INTERNATIONAL STANDARD

ISO 4065

Third edition
2018-01

Corrected version
2019-12

Thermoplastics pipes — Universal wall thickness table

Tubes en matières thermoplastiques — Tableau universel des épaisseurs de paroi

Reference number
ISO 4065:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

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 voluntary nature of standards, 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.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

This third edition cancels and replaces the second edition (ISO 4065:1996), which has been technically revised.

The significant changes are:

— S-values and design stresses for 6,0 bar are deleted;

— Wall thickness values for pipes with diameters up to 3000 mm are included;

— The upper limit for tabled wall thicknesses increased to 150 mm;

— Additional pipe series S 10,5, S 13,3 and S 16,7 are left for use in non-pressure purposes only;

— Definitions are updated to follow modern plastics piping terminology.

This corrected version of ISO 4065:2018 incorporates the following corrections:

The missing decimal separators in Tables 1 and 2 have been reinserted.

Thermoplastics pipes — Universal wall thickness table

1 Scope

This document specifies the relationship between the nominal wall thickness e_n and the nominal outside diameter d_n of thermoplastics pipes.

It is applicable to solid-wall thermoplastics pipes of constant circular cross-section along the whole length of the pipe, whatever their method of manufacture, their composition or their intended application.

NOTE Pipes with constant circular cross-section along the whole length of the pipe are commonly known as pipes with smooth external and internal surfaces.

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 3, *Preferred numbers — Series of preferred numbers*

ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
nominal outside diameter
d_n
specified outside diameter, assigned to a nominal size DN

Note 1 to entry: Nominal outside diameter is expressed in millimetres.

Note 2 to entry: For metric pipes conforming to this document, the nominal outside diameter, expressed in millimetres, is the minimum mean outside diameter *dem.min* specified in the applicable pipe standard.

3.2
mean outside diameter
d_{em}
value of the measurement of the outer circumference of the pipe in any cross-section divided by π, rounded up to the nearest 0,1 mm

Note 1 to entry: The value of π is taken to be 3,142.

3.3
wall thickness at any point
e
measured wall thickness at any point around the circumference of the pipe, rounded to the next higher 0,1 mm

3.4
nominal wall thickness
e_n
wall thickness tabulated in this document, and identical to the minimum permissible wall thickness at any point, e_{min}

3.5
standard dimension ratio
SDR
numerical designation of a pipe series, which is a convenient round number, approximately equal to the ratio of the nominal outside diameter d_n *of* a pipe to its nominal wall thickness e_n

Note 1 to entry: This value may also be derived from the formula given in 3.6.

3.6
pipe series
S
dimensionless number related to the nominal outside diameter d_n and nominal wall thickness e_n given by the following formula:

$$S = \frac{SDR - 1}{2}$$

4 Calculation of values

4.1 Calculation of S values

For pressure pipes the relationship is expressed as follows:

$$S = \frac{\sigma}{p} \quad (1)$$

where

$$\sigma = \frac{p(d_e - e)}{2e}$$

where

p is the internal pressure;

σ is the induced stress;

p and *σ* being expressed in the same units.

For the selection of *p* and *σ*, refer to ISO 161-1[1].

S-values are selected from the R 10 series of preferred numbers given in ISO 3, except for S 11,2 and S 14 which are selected from the R 20 series (see Tables 2 and 3).

4.2 Calculation of wall thicknesses

According to ISO 161-1, wall thicknesses for pressure pipes are calculated from either of the following formulae:

$$e_n = \frac{1}{2\frac{\sigma}{p}+1} \times d_n \tag{2}$$

and

$$e_n = \frac{1}{2S+1} \times d_n \tag{3}$$

where

e_n is the nominal wall thickness;

d_n is the nominal outside diameter;

e_n and d_n being expressed in the same units;

σ is the induced stress;

p is the internal pressure;

σ and p being expressed in the same units;

S is the series number.

The general formulae are also applicable to the relationship between the nominal pressure PN and the design stress σ_s, as follows:

$$e_n = \frac{1}{2\frac{\sigma_s}{PN}+1} \times d_n \tag{4}$$

where σ_s is the design stress.

Values for PN are selected from the R 10 series of preferred numbers given in ISO 3.

Values for σ_s equal to or less than 10 MPa are selected from the R 10 series of preferred numbers given in ISO 3, while those greater than 10 MPa are selected from the R 20 series.

S may therefore be defined as the quotient of the design stress and the maximum allowable operating pressure as follows:

$$S = \frac{\sigma_s}{PN} \tag{5}$$

For nominal pressures between 2,5 bar and 25 bar and design stresses between 2,5 MPa and 36 MPa, the corresponding S values are given in Table 1.

Table 1 — Individual S-values calculated from selected values of design stress, σ_S, and nominal pressure, PN

Design stress σ_S MPa	PN bar										
	25	**20**	**16**	**12,5**	**10**	**8**	**6,3**	**5**	**4**	**3,15**	**2,5**
	S-values										
36	14,400	18,000	22,500	28,800	36,000	45,000	57,143				
32	12,800	16,000	20,000	25,600	32,000	40,000	50,794	64,000			
28	11,200	14,000	17,500	22,400	28,000	35,000	44,444	56,000			
25	10,000	12,500	15,625	20,000	25,000	31,250	39,683	50,000	62,500		
23	9,2000	11,500	14,375	18,400	23,000	28,750	36,508	46,000	57,500		
22,4	8,9600	11,200	14,000	17,920	22,400	28,000	35,556	44,800	56,000		
22	8,8000	11,000	13,750	17,600	22,000	27,500	34,921	44,000	55,000		
20	8,0000	10,000	12,500	16,000	20,000	25,000	31,746	40,000	50,000	63,492	
18	7,2000	9,0000	11,250	14,400	18,000	22,500	28,571	36,000	45,000	57,143	
16	6,4000	8,0000	10,000	12,800	16,000	20,000	25,397	32,000	40,000	50,794	64,000
14	5,6000	7,0000	8,7500	11,200	14,000	17,000	22,222	28,000	35,000	44,444	56,000
12,5	5,0000	6,2500	7,8125	10,000	12,500	15,625	19,841	25,000	31,250	39,683	50,000
11,2	4,4800	5,6000	7,0000	8,9600	11,200	14,000	17,778	22,400	28,000	35,556	44,800
10	4,0000	5,0000	6,2500	8,0000	10,000	12,500	15,873	20,000	25,000	31,746	40,000
8	3,2000	4,0000	5,0000	6,4000	8,0000	10,000	12,698	16,000	20,000	25,397	32,000
6,3	2,5200	3,1500	3,9375	5,0400	6,3000	7,8750	10,000	12,600	15,750	20,000	25,200
5	2,0000	2,5000	3,1250	4,0000	5,0000	6,2500	7,9365	10,000	12,500	15,873	20,000
4			25000	3,2000	4,0000	5,0000	6,4392	8,0000	10,000	12,698	16,000
3,15		2,0000	1,9688	2,5200	3,1500	3,9375	5,0000	6,3000	7,8750	10,000	12,600
2,5				2,0000	2,5000	3,1250	3,9683	5,0000	6,2500	7,9635	10,000
NOTE Individual S-values below 2,0000 have been excluded from this table as the resulting pipe geometry is considered to be unacceptable for practical applications.											

Table 2 gives the calculated values of S taken from ISO 497[2].

Table 2 — Nominal S-values and their calculated values, taken from ISO 497 for PN values of 2; 2,5; 3,15; 4; 5; 6,3; 8; 10; 12,5; 16; 20 and 25 bar[a]

Nominal S-values	Calculated values	Nominal S-values	Calculated values
2	1,9953	12,5	12,589
2,5	2,5119	14	14,125
3,2	3,1623	16	15,849
4	3,9811	20	19,953
5	5,0119	25	25,119
6,3	6,3096	32	31,613
8	7,9433	40	39,811
10	10,000	50	50,119
[a] Higher values shall be taken from the R 10 series of numbers given in ISO 3.			

NOTE S is the quotient of two R 10 numbers for design stresses of 10 MPa and below, and therefore it is itself a number of the R 10 series also. For values greater than 10 MPa, S is the quotient of an R 10 and an R 20 number, and therefore in this case the number is an R 20 value.

This is the key to the reduction in the many theoretical combinations of design stress and operating pressure to a practical selection of values of S. Since preferred numbers are themselves rounded off from the theoretical values, quotients of preferred numbers cannot basically be identical either with preferred numbers or with the theoretical values.

These theoretical values may, however, be considered as mean values for all corresponding quotients. Therefore, a universal wall thickness table which is mathematically based on the theoretical values of the R 10 and R 20 series of preferred numbers for S guarantees a minimum number of deviations from the numerous theoretical wall thicknesses.

5 Wall thickness tables

Table 3 gives the relationship between the nominal wall thickness e_n and the nominal outside diameter d_n based on the S-values given in Table 2.

The wall thicknesses of additional pipe series used for non-pressure applications are given in Table 4, and are calculated from the S-values mentioned in the footnote of that table.

NOTE Although the calculation of the wall thickness with the value of S derived from the quotient of the design stress σ_s and a nominal pressure PN which applies to pipes predominantly subject to internal hydrostatic pressure, the values given in Tables 3 and 4 also apply to pipes not subject to internal pressure.

6 Deviations

Notwithstanding the generalities expressed in Clause 5, it is appreciated that there may be some occasions when specific applications require other wall thicknesses in order to take into account additional factors such as stiffness or temperature conditions. It is strongly recommended that such exceptions are kept to a minimum, however.

