression of an elastomeric sealing element between them

3.3 Fittings for fusion

3.3.1
socket fusion fitting
fitting in which the joint with the pipe is made by melting together the outer part of the pipe with the inner part of the fitting by means of heat induced by heated tool

3.3.2
electro fusion fitting
fitting in which the joint with the pipe is made by melting together the outer part of the pipe and the inner part of the fitting by means of heat induced by current flowing in an appropriate resistor inserted in the fitting body

3.4
fitting with incorporated inserts
fitting in which the joint is made by means of connecting threads or other outlets, inserted in the plastics body combined with fusion ends for socket fusion or electro fusion

4 Material characteristics

4.1 Plastics fitting material

4.1.1 Fitting material identical to the PP pipe compound

The PP compound shall comply with ISO 15874-1:2013, 5.1.

The material shall be tested in form of tubular test pieces.

When tested in accordance with the test methods specified in Table 1, using the indicated parameters, the test pieces shall withstand the hydrostatic test pressure, p_F, given in Table 6, 7, 8 or 9 without bursting or leakage.

Table 1 — Mechanical characteristic of tubular test pieces made of PP by injection moulding

Characteristic	Requirement	Test parameters for the individual tests				Test method
Resistance to internal pressure	No bursting or leakage during the test period	**PP-H**				ISO 1167-1 and ISO 1167-3
		Hydrostatic (hoop) stress MPa	**Test temp.** °C	**Test period** h	**Number of test pieces**	
		21,0	20	1	3	
		3,6	95	1000	3	
		PP-B				
		Hydrostatic (hoop) stress MPa	**Test temp.** °C	**Test period** h	**Number of test pieces**	
		16,0	20	1	3	
		2,6	95	1000	3	
		PP-R				
		Hydrostatic (hoop) stress MPa	**Test temp.** °C	**Test period** h	**Number of test pieces**	
		16,0	20	1	3	
		3,5	95	1000	3	
		PP-RCT				
		Hydrostatic (hoop) stress MPa	**Test temp.** °C	**Test period** h	**Number of test pieces**	
		15,0	20	1	3	
		3,8	95	1000	3	
		Test parameters for all tests				
		Sampling procedure Type of end cap Orientation of test piece Type of test		[a] Type A Not specified Water-in–water		

[a] The sampling procedure is not specified. For guidance see ISO/TS 15874-7 [2].

4.1.2 PP Fitting material not identical to the PP pipe compound

4.1.2.1 Evaluation of σ_{LPL}-values and control points

The fitting material in form of injection-moulded or extruded tubular test pieces shall be evaluated by using the method given in ISO 9080 or equivalent where internal pressure tests are made in accordance with ISO 1167-1 and ISO 1167-3 to find the σ_{LPL}-values. The σ_{LPL}-values thus determined shall be used to determine the design stress, σ_{DF}, (see Annex A of ISO 15874-2:2013) and values of hydrostatic stress, σ_F, corresponding to the temperature and time control points given in Table 2.

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

If evaluation using the method given in ISO 9080 or equivalent is available from long-term internal pressure tests relative to extruded pipes of the same compound as used for the fitting, the relevant test temperature shall be equal to or higher than the maximum design temperature, T_{max}, for the service condition class.

Table 2 — Control points for testing fitting materials with tubular test pieces relative to classification of service conditions

	All application classes	Application			
		Class 1	Class 2	Class 4	Class 5
Maximum design temperature, T_{max}, in °C	—	80	80	70	90
Test temperature, T_{Test}, in °C	20	95 [a]	95 [a]	80	95
Test duration, in h	1	1000	1000	1000	1000
[a] Conducted at 95 °C to match existing test facilities.					

It is recommended that the nominal diameter of the injection-moulded tubular test pieces should be in the range of the nominal diameters of fittings normally produced by the manufacturer.

4.1.2.2 Thermal stability

When testing the thermal stability by hydrostatic pressure testing in accordance with ISO 1167-1 at 110 °C for 8 760 h, using a test piece in pipe form or a fitting connected to pipes, the test piece shall withstand the test without bursting. The test shall be conducted in water-in-air at an internal pressure equivalent to the hydrostatic stress used in the pipe material thermal stability test.

If a fitting connected to pipes is used as a test piece and the pipe connection fails then the thermal stability test shall be repeated using a test piece in pipe form.

4.1.3 Plastics fitting material other than PP

Plastics material, other than PP, for fittings intended to be used in PP piping systems for hot and cold water within buildings for the conveyance of water, whether or not for human consumption (domestic systems) and for heating systems shall conform to 4.1.2.

4.2 Metallic fitting material

Metallic material for fittings intended to be used with components conforming to ISO 15874 shall conform to the requirements given in EN 1254-3 or EN 10088-1, as applicable.

4.3 Influence on water intended for human consumption

The material shall conform to ISO 15874-1.

5 General characteristics

5.1 Appearance

When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and free from scoring, cavities, and other surface defects to an extent that would prevent conformity to this standard. The material shall not contain visible impurities. Slight variations in appearance of the colour shall be permitted. Each end of a fitting shall be square to its axis.

5.2 Opacity

Fittings that are declared to be opaque shall not transmit more than 0,2 % of visible light when tested in accordance with ISO 7686.

NOTE This test is not necessary when the fitting body is made from a compound already declared opaque for the production of pipes.

6 Geometrical characteristics

6.1 General

Dimensions shall be measured in accordance with ISO 3126.

6.1.1 Nominal diameter(s)

The nominal diameter(s), d_n, of a fitting shall correspond to and be designated by the nominal outside diameter(s) of the pipe(s) conforming to ISO 15874-2 for which they are designed.

6.1.2 Angles

The preferred nominal angles of non-straight fittings are 45° and 90°.

6.1.3 Threads

Threads used for jointing shall conform to EN 10226-1. Where a thread is used as a fastening thread for jointing an assembly (e.g. union nuts) it shall conform to ISO 228-1 except that these requirements need not apply to the threads used by the manufacturer to join component parts of a fitting together.

6.2 Dimensions of sockets for socket fusion and electrofusion fittings

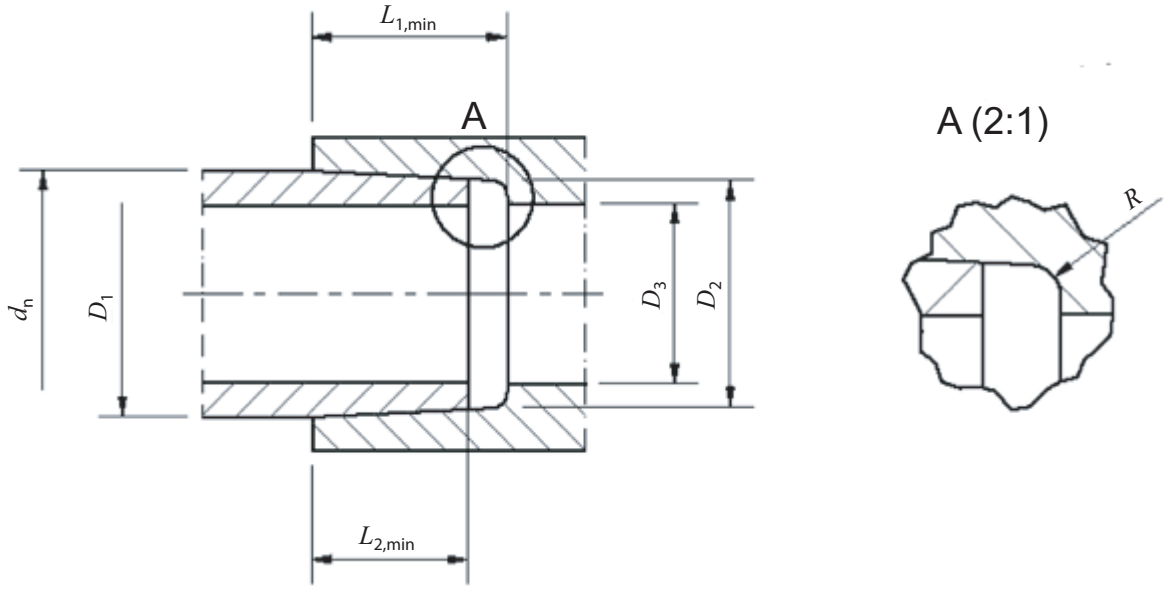
6.2.1 Dimensions of socket fusion fitting

Socket fusion fittings shall be classified in two types as follows:

Type A Fittings intended to be used with pipes, where no external machining of the pipe is required

Type B Fittings intended to be used with pipes, where machining of the outside surface of the pipe is necessary in accordance with the instructions of the manufacturer

The nominal diameters of the socket fusion fittings shall conform to Table 3 or Table 4.



Key

d_n is the nominal diameter.

D_1 is the inside diameter of the socket mouth which comprises the mean diameter of the circle at the inner section of the extension of the socket with the plane of the socket mouth.

D_2 is the mean inside diameter of the socket root which comprises the mean diameter of the circle in a plane parallel to the plane of the socket mouth and separated from it by a distance of $L_{1,min}$.

D_3 is the minimum diameter of the flow channel (bore) through the body of a fitting.

$L_{1,min}$ is the minimum socket length, which comprises the distance from the socket mouth to the shoulder.

$L_{2,min}$ is the minimum insertion length which comprises the depth of penetration of the heated pipe end into the socket.

R is the allowed maximum root radius.

Figure 1 — Socket and spigot dimensions for socket fusion fittings

Table 3 — Dimensioning of the sockets of socket fittings for socket fusion

Dimensions in millimetres

Nominal diameter of the fitting	Mean inside diameter of socket				Maximum out-of-roundness	Minimum bore [a] D_3	Radius at socket root	Socket length	Penetration of pipe into socket
	Root D_1		Root D_2						
d_n	$D_{1,min}$	$D_{1,max}$	$D_{2,min}$	$D_{2,max}$		$D_{3,min}$	R	$L_{1,min}$[b]	$L_{2,min}$[c]
16	15,2	15,5	15,1	15,4	0,4	11,2	2,5	13,0	9,5
20	19,2	19,5	19,0	19,3	0,4	15,2	2,5	14,5	11,0
25	24,2	24,5	23,9	24,3	0,4	19,4	2,5	16,0	12,5
32	31,1	31,5	30,9	31,3	0,5	25,0	3,0	18,0	14,5
40	39,0	39,4	38,8	39,2	0,5	31,4	3,0	20,5	17,0
50	48,9	49,4	48,7	49,2	0,6	39,4	3,0	23,5	20,0
63	61,9	62,5	61,6	62,1	0,6	49,8	4,0	27,5	24,0
75	73,4	74,7	72,6	73,6	1,0	59,4	4,0	30,0	26,0
90	88,2	89,7	87,4	88,4	1,0	71,6	4,0	33,0	29,0
110	108,0	109,7	107,0	108,2	1,0	87,6	4,0	37,0	32,5

Table 3 *(continued)*

Nominal diameter of the fitting	Mean inside diameter of socket				Maximum out-of-roundness	Minimum bore [a] D_3	Radius at socket root	Socket length	Penetration of pipe into socket
	Root D_1		Root D_2						
d_n	$D_{1,min}$	$D_{1,max}$	$D_{2,min}$	$D_{2,max}$		$D_{3,min}$	R	$L_{1,min}$[b]	$L_{2,min}$[c]
125	122,4	124,6	121,5	123,0	1,2	99,7	4,0	40,0	35,0

a Only applicable, if a shoulder exists

b Length of the socket (rounded), $d_n \leq 63$ $L_{1,min} = 0{,}3\ d_n + 8{,}5$ mm

$d_n \geq 75$ $L_{1,min} = 0{,}2\ d_n + 15$ mm

c Penetration of pipe into socket, $d_n \leq 63$ $L_{2,min} = L_{1,min} - 3{,}5$ mm

$d_n \geq 75$ $L_{2,min}$ = no formula available

Table 4 — Diameters and lengths of sockets for socket fusion fittings of type B

Dimensions in millimetres

Nominal diameter of the fitting	Mean inside diameter of socket				Maximum out-of-roundness	Minimum bore [a] D_3	Radius at socket root	Socket length	Penetration of pipe into socket
	Root D_1		Root D_2						
d_n	$D_{1,min}$	$D_{1,max}$	$D_{2,min}$	$D_{2,max}$		$D_{3,min}$	R	$L_{1,min}$[b]	$L_{2,min}$[c]
16	15,2	15,5	15,1	15,4	0,4	11,2	2,5	13,0	9,5
20	19,2	19,5	19,0	19,3	0,4	15,2	2,5	14,5	11,0
25	24,2	24,5	23,9	24,3	0,4	19,4	2,5	16,0	12,5
32	31,1	31,5	30,9	31,3	0,5	25,0	3,0	18,0	14,5
40	39,0	39,4	38,8	39,2	0,5	31,4	3,0	20,5	17,0
50	48,9	49,4	48,7	49,2	0,6	39,4	3,0	23,5	20,0
63	61,9	62,5	61,6	62,1	0,6	49,8	4,0	27,5	24,0
75	73,7	74,2	73,4	73,9	1,0	59,4	4,0	31,0	27,5
90	88,6	89,2	88,2	88,8	1,0	71,6	4,0	35,5	32,0
110	108,4	109,0	108,0	108,6	1,0	87,6	4,0	41,5	38,0
125	122,7	123,9	122,3	123,5	1,2	99,7	4,0	46,5	43,0

a Only applicable if a shoulder exists

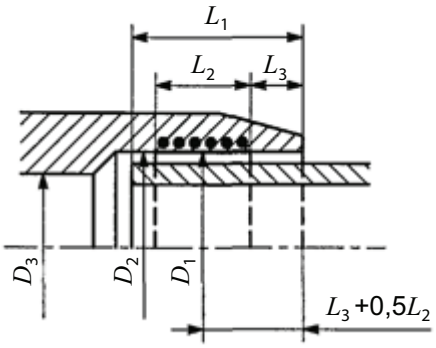
b Length of the socket (rounded), $L_{1,min} = 0{,}3\ d_n + 8{,}5$ mm

c Penetration of pipe into socket, $L_{2,min} = L_{1,min} - 3{,}5$ mm

6.2.2 Dimensions of sockets for electrofusion fittings

The principal dimensions of sockets for electrofusion fittings as shown in Figure 2 shall be in accordance with Table 5.

The values of lengths L_1 and L_2 (see Figure 2) shall be in accordance with Table 5. The manufacturer shall declare the actual length.



Key

D_1 is the mean inside diameter of the fusion zone which comprises the mean inside diameter when measured in a plane parallel to the plane of the mouth at a distance $L_3 + 0{,}5L_2$ from that face.

D_2 is the minimum inside diameter of the socket measured in any plane parallel to the plane of the mouth at a distance not greater than L_1 from that plane.

D_3 is the minimum bore which comprises the minimum diameter of the flow channel through the body of the fitting.

L_1 is the depth of penetration of the pipe or male end of a spigot fitting. In the case of a coupling without a stop it is not greater than half the total length of the fitting.

L_2 is the nominal length of the fusion zone, which comprises the heated length as declared by the manufacturer.

L_3 is the nominal unheated entrance length of the fitting, which comprises the distance between the mouth of the fitting and the start of the fusion zone as declared by the manufacturer.

Figure 2 — Principal dimensions for electrofusion fittings

Table 5 — Socket dimensions for electrofusion fittings

Dimensions in millimetres

Nominal diameter of the fitting	Minimum mean inside diameter [a] of fusion zone	Nominal length of fusion zone	Depth of penetration	Nominal diameter of the fitting
d_n	$D_{1,min}$	$L_{2,min}$	$L_{1,min}$	$L_{1,max}$
16	16,1	10	20	35
20	20,1	10	20	37
25	25,1	10	20	40
32	32,1	10	20	44
40	40,1	10	20	49
50	50,1	10	20	55
63	63,2	11	23	63
75	75,2	12	25	70
90	90,2	13	28	79
110	110,3	15	32	85
125	125,3	16	35	90
140	140,3	18	38	95
160	160,4	20	42	101

[a] In piping systems that involve spigot trimming, smaller values for D_1 are permitted if conforming to the manufacturer's specification.

6.3 Dimensions of metallic fittings

Metallic fittings shall conform to EN 1254-3.

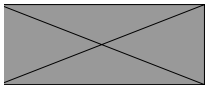
7 Mechanical characteristics of plastics fittings

7.1 General

When tested in accordance with ISO 1167-1, ISO 1167-3 and ISO 1167-4 using the test parameters given in Table 6, 7, 8 or 9 where the test pressure is given in relation to the class of fitting and design pressure, the component shall withstand the test pressure, p_F, without bursting or leakage during the test period.

The testing shall be conducted in water-in-air.

The test pressure shall be calculated using the following equation:



where:

p_F is the hydrostatic test pressure, in bars, to be applied to the fitting body during the test period;

σ_F is the value of the hydrostatic stress, in megapascals, of the fitting body material corresponding to the test duration and test temperature conditions in Table 6, 7, 8 or 9;

σ_{DF} is the design stress value, in megapascals, of the fitting body material as determined for the appropriate service condition class from data produced in accordance with 4.1 and Annex A of ISO 15874-2:2013.

p_D is the design pressure of 4 bar or 6 bar or 8 bar or 10 bar, as applicable.

Fittings may be connected to the pipes for which they are intended to be used. Other methods may be used to seal the ends of the fitting body in order that the required pressure can be applied.

7.2 Fitting material identical to the PP pipe compound

In this case σ_{DF} has the same value as σ_{DP} and the fitting shall conform to the requirements given in Table 6, 7, 8 or 9 using the test pressures, p_F, given, as applicable to the class of fitting and the design pressure.

7.3 Fitting made from PP not identical to the PP pipe compound

The fitting shall conform to the requirements given in Table 6, 7, 8 or 9 relating to test temperature and minimum time to failure as applicable to the class of fitting and design pressure, using the equation in 7.1 and relevant values for hydrostatic stress, σ_F, and design stress, σ_{DF}, derived as in 4.1.2, to determine the test pressure p_F.

7.4 Fittings made from plastics other than PP

Fittings intended to be used in PP piping systems for hot and cold water within buildings for the conveyance of water, whether or not for human consumption (domestic systems), and for heating systems shall conform to 7.3.

Table 6 — Determination of test pressure p_F for PP-H

	Application							
	Class 1		Class 2		Class 4		Class 5	
Max. design temperature, T_{max}, in °C	80		80		70		90	
Design stress of fitting material, σ_{DF}, in MPa	2,88		1,99		3,23		1,82	
Test temperature [a], T_{test}, in °C	20	95	20	95	20	80	20	95
Test duration, t, in h	1	1000	1	1000	1	1000	1	1000
Hydrostatic stress of fitting material, σ_F , in MPa	21	3,6	21	3,6	21	5,0	21	3,6
Test pressure, p_F, in bars, for a design pressure, p_D, of:								
4 bar	33,6 [b]	5,7 [b]	42,3	7,2	33,6 [b]	8,0 [b]	46,1	7,8
6 bar	43,8	7,5	63,5	10,8	39,1	9,3	69,1	11,8
8 bar	58,4	9,9	84,7	14,4	52,1	12,4	92,2	15,7
10 bar	73,0	12,4	105,9	18,0	65,1	15,5	115,2	19,6
Number of test pieces	3	3	3	3	3	3	3	3

[a] Generally the highest test temperature is taken to be (T_{max} + 10) °C with an upper limit of 95 °C. However to match existing test facilities the highest test temperature for classes 1 and 2 is also set at 95 °C. The hydrostatic stresses given correspond to the given test temperatures.

[b] The 20 °C, 10 bar, 50 years, cold water requirement, being higher, determines this value (see ISO 15874-1:2013, Clause 4).

Table 7 — Determination of test pressure p_F for PP-B

	Application							
	Class 1		Class 2		Class 4		Class 5	
Max. design temperature, T_{max}, in °C	80		80		70		90	
Design stress of fitting material, σ_{DF}, in MPa	1,66		1,19		1,94		1,19	
Test temperature a, T_{test}, in °C	20	95	20	95	20	80	20	95
Test duration, t, in h	1	1000	1	1000	1	1000	1	1000
Hydrostatic stress of fitting material, σ_F , in MPa	16	2,6	16	2,6	16	3,7	16	2,6
Test pressure, p_F, in bars, for a design pressure, p_D, of: 4 bar	38,5	6,4	53,8	8,9	32,9	7,6	53,8	8,9
6 bar	57,7	9,5	80,7	13,3	49,4	11,5	80,7	13,3
8 bar	77,0	12,7	107,6	17,8	65,9	15,3	107,7	17,8
10 bar	96,2	15,9	134,5	22,2	82,3	19,1	134,6	22,2
Number of test pieces	3	3	3	3	3	3	3	3

[a] Generally the highest test temperature is taken to be (T_{max} + 10) °C with an upper limit of 95 °C. However to match existing test facilities the highest test temperature for classes 1 and 2 is also set at 95 °C. The hydrostatic stresses given correspond to the given test temperatures.

Table 8 — Determination of test pressure p_F for PP-R

	Application							
	Class 1		Class 2		Class 4		Class 5	
Max. design temperature, T_{max}, in °C	80		80		70		90	
Design stress of fitting material, σ_{DF}, in MPa	3,02		2,12		3,29		1,89	
Test temperature [a] , T_{test}, in °C	20	95	20	95	20	80	20	95
Test duration, t, in h	1	1000	1	1000	1	1000	1	1000
Hydrostatic stress of fitting material, σ_F , in MPa	16	3,5	16	3,5	16	4,6	16	3,5
Test pressure, p_F, in bars, for a design pressure, p_D, of: 4 bar	23,1 [b]	5,1 [b]	30,3	6,6	23,1 [b]	6,6 [b]	33,9	7,4
6 bar	31,8	7,0	45,4	9,9	29,2	8,3	50,8	11,1
8 bar	42,5	9,3	60,5	13,2	38,9	11,1	67,7	14,8
10 bar	53,1	11,6	75,6	16,5	48,7	13,9	84,6	18,5
Number of test pieces	3	3	3	3	3	3	3	3

[a] Generally the highest test temperature is taken to be (T_{max} + 10) °C with an upper limit of 95 °C. However to match existing test facilities the highest test temperature for classes 1 and 2 is also set at 95 °C. The hydrostatic stresses given correspond to the given test temperatures.

[b] The 20 °C, 10 bar, 50 years, cold water requirement, being higher, determines this value (see ISO 15874-1:2013, Clause 4).

Table 9 — Determination of test pressure p_F for PP-RCT

	Application							
	Class 1		Class 2		Class 4		Class 5	
Max. design temperature, T_{max}, in °C	80		80		70		90	
Design stress of fitting material, σ_{DF}, in MPa	3,64		3,40		3,67		2,92	
Test temperature [a] , T_{test}, in °C	20	95	20	95	20	80	20	95
Test duration, t, in h	1	1000	1	1000	1	1000	1	1000
Hydrostatic stress of fitting material, σ_F , in MPa	15	3,8	15	3,8	15	5,0	15	3,8
Test pressure, p_F, in bars, for a design pressure, p_D, of: 4 bar	18,2 [b]	4,6 [b]	18,2 [b]	4,6 [b]	18,2 [b]	6,1 [b]	20,5	5,2
6 bar	24,7	6,2	26,4	6,7	24,5	8,2	30,8	7,8
8 bar	33,0	8,3	35,2	8,9	32,6	10,9	41,1	10,4
10 bar	41,2	10,4	44,1	11,1	40,8	13,7	51,3	12,9
Number of test pieces	3	3	3	3	3	3	3	3

[a] Generally the highest test temperature is taken to be (T_{max} + 10) °C with an upper limit of 95 °C. However to match existing test facilities the highest test temperature for classes 1 and 2 is also set at 95 °C. The hydrostatic stresses given correspond to the given test temperatures.

[b] The 20 °C, 10 bar, 50 years, cold water requirement, being higher, determines this value (see ISO 15874-1:2013, Clause 4).

8 Physical and chemical characteristics of plastics components

The melt flow rate (MFR) of the compound and the injection-moulded fitting made from the same material batch shall be determined in accordance with the procedures given in ISO 1133-1 using the temperature and force

criteria appropriate to the material involved. The difference between the MFR of the injection-moulded material and the MFR of the original compound shall be determined.

For PP compounds and injection-moulded products of the same compound the same set of conditions (230°C/2,16 kg) of ISO 1133-1 shall be used and the difference between the MFR values shall not be greater than 30 %.

9 Sealing elements

The sealing element shall have no detrimental effect on the properties of the pipe or fitting and shall not cause the test assembly to fail to conform to ISO 15874-5.

The material of the elastomeric sealing elements used in joint assemblies shall conform to EN 681-1 or EN 681-2, as applicable.

10 Performance requirements

When fittings conforming to this part of ISO 15874 are jointed to pipes conforming to ISO 15874-2, the fitting and the joints shall conform to ISO 15874-5. Intended combinations of materials of pipes and fittings, e.g. PP-RCT pipes and PP-R fittings, shall be given in the manufacturers documentation.

11 Marking

11.1 General requirements

Marking elements shall be printed or formed directly on the fitting in such a way that after storage, handling, and installation (e.g. in accordance with CEN/TR 12108 [1]), legibility is maintained.

NOTE The manufacturer is not responsible for marking being illegible, due to actions such as painting, scratching, covering of the components or by use of detergent etc. on the components unless agreed or specified by the manufacturer.

Marking shall not initiate cracks or other types of defects which adversely influence the performance of the fitting.

If printing is used, the colouring of the printed information shall differ from the basic colouring of the fitting.

The size of the marking shall be such that the marking is legible without magnification.

11.2 Minimum required marking

The minimum required marking of the fitting is specified in Table 10.

Table 10 — Minimum marking for fittings

Aspects	Marking or symbol
Number of this International Standard	ISO 15874
Manufacturer´s name and/or trade mark [a]	Name or code
Nominal diameter d_n [a]	e.g. 16
Nominal wall thickness(es) of the corresponding pipe(s) (for compression or crimped fittings only)	e.g. 2.2
Material identification (for fusion fittings only) [a]	e.g. PP-R
Application class combined with design pressure	e.g. Class 1/10 bar
Opacity[b]	opaque
Manufacturer´s information [a]	[c]

[a] These aspects (where appropriate) must be marked on the fitting. All other aspects may be marked on the fitting or alternatively put on to a label supplied with the fittings.

[b] If declared by the manufacturer.

[c] To provide traceability the following details shall be given:

a) the production period, year and month; in figures or in code;

b) a name or code for the production site if the manufacturer is producing at different sites.

NOTE Attention is drawn to the possible need to include CE marking when required for legislative purposes.

11.3 Additional marking

The fitting types A or B shall be marked on the package.

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

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