BRITISH STANDARD

ISO metric screw threads

Part 1: Principles and basic data

ICS 21.040.10

British Standards

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 68, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 3643 is published by BSI and came into effect on 30 November 2007. It was prepared by Subcommittee SFTSE/1, *Screws and fasteners technical specification committee*, under the authority of Technical Committee FME/9, *Nuts, bolts and accessories*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 3643 supersedes BS 3643-1:1981, which is withdrawn.

Relationship with other publications

This part of BS 3643 is based on a series of BS ISO, and ISO, standards for ISO metric general purpose screw threads, each clause, from Clause **4** onwards, being based on one BS ISO, or ISO, as follows:

- Clause **4**: Basic profile: BS ISO 68-1:1998;
- Clause **5**: General plan: BS ISO 261:1998;
- Clause **6**: Basic dimensions: ISO 724:1993;
- Clause **7**: Tolerances – Principles and basic data: BS ISO 965-1:1998;
- Clause **8**: Tolerances – Deviations for constructional screw threads: BS ISO 965-3:1998;
- Clause **9**: Tolerances – Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing: BS ISO 965-4:1998;
- Clause **10**: Tolerances – Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads with maximum size of tolerance position h before galvanizing: BS ISO 965-5:1998.

BS 3643 consists of the following parts:

- *Part 1: Principles and basic data;*
- *Part 2: Specification for selected limits of size.*

BS 3643-2 specifies the fundamental deviations, tolerances and limits of size for the tolerances classes 4H, 5H, 6H and 7H for internal threads and 4h, 6g and 8g for external threads where appropriate for:

- a course pitch series with the range 1 mm to 68 mm diameter;
- a fine pitch series with the range 1 mm to 33 mm diameter;
- a constant pitch series with the range 8 mm to 300 mm diameter.

Information about this document

This part of BS 3643 has been revised to bring it up to date. The 1981 edition of the standard was based on ISO 68:1963, ISO 261:1973, ISO 724:1968, ISO 965-1:1980 and ISO 965-3:1980. These standards have all been withdrawn and superseded and this part of BS 3643 has been revised to reflect the latest editions of these standards (see above).

Two extra clauses have been added to this revision, based on BS ISO 965-4:1998 and BS ISO 965-5:1998, respectively.

This part of BS 3643 does not include a clause based on BS ISO 965-2:1998. Selected limits of size for use in the UK are specified in BS 3643-2:2007.

This part of BS 3643 also does not include a clause based on BS ISO 262:1998 as these sizes can be expected to be specified in the relevant product standards. However, the data given in BS ISO 262:1998 have been included in Table 3.

Additional guidance notes are given in Annex A. These notes are presented separately so as not to disrupt the correspondence between the clauses of the main text and the BS ISO, or ISO, standards on which they are based. Information is given in Annex B on calculating limits of size for metric screw threads for which dimensions are not given in the tables in this part of BS 3643. This information is given because it is recognized that the limitations placed by the BS ISO and ISO standards on nominal sizes and on the diameter/pitch combinations, might in certain cases need to be exceeded.

Hazard warnings

WARNING. Attention is drawn to the fact that, with the different screw thread forms available, there is the possibility of mismatch, which is potentially hazardous. It is the responsibility of the designer of the end product to ensure that this possibility is reduced to a minimum. For further information on mismatches of screw thread systems see PD 6494.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 3643 gives a compilation of principles and basic data for single-start, parallel screw threads having the ISO basic profile for triangular screw threads. Guidance on calculating limits of size for metric screw threads not included in Tables 1 to 14 is given in Annex B.

2 Normative references

The following referenced documents are indispensable for the application 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.

BS 919-3, *Screw gauge limits and tolerances – Part 3: Specification for gauges for screw threads of ISO metric form*

BS 6528:1984, *Glossary of terms for cylindrical screw threads*

3 Terms and definitions and symbols

3.1 Terms and definitions

For the purposes of this part of BS 3643 the terms and definitions given in BS 6528:1984 apply together with the following.

3.1.1 basic profile

theoretical profile of a screw thread in an axial plane defined by theoretical dimensions and angles common to internal and external threads

NOTE 1 This definition is repeated from BS 6528:1984 for the convenience of users of this standard.

NOTE 2 The basic profile is shown as a thick line in Figure 1.

3.2 Symbols

For the purposes of this part of BS 3643 the following symbols apply.

D	basic major diameter of internal thread (nominal diameter)
D_1	basic minor diameter of internal thread
D_2	basic pitch diameter of internal thread
d	basic major diameter of external thread (nominal diameter)
d_1	basic minor diameter of external thread
d_2	basic pitch diameter of external thread
d_3	minor diameter of external thread
H	height of fundamental triangle
P	pitch
T	tolerance
T_{D1}	tolerances for D_1
T_{D2}	tolerances for D_2
T_{d1}	tolerances for d_1
T_{d2}	tolerances for d_2
ei, EI	lower deviations (see Figure 2)
es, ES	upper deviations (see Figure 2)
R	root radius of external thread
C	root truncation of external thread
S	designation for thread engagement group “short”
N	designation for thread engagement group “normal”
L	designation for thread engagement group “long”

4 Basic profile

4.1 General

This clause specifies the basic profile for ISO general purpose metric screw threads as shown in Figure 1. The dimensions for the various standard pitches are given in Table 1.

4.2 Dimensions

The fundamental deviations and tolerances specified in Clause **7** are applied to the dimensions of the basic profile shown in Figure 1 and derived from Table 1.

$$H = \frac{\sqrt{3}}{2}P = 0.866\ 025\ 404P$$

$$\frac{5}{8}H = 0.541\ 265\ 877P$$

$$\frac{3}{8}H = 0.324\ 759\ 526P$$

$$\frac{H}{4} = 0.216\ 506\ 351P$$

$$\frac{H}{8} = 0.108\ 253\ 175P$$

Figure 1 **Basic profile of ISO metric thread**

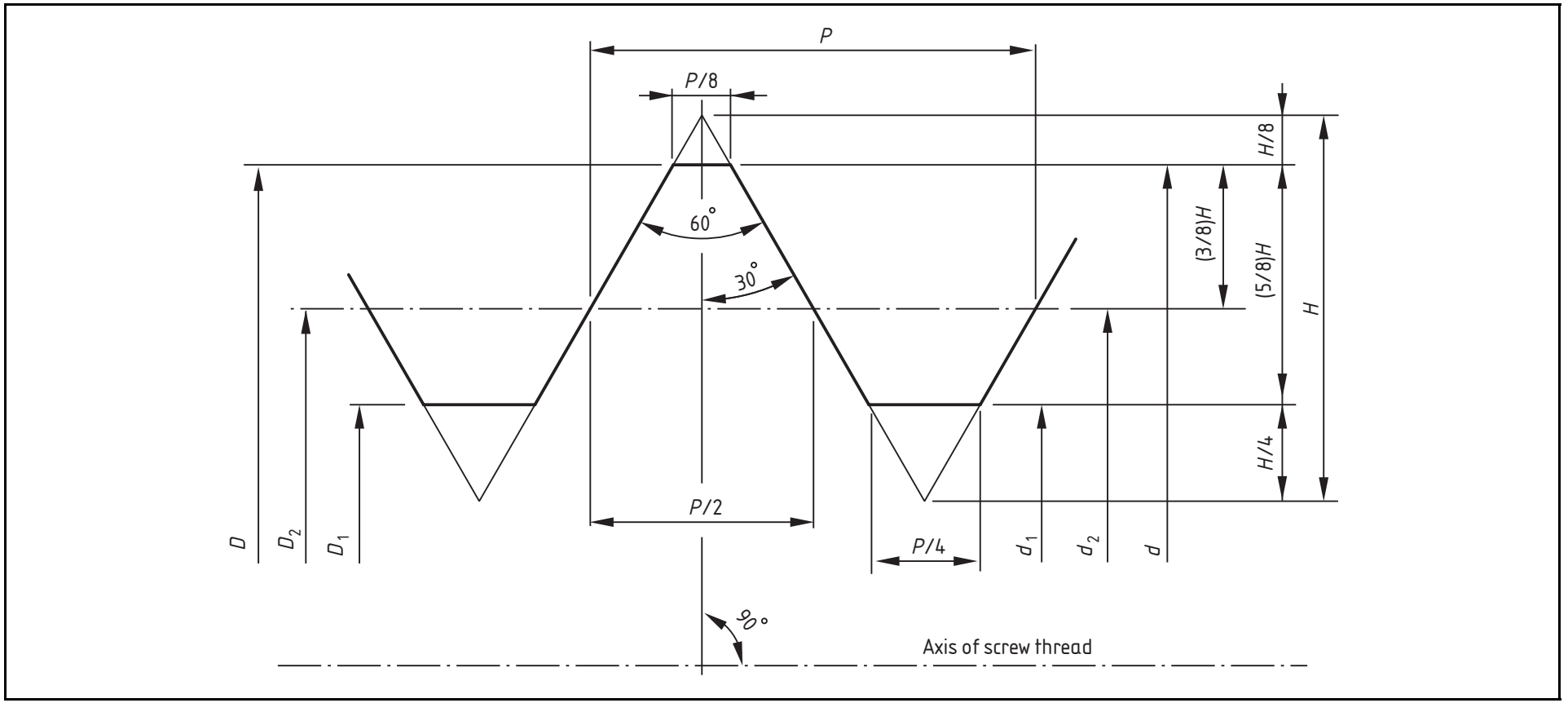


Table 1 **Basic profile dimensions**

Dimensions in millimetres

Pitch P	H	$\frac{5}{8}H$	$\frac{3}{8}H$	$\frac{H}{4}$	$\frac{H}{8}$
0.2	0.173 205	0.108 253	0.064 952	0.043 301	0.021 651
0.25	0.216 506	0.135 316	0.081 190	0.054 127	0.027 063
0.3	0.259 808	0.162 380	0.097 428	0.064 952	0.032 476
0.35	0.303 109	0.189 443	0.113 666	0.075 777	0.037 889
0.4	0.346 410	0.216 506	0.129 904	0.086 603	0.043 301
0.45	0.389 711	0.243 570	0.146 142	0.097 428	0.048 714
0.5	0.433 013	0.270 633	0.162 380	0.108 253	0.054 127
0.6	0.519 615	0.324 760	0.194 856	0.129 904	0.064 952
0.7	0.606 218	0.378 886	0.227 332	0.151 554	0.075 777
0.75	0.649 519	0.405 949	0.243 570	0.162 380	0.081 190
0.8	0.692 820	0.433 013	0.259 808	0.173 205	0.086 603
1	0.866 025	0.541 266	0.324 760	0.216 506	0.108 253
1.25	1.082 532	0.676 582	0.405 949	0.270 633	0.135 316
1.5	1.299 038	0.811 899	0.487 139	0.324 760	0.162 380
1.75	1.515 544	0.947 215	0.568 329	0.378 886	0.189 443
2	1.732 051	1.082 532	0.649 519	0.433 013	0.216 506
2.5	2.165 063	1.353 165	0.811 899	0.541 266	0.270 633
3	2.598 076	1.623 798	0.974 279	0.649 519	0.324 760
3.5	3.031 089	1.894 431	1.136 658	0.757 772	0.378 886
4	3.464 102	2.165 063	1.299 038	0.866 025	0.433 013
4.5	3.897 114	2.435 696	1.461 418	0.974 279	0.487 139
5	4.330 127	2.706 329	1.623 798	1.082 532	0.541 266
5.5	4.763 140	2.976 962	1.786 177	1.190 785	0.595 392
6	5.196 152	3.247 595	1.948 557	1.299 038	0.649 519
8	6.928 203	4.330 127	2.598 076	1.732 051	0.866 025

5 General plan

5.1 General

This clause specifies ISO general purpose metric screw threads having the basic profile as defined in Clause **4**.

5.2 Designation

A screw thread conforming to this part of BS 3643 shall be designated in accordance with Clause **7**.

5.3 Choice of diameter and pitch

NOTE Table 3 has been retained unaltered from the 1981 edition of BS 3643-1.

5.3.1 Choose, for preference, diameters in column 1 of Table 3 and, if necessary, in column 2 and then in column 3.

Diameter 35 mm, and pitch 1.25 mm of diameter 14 mm shall be used only for the special cases indicated in the footnotes.

Pitches shown in parentheses are to be avoided as far as possible.

5.3.2 The words “coarse” and “fine” are given in order to conform to usage. No concept of quality shall, however, be associated with these words.

It shall be understood that the “coarse” pitches are the largest metric pitches used in current practice.

5.3.3 For the diameter (or the diameter range) selected, choose one of the pitches shown on the corresponding line (or lines).

5.3.4 If screw threads finer than those appearing in Table 3 are found necessary, only the following pitches shall be used:

3 mm; 2 mm; 1.5 mm; 1 mm; 0.75 mm; 0.5 mm; 0.35 mm; 0.25 mm; 0.2 mm.

When selecting such pitches, take into account the fact that there is increasing difficulty in complying with tolerances as the diameter is increased for a given pitch. It is suggested that diameters larger than those shown in Table 2 should generally not be used with the pitches indicated.

Table 2 **Maximum nominal diameter**

Dimensions in millimetres

Pitch	Maximum nominal diameter
0.5	22
0.75	33
1	80
1.5	150
2	200
3	300

Table 3 **Diameter/pitch combinations**

Dimensions in millimetres

Nominal diameters			**Pitches**							
Column 1 1st choice	**Column 2 2nd choice**	**Column 3 3rd choice**	**Coarse series**	**Fine series**	**Constant series**					
					3	**2**	**1.5**	**1.25**	**1**	**0.75**
1			0.25	0.2						
	1.1		0.25	0.2						
1.2			0.25	0.2						
	1.4		0.3	0.2						
1.6			0.35	0.2						
	1.8		0.35	0.2						
2			0.4	0.25						
	2.2		0.45	0.25						
2.5			0.45	0.35						
3			0.5	0.35						
	3.5		0.6	0.35						
4			0.7	0.5						
	4.5		0.75	0.5						
5			0.8	0.5						
		5.5		(0.5)						
6			1	0.75						
	7		1	0.75						
8			1.25	1						0.75
		9	1.25						1	0.75
10			1.5	1.25					1	0.75
		11	1.5						1	0.75
12			1.75	1.25			1.5		1	
	14		2	1.5				1.25 [A]	1	
		15					1.5		1	
16			2	1.5					1	
		17					1.5		1	
	18		2.5	1.5		2			1	
20			2.5	1.5		2			1	
	22		2.5	1.5		2			1	
24			3	2			1.5		1	
		25				2	1.5		1	
		26					1.5			
	27		3	2			1.5		1	
		28				2	1.5		1	
30			3.5	2	(3)		1.5		1	
		32				2	1.5			
	33		3.5	2	(3)		1.5			
		35 [B]					1.5			
36			4		3	2	1.5			
		38					1.5			
	39		4		3	2	1.5			

Pitches shown in parentheses are to be avoided as far as possible.

[A] Only for spark plugs for engines.

[B] Only for locking nuts for bearings.

Table 3 **Diameter/pitch combinations** (*continued*)

Dimensions in millimetres

Nominal diameters			**Pitches**					
Column 1 1st choice	**Column 2 2nd choice**	**Column 3 3rd choice**	**Coarse series**	**Constant series**				
				6	**4**	**3**	**2**	**1.5**
		40				3	2	1.5
42			4.5		4	3	2	1.5
	45		4.5		4	3	2	1.5
48			5		4	3	2	1.5
		50				3	2	1.5
	52		5		4	3	2	1.5
		55			4	3	2	1.5
56			5.5		4	3	2	1.5
		58			4	3	2	1.5
	60		5.5		4	3	2	1.5
		62			4	3	2	1.5
64			6		4	3	2	1.5
		65			4	3	2	1.5
	68		6		4	3	2	1.5
		70		6	4	3	2	1.5
72				6	4	3	2	1.5
		75			4	3	2	1.5
	76			6	4	3	2	1.5
		78					2	
80				6	4	3	2	1.5
		82					2	
	85			6	4	3	2	
90				6	4	3	2	
	95			6	4	3	2	
100				6	4	3	2	
	105			6	4	3	2	
110				6	4	3	2	
	115			6	4	3	2	
	120			6	4	3	2	
125				6	4	3	2	
	130			6	4	3	2	
		135		6	4	3	2	
140				6	4	3	2	
		145		6	4	3	2	
	150			6	4	3	2	
		155		6	4	3		
160				6	4	3		
		165		6	4	3		
	170			6	4	3		
		175		6	4	3		
180				6	4	3		
		185		6	4	3		
	190			6	4	3		
		195		6	4	3		
200				6	4	3		
		205		6	4	3		
	210			6	4	3		
		215		6	4	3		
220				6	4	3		
		225		6	4	3		
		230		6	4	3		
		235		6	4	3		
	240			6	4	3		
		245		6	4	3		
250				6	4	3		
		255		6	4			
	260			6	4			
		265		6	4			
		270		6	4			
		275		6	4			
280				6	4			
		285		6	4			
		290		6	4			
		295		6	4			
	300			6	4			

6 Basic dimensions

6.1 General

This clause specifies the basic dimensions, in millimetres, of ISO metric screw threads in accordance with Clause **5**.

The values refer to the basic profile in accordance with Clause **4**.

6.2 Basic dimensions

The basic dimensions shall be as shown in Figure 2 and given in Table 4.

The values of D_2, d_2, D_1 and d_1 have been calculated from the following formulae and rounded, in Table 4, to the third decimal place:

$$D_2 = D - 2 \times \frac{3}{8} H = D - 0.649\ 5P$$

$$d_2 = d - 2 \times \frac{3}{8} H = d - 0.649\ 5P$$

$$D_1 = D - 2 \times \frac{5}{8} H = D - 1.082\ 5P$$

$$d_1 = d - 2 \times \frac{5}{8} H = d - 1.082\ 5P$$

Figure 2 **Basic dimensions**

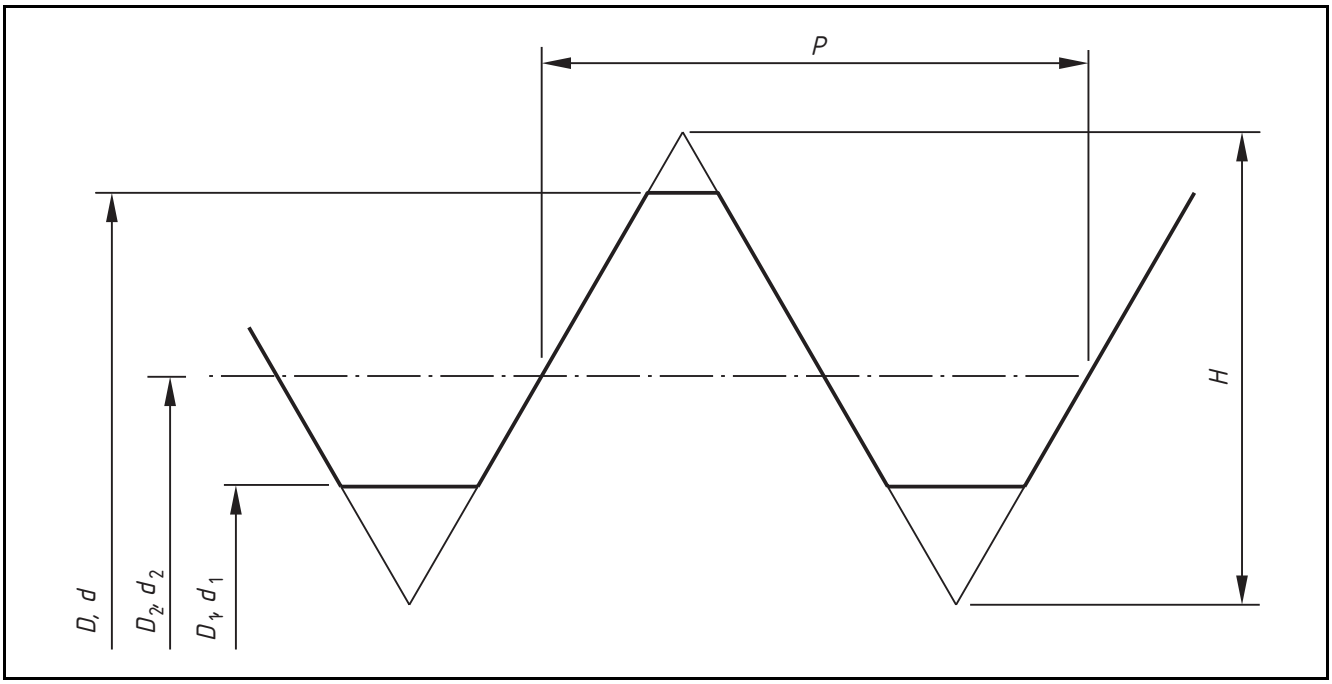


Table 4 **Basic dimensions**

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
1	0.25	0.838	0.729
	0.2	0.870	0.783
1.1	0.25	0.938	0.829
	0.2	0.970	0.883
1.2	0.25	1.038	0.929
	0.2	1.070	0.983
1.4	0.3	1.205	1.075
	0.2	1.270	1.183
1.6	0.35	1.373	1.221
	0.2	1.470	1.383
1.8	0.35	1.573	1.421
	0.2	1.670	1.583
2	0.4	1.740	1.567
	0.25	1.838	1.729
2.2	0.45	1.908	1.713
	0.25	2.038	1.929
2.5	0.45	2.208	2.013
	0.35	2.273	2.121
3	0.5	2.675	2.459
	0.35	2.773	2.621
3.5	0.6	3.110	2.850
	0.35	3.273	3.121
4	0.7	3.545	3.242
	0.5	3.675	3.459
4.5	0.75	4.013	3.688
	0.5	4.175	3.959
5	0.8	4.480	4.134
	0.5	4.675	4.459
5.5	0.5	5.175	4.959
6	1	5.350	4.917
	0.75	5.513	5.188
7	1	6.350	5.917
	0.75	6.513	6.188
8	1.25	7.188	6.647
	1	7.350	6.917
	0.75	7.513	7.188
9	1.25	8.188	7.647
	1	8.350	7.917
	0.75	8.513	8.188

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
10	1.5	9.026	8.376
	1.25	9.188	8.647
	1	9.350	8.917
	0.75	9.513	9.188
11	1.5	10.026	9.376
	1	10.350	9.917
	0.75	10.513	10.188
12	1.75	10.863	10.106
	1.5	11.026	10.376
	1.25	11.188	10.647
	1	11.350	10.917
14	2	12.701	11.835
	1.5	13.026	12.376
	1.25	13.188	12.647
	1	13.350	12.917
15	1.5	14.026	13.376
	1	14.350	13.917
16	2	14.701	13.835
	1.5	15.026	14.376
	1	15.350	14.917
17	1.5	16.026	15.376
	1	16.350	15.917
18	2.5	16.376	15.294
	2	16.701	15.835
	1.5	17.026	16.376
	1	17.350	16.917
20	2.5	18.376	17.294
	2	18.701	17.835
	1.5	19.026	18.376
	1	19.350	18.917
22	2.5	20.376	19.294
	2	20.701	19.835
	1.5	21.026	20.376
	1	21.350	20.917
24	3	22.051	20.752
	2	22.701	21.835
	1.5	23.026	22.376
	1	23.350	22.917
25	2	23.701	22.835
	1.5	24.026	23.376
	1	24.350	23.917

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
26	1.5	25.026	24.376
27	3	25.051	23.752
	2	25.701	24.835
	1.5	26.026	25.376
	1	26.350	25.917
28	2	26.701	25.835
	1.5	27.026	26.376
	1	27.350	26.917
30	3.5	27.727	26.211
	3	28.051	26.752
	2	28.701	27.835
	1.5	29.026	28.376
	1	29.350	28.917
32	2	30.701	29.835
	1.5	31.026	30.376
33	3.5	30.727	29.211
	3	31.051	29.752
	2	31.701	30.835
	1.5	32.026	31.376
35	1.5	34.026	33.376
36	4	33.402	31.670
	3	34.051	32.752
	2	34.701	33.835
	1.5	35.026	34.376
38	1.5	37.026	36.376
39	4	36.402	34.670
	3	37.051	35.752
	2	37.701	36.835
	1.5	38.026	37.376
40	3	38.051	36.752
	2	38.701	37.835
	1.5	39.026	38.376
42	4.5	39.077	37.129
	4	39.402	37.670
	3	40.051	38.752
	2	40.701	39.835
	1.5	41.026	40.376

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, *d*	*P*	D_2, d_2	D_1, d_1
45	4.5	42.077	40.129
	4	42.402	40.670
	3	43.051	41.752
	2	43.701	42.835
	1.5	44.026	43.376
48	5	44.752	42.587
	4	45.402	43.670
	3	46.051	44.752
	2	46.701	45.835
	1.5	47.026	46.376
50	3	48.051	46.752
	2	48.701	47.835
	1.5	49.026	48.376
52	5	48.752	46.587
	4	49.402	47.670
	3	50.051	48.752
	2	50.701	49.835
	1.5	51.026	50.376
55	4	52.402	50.670
	3	53.051	51.752
	2	53.701	52.835
	1.5	54.026	53.376
56	5.5	52.428	50.046
	4	53.402	51.670
	3	54.051	52.752
	2	54.701	53.835
	1.5	55.026	54.376
58	4	55.402	53.670
	3	56.051	54.752
	2	56.701	55.835
	1.5	57.026	56.376
60	5.5	56.428	54.046
	4	57.402	55.670
	3	58.051	56.752
	2	58.701	57.835
	1.5	59.026	58.376
62	4	59.402	57.670
	3	60.051	58.752
	2	60.701	59.835
	1.5	61.026	60.376

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
64	6	60.103	57.505
	4	61.402	59.670
	3	62.051	60.752
	2	62.701	61.835
	1.5	63.026	62.376
65	4	62.402	60.670
	3	63.051	61.752
	2	63.701	62.835
	1.5	64.026	63.376
68	6	64.103	61.505
	4	65.402	63.670
	3	66.051	64.752
	2	66.701	65.835
	1.5	67.026	66.376
70	6	66.103	63.505
	4	67.402	65.670
	3	68.051	66.752
	2	68.701	67.835
	1.5	69.026	68.376
72	6	68.103	65.505
	4	69.402	67.670
	3	70.051	68.752
	2	70.701	69.835
	1.5	71.026	70.376
75	4	72.402	70.670
	3	73.051	71.752
	2	73.701	72.835
	1.5	74.026	73.376
76	6	72.103	69.505
	4	73.402	71.670
	3	74.051	72.752
	2	74.701	73.835
	1.5	75.026	74.376
78	2	76.700	75.835
80	6	76.103	73.505
	4	77.402	75.670
	3	78.051	76.752
	2	78.701	77.835
	1.5	79.026	78.376
82	2	80.701	79.835

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, *d*	*P*	D_2, d_2	D_1, d_1
85	6	81.103	78.505
	4	82.402	80.670
	3	83.051	81.752
	2	83.701	82.835
90	6	86.103	83.505
	4	87.402	85.670
	3	88.051	86.752
	2	88.701	87.835
95	6	91.103	88.505
	4	92.402	90.670
	3	93.051	91.752
	2	93.701	92.835
100	6	96.103	93.505
	4	97.402	95.670
	3	98.051	96.752
	2	98.701	97.835
105	6	101.103	98.505
	4	102.402	100.670
	3	103.051	101.752
	2	103.701	102.835
110	6	106.103	103.505
	4	107.402	105.670
	3	108.051	106.752
	2	108.701	107.835
115	6	111.103	108.505
	4	112.402	110.670
	3	113.051	111.752
	2	113.701	112.835
120	6	116.103	113.505
	4	117.402	115.670
	3	118.051	116.752
	2	118.701	117.835
125	6	121.103	118.505
	4	122.402	120.670
	3	123.051	121.752
	2	123.701	122.835
130	6	126.103	123.505
	4	127.402	125.670
	3	128.051	126.752
	2	128.701	127.835

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
135	6	131.103	128.505
	4	132.402	130.670
	3	133.051	131.752
	2	133.701	132.835
140	6	136.103	133.505
	4	137.402	135.670
	3	138.051	136.752
	2	138.701	137.835
145	6	141.103	138.505
	4	142.402	140.670
	3	143.051	141.752
	2	143.701	142.835
150	8	144.804	141.340
	6	146.103	143.505
	4	147.402	145.670
	3	148.051	146.752
	2	148.701	147.835
155	6	151.103	148.505
	4	152.402	150.670
	3	153.051	151.752
160	8	154.804	151.340
	6	156.103	153.505
	4	157.402	155.670
	3	158.051	156.752
165	6	161.103	158.505
	4	162.402	160.670
	3	163.051	161.752
170	8	164.804	161.340
	6	166.103	163.505
	4	167.402	165.670
	3	168.051	166.752
175	6	171.103	168.505
	4	172.402	170.670
	3	173.051	171.752
180	8	174.804	171.340
	6	176.103	173.505
	4	177.402	175.670
	3	178.051	176.752
185	6	181.103	178.505
	4	182.402	180.670
	3	183.051	181.752

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, *d*	*P*	D_2, d_2	D_1, d_1
190	8	184.804	181.340
	6	186.103	183.505
	4	187.402	185.670
	3	188.051	186.752
195	6	191.103	188.505
	4	192.402	190.670
	3	193.051	191.752
200	8	194.804	191.340
	6	196.103	193.505
	4	197.402	195.670
	3	198.051	196.752
205	6	201.103	198.505
	4	202.402	200.670
	3	203.051	201.752
210	8	204.804	201.340
	6	206.103	203.505
	4	207.402	205.670
	3	208.051	206.752
215	6	211.103	208.505
	4	212.402	210.670
	3	213.051	211.752
220	8	214.804	211.340
	6	216.103	213.505
	4	217.402	215.670
	3	218.051	216.752
225	6	221.103	218.505
	4	222.402	220.670
	3	223.051	221.752
230	8	224.804	221.340
	6	226.103	223.505
	4	227.402	225.670
	3	228.051	226.752
235	6	231.103	228.505
	4	232.402	230.670
	3	233.051	231.752
240	8	234.804	231.340
	6	236.103	233.505
	4	237.402	235.670
	3	238.051	236.752

Table 4 **Basic dimensions** (*continued*)

Nominal diameter = Major diameter	**Pitch**	**Pitch diameter**	**Minor diameter**
D, d	P	D_2, d_2	D_1, d_1
245	6	241.103	238.505
	4	242.402	240.670
	3	243.051	241.752
250	8	244.804	241.340
	6	246.103	243.505
	4	247.402	245.670
	3	248.051	246.752
255	6	251.103	248.505
	4	252.402	250.670
260	8	254.804	251.340
	6	256.103	253.505
	4	257.402	255.670
265	6	261.103	258.505
	4	262.402	260.670
270	8	264.804	261.340
	6	266.103	263.505
	4	267.402	265.670
275	6	271.103	268.505
	4	272.402	270.670
280	8	274.804	271.340
	6	276.103	273.505
	4	277.402	275.670
285	6	281.103	278.505
	4	282.402	280.670
290	8	284.804	281.340
	6	286.103	283.505
	4	287.402	285.670
295	6	291.103	288.505
	4	292.402	290.670
300	8	294.804	291.340
	6	296.103	293.505
	4	297.402	295.670

7 Tolerances – Principles and basic data

7.1 General

This clause specifies a tolerance system for screw threads conforming to Clause **5**. The tolerance system refers to the basic profile in accordance with Clause **4**.

7.2 Structure of the tolerance system

The system gives tolerances defined by tolerance grades and tolerance positions and a selection of grades and positions.

The system provides for the following.

a) A series of tolerance grades for each of the four screw thread diameters, as follows:

	Tolerance grades
D_1	4, 5, 6, 7, 8
d	4, 6, 8
D_2	4, 5, 6, 7, 8
d_2	3, 4, 5, 6, 7, 8, 9

Details of tolerance grades and combinations of tolerance grades for pitch and crest diameters according to tolerance quality and length of engagement group required, with an order of preference, are given in **7.10**.

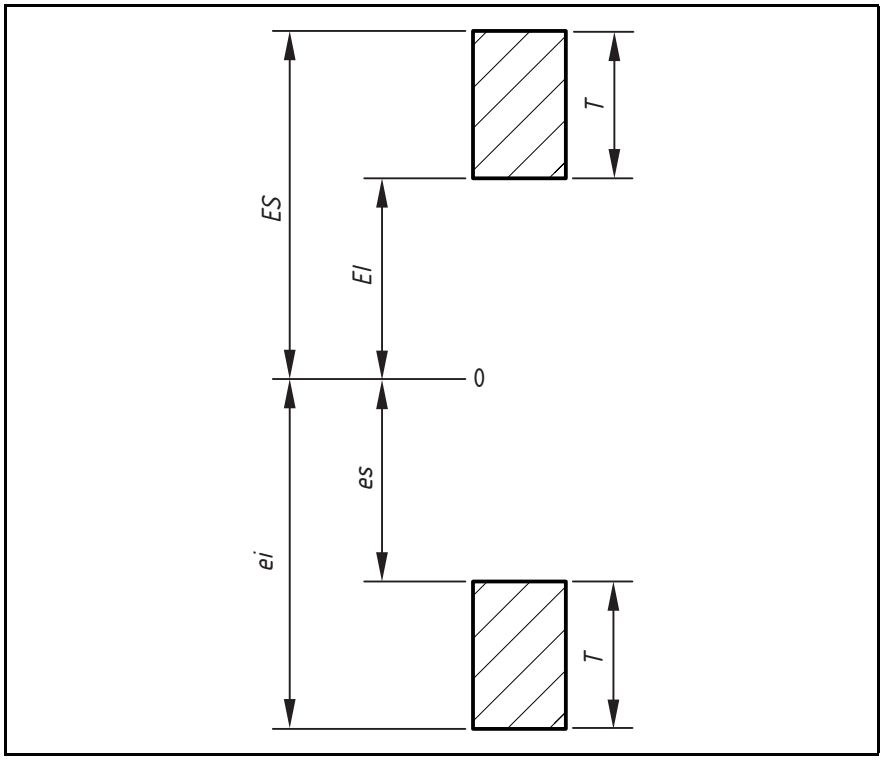
b) A series of tolerance positions:

- G and H for internal threads;
- e, f, g and h for external threads.

The established tolerance positions are in accordance with the requirements of current coating thicknesses and with the demands of easy assembly. Tolerance positions with respect to the zero line (basic size) are shown in Figure 3.

c) A selection of recommended combinations of grades and positions (tolerance classes) giving the commonly used tolerance qualities fine, medium and coarse for the three groups of length of thread engagement short, normal and long. A further selection of tolerance classes is given for commercial bolt and nut threads. Tolerance classes other than those shown in **7.10** are not recommended and shall be used only for special cases.

Figure 3 **Tolerance positions with respect to zero line (basic size)**



7.3 Designation

The complete designation for a screw thread comprises a designation for the thread system and size, a designation for the thread tolerance class followed by further individual items if necessary.

A screw thread conforming to this part of BS 3643 shall be designated by the letter M followed by the value of the nominal diameter and of the pitch, expressed in millimetres and separated by the sign "×".

EXAMPLE

M8 × 1.25

For coarse pitch threads listed in Table 2 and Table 3 the pitch may be omitted.

The tolerance class designation comprises a class designation for the pitch diameter tolerance followed by a class designation for the crest diameter tolerance.

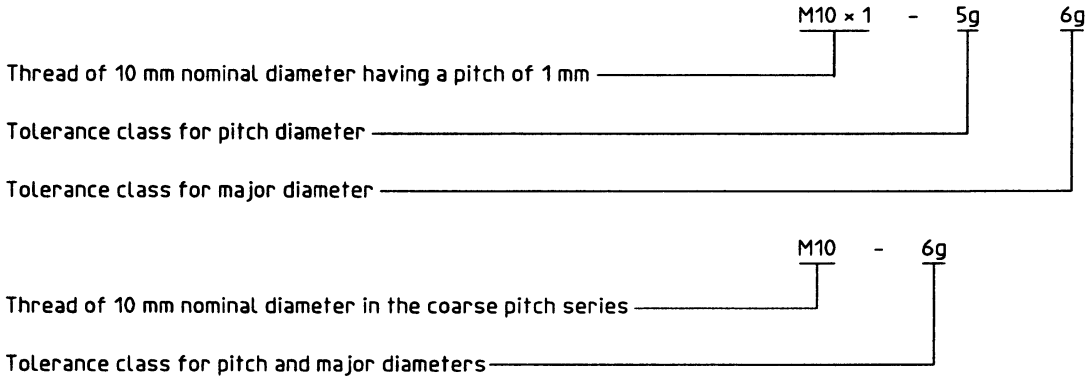
Each class designation consists of:

- a figure indicating the tolerance grade;
- a letter indicating the tolerance position, capital (upper case) for internal threads, small (lower case) for external threads.

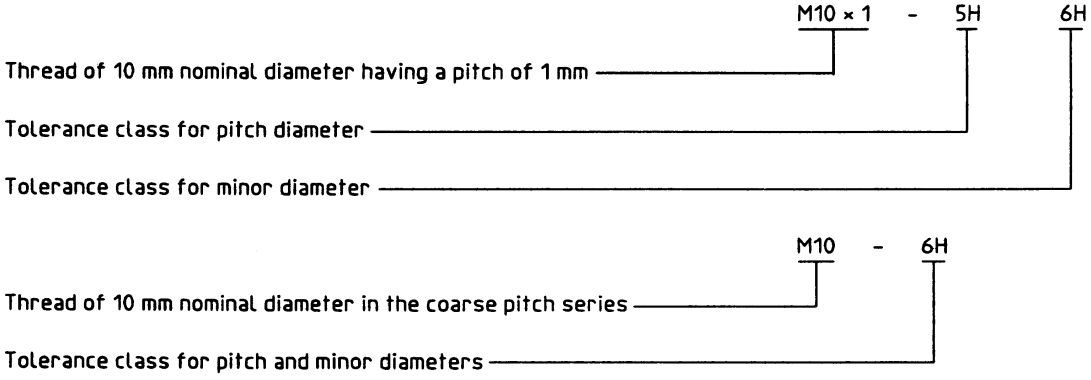
If the two class designations for the pitch diameter and crest diameter (major or minor diameter for internal and external threads respectively) are the same, it is not necessary to repeat the symbols.

EXAMPLES

External thread



Internal thread



A fit between threaded parts is indicated by the internal thread tolerance class followed by the external thread tolerance class separated by a stroke.

EXAMPLES

M6 – 6H/6g

M20 × 2 – 6H/5g6g

The absence of a tolerance class designation means that tolerance quality "medium" with the following tolerance classes are specified:

Internal threads

- 5H for threads up to and including M1.4;
- 6H for threads M1.6 and larger.

NOTE Except for threads with pitch P = 0.2 mm for which tolerance grade 4 is defined only (see Table 7 and Table 9).

External threads

- 6h for threads up to and including M1.4;
- 6g for threads M1.6 and larger.

The designation for the group of length of thread engagement "short" S and "long" L should be added to the tolerance class designation separated by a dash.

EXAMPLES

M20 × 2 – 5H – S

M6 – 7H/7g6g – L

The absence of the designation for the group of length of thread engagement means the group "normal" N is specified.

7.4 Tolerance grades

For each of the two elements, pitch diameter and crest diameter, a number of tolerance grades have been established. In each case, grade 6 shall be used for tolerance quality medium and normal length of thread engagement. The grades below 6 are intended for tolerance quality fine and/or short lengths of thread engagement. The grades above 6 are intended for tolerance quality coarse and/or long lengths of thread engagement. In some grades, certain tolerance values for small pitches are not shown because of insufficient thread overlap or the requirement that the pitch diameter tolerance shall not exceed the crest diameter tolerance.

7.5 Tolerance positions

The following tolerance positions are standardized:

- for internal threads: G with positive fundamental deviation
  H with zero fundamental deviation
  (See Figure 4 and Figure 5)
- for external threads: e, f and g with negative fundamental deviation
  h with zero fundamental deviation
  (See Figure 6 and Figure 7)

The values of the fundamental deviations are given in Table 5.

Figure 4 **Internal threads with tolerance position G**

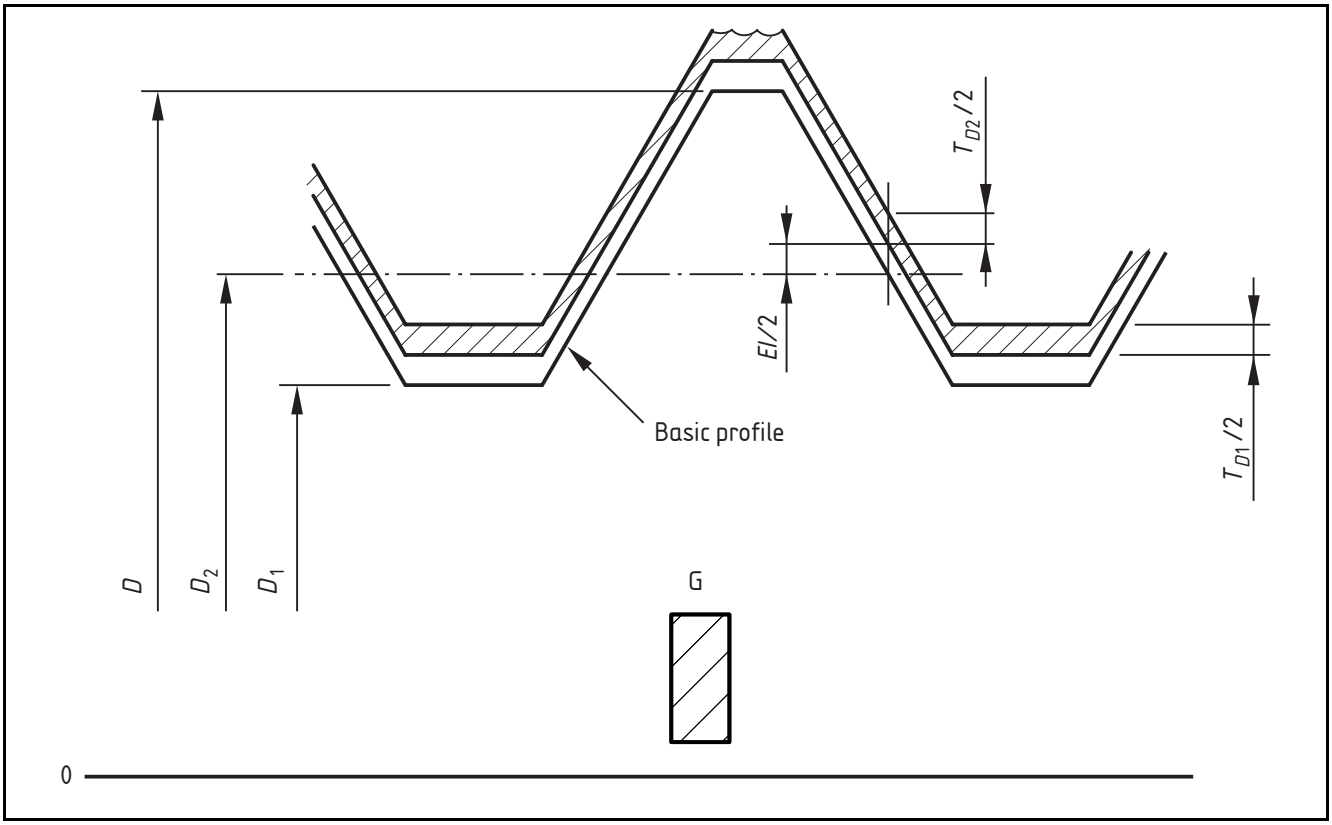


Figure 5 **Internal threads with tolerance position H**

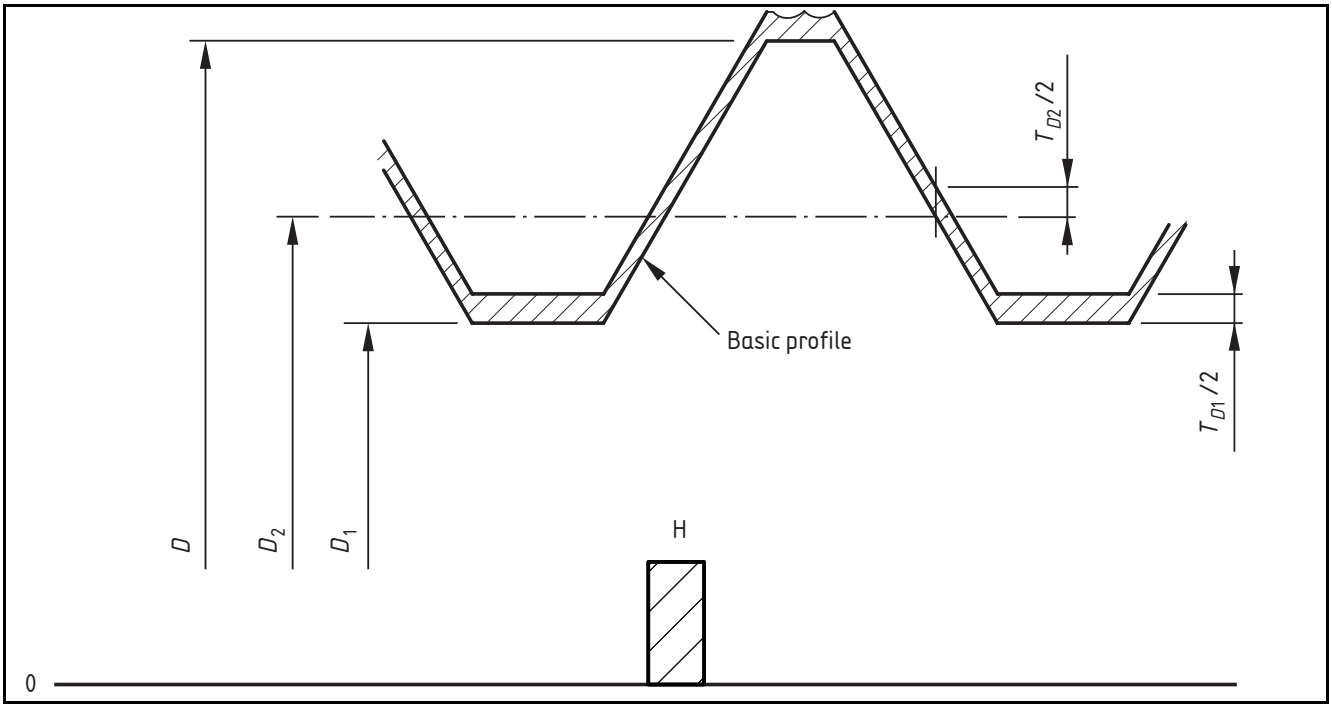
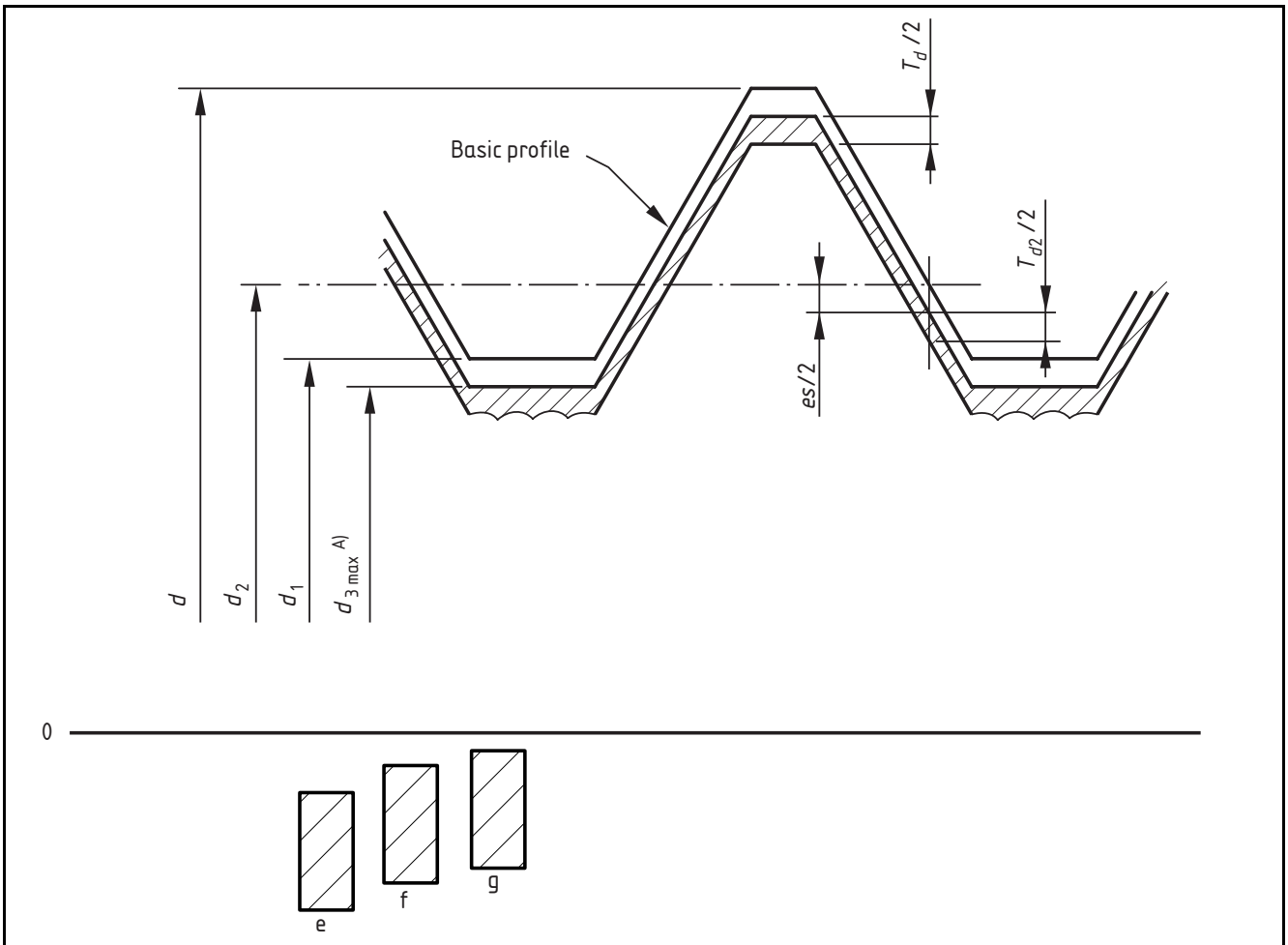
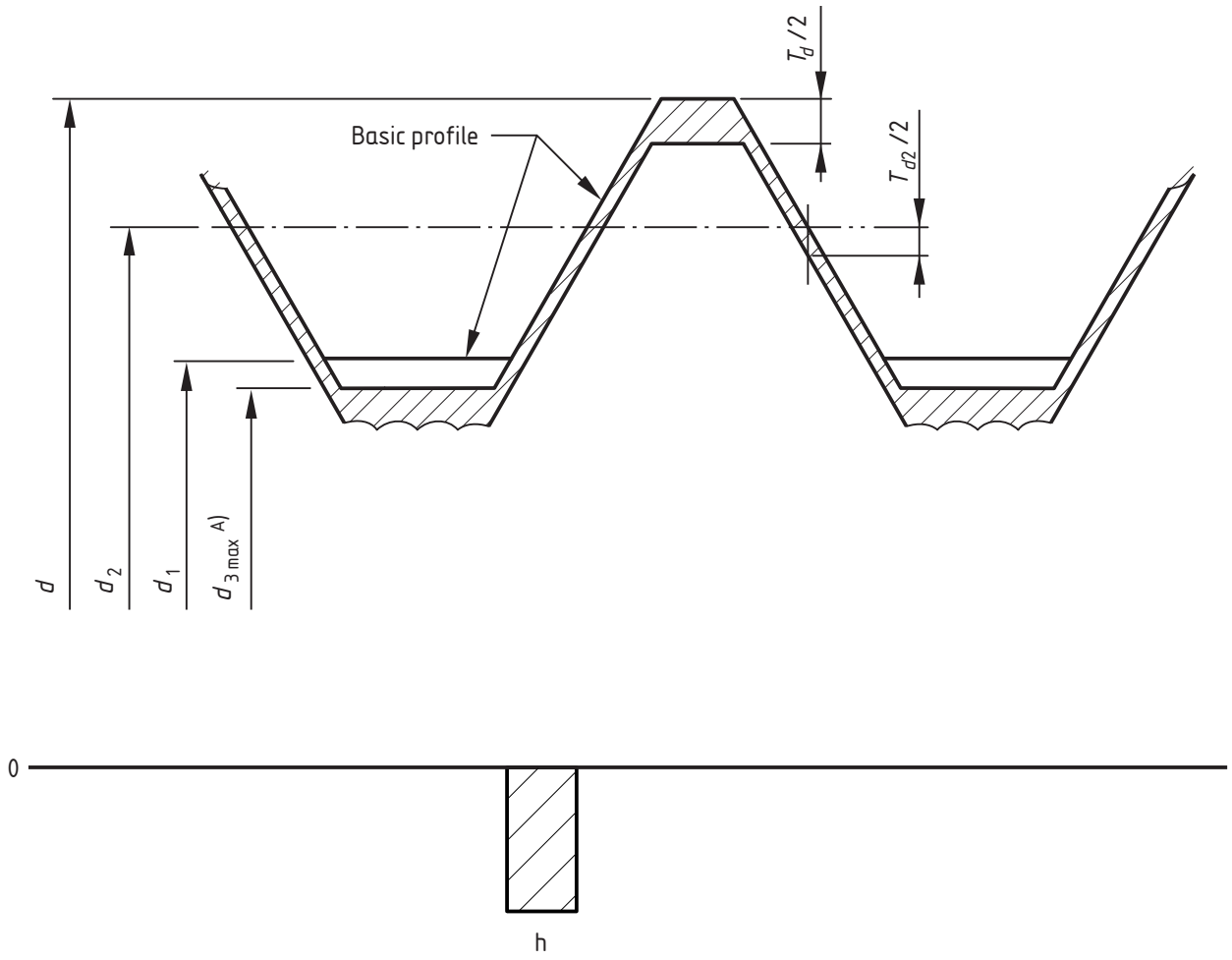


Figure 6 **External threads with tolerance positions e, f and g**



A) Applicable only in connection with minimum material limits ($d_{2\,min}$). See **7.9** and Figure 8.

Figure 7 **External threads with tolerance position h**



A) Applicable only in connection with minimum material limits ($d_{2\,min}$). See **7.9** and Figure 8.

Table 5 **Fundamental deviations for internal threads and external threads**

Pitch *P*	**Fundamental deviation**					
	Internal thread D_2, D_1		**External thread** d, d_2			
	G *EI*	H *EI*	e *es*	f *es*	g *es*	h *es*
mm	µm	µm	µm	µm	µm	µm
0.2	+17	0	—	—	−17	0
0.25	+18	0	—	—	−18	0
0.3	+18	0	—	—	−18	0
0.35	+19	0	—	−34	−19	0
0.4	+19	0	—	−34	−19	0
0.45	+20	0	—	−35	−20	0
0.5	+20	0	−50	−36	−20	0
0.6	+21	0	−53	−36	−21	0
0.7	+22	0	−56	−38	−22	0
0.75	+22	0	−56	−38	−22	0
0.8	+24	0	−60	−38	−24	0
1	+26	0	−60	−40	−26	0
1.25	+28	0	−63	−42	−28	0
1.5	+32	0	−67	−45	−32	0
1.75	+34	0	−71	−48	−34	0
2	+38	0	−71	−52	−38	0
2.5	+42	0	−80	−58	−42	0
3	+48	0	−85	−63	−48	0
3.5	+53	0	−90	−70	−53	0
4	+60	0	−95	−75	−60	0
4.5	+63	0	−100	−80	−63	0
5	+71	0	−106	−85	−71	0
5.5	+75	0	−112	−90	−75	0
6	+80	0	−118	−95	−80	0
8	+100	0	−140	−118	−100	0

7.6 Lengths of thread engagement

The length of thread engagement is classified into one of three groups, S (short), N (normal) or L (long), in accordance with Table 6.

Table 6 **Lengths of thread engagement**
Dimensions in millimetres

Basic major diameter *D*, *d*		**Pitch** *P*	**Lengths of thread engagement**			
			Short	**Normal**		**Long**
over	**up to and including**		**up to and including**	**over**	**up to and including**	**over**
0.99	1.4	0.2	0.5	0.5	1.4	1.4
		0.25	0.6	0.6	1.7	1.7
		0.3	0.7	0.7	2	2
1.4	2.8	0.2	0.5	0.5	1.5	1.5
		0.25	0.6	0.6	1.9	1.9
		0.35	0.8	0.8	2.6	2.6
		0.4	1	1	3	3
		0.45	1.3	1.3	3.8	3.8
2.8	5.6	0.35	1	1	3	3
		0.5	1.5	1.5	4.5	4.5
		0.6	1.7	1.7	5	5
		0.7	2	2	6	6
		0.75	2.2	2.2	6.7	6.7
		0.8	2.5	2.5	7.5	7.5
5.6	11.2	0.75	2.4	2.4	7.1	7.1
		1	3	3	9	9
		1.25	4	4	12	12
		1.5	5	5	15	15
11.2	22.4	1	3.8	3.8	11	11
		1.25	4.5	4.5	13	13
		1.5	5.6	5.6	16	16
		1.75	6	6	18	18
		2	8	8	24	24
		2.5	10	10	30	30
22.4	45	1	4	4	12	12
		1.5	6.3	6.3	19	19
		2	8.5	8.5	25	25
		3	12	12	36	36
		3.5	15	15	45	45
		4	18	18	53	53
		4.5	21	21	63	63
45	90	1.5	7.5	7.5	22	22
		2	9.5	9.5	28	28
		3	15	15	45	45
		4	19	19	56	56
		5	24	24	71	71
		5.5	28	28	85	85
		6	32	32	95	95
90	180	2	12	12	36	36
		3	18	18	53	53
		4	24	24	71	71
		6	36	36	106	106
		8	45	45	132	132
180	355	3	20	20	60	60
		4	26	26	80	80
		6	40	40	118	118
		8	50	50	150	150

7.7 Crest diameter tolerances

7.7.1 Minor diameter tolerances of internal threads (T_{D1})

For the minor diameter tolerances of internal threads, T_{D1}, there are five tolerance grades, 4, 5, 6, 7 and 8, in accordance with Table 7.

Table 7 **Minor diameter tolerances of internal threads** (T_{D1})

Pitch *P*	**Tolerance grade**				
	4	**5**	**6**	**7**	**8**
mm	µm	µm	µm	µm	µm
0.2	38	—	—	—	—
0.25	45	56	—	—	—
0.3	53	67	85	—	—
0.35	63	80	100	—	—
0.4	71	90	112	—	—
0.45	80	100	125	—	—
0.5	90	112	140	180	—
0.6	100	125	160	200	—
0.7	112	140	180	224	—
0.75	118	150	190	236	—
0.8	125	160	200	250	315
1	150	190	236	300	375
1.25	170	212	265	335	425
1.5	190	236	300	375	475
1.75	212	265	335	425	530
2	236	300	375	475	600
2.5	280	355	450	560	710
3	315	400	500	630	800
3.5	355	450	560	710	900
4	375	475	600	750	950
4.5	425	530	670	850	1 060
5	450	560	710	900	1 120
5.5	475	600	750	950	1 180
6	500	630	800	1 000	1 250
8	630	800	1 000	1 250	1 600

7.7.2 Major diameter tolerances of external threads (T_d)

For the major diameter tolerances of external threads, T_d, there are three tolerance grades, 4, 6 and 8, in accordance with Table 8.

The tolerance grades 5 and 7 do not exist for the major diameter of external threads.

Table 8 **Major diameter tolerances of external threads** (T_d)

Pitch P	**Tolerance grade**		
	4	**6**	**8**
mm	µm	µm	µm
0.2	36	56	—
0.25	42	67	—
0.3	48	75	—
0.35	53	85	—
0.4	60	95	—
0.45	63	100	—
0.5	67	106	—
0.6	80	125	—
0.7	90	140	—
0.75	90	140	—
0.8	95	150	236
1	112	180	280
1.25	132	212	335
1.5	150	236	375
1.75	170	265	425
2	180	280	450
2.5	212	335	530
3	236	375	600
3.5	265	425	670
4	300	475	750
4.5	315	500	800
5	335	530	850
5.5	355	560	900
6	375	600	950
8	450	710	1 180

7.8 Pitch diameter tolerances

For the pitch diameter tolerances of internal threads, T_{D2}, there are five tolerance grades, 4, 5, 6, 7 and 8, in accordance with Table 9.

For the pitch diameter tolerances of external threads, T_{d2}, there are seven tolerance grades, 3, 4, 5, 6, 7, 8 and 9, in accordance with Table 10.

Table 9 **Pitch diameter tolerances of internal threads** (T_{D2})

Basic major diameter *D*		**Pitch** *P*	**Tolerance grade**				
over	**up to and including**		**4**	**5**	**6**	**7**	**8**
mm	mm	mm	µm	µm	µm	µm	µm
0.99	1.4	0.2	40	—	—	—	—
		0.25	45	56	—	—	—
		0.3	48	60	75	—	—
1.4	2.8	0.2	42	—	—	—	—
		0.25	48	60	—	—	—
		0.35	53	67	85	—	—
		0.4	56	71	90	—	—
		0.45	60	75	95	—	—
2.8	5.6	0.35	56	71	90	—	—
		0.5	63	80	100	125	—
		0.6	71	90	112	140	—
		0.7	75	95	118	150	—
		0.75	75	95	118	150	—
		0.8	80	100	125	160	200
5.6	11.2	0.75	85	106	132	170	—
		1	95	118	150	190	236
		1.25	100	125	160	200	250
		1.5	112	140	180	224	280
11.2	22.4	1	100	125	160	200	250
		1.25	112	140	180	224	280
		1.5	118	150	190	236	300
		1.75	125	160	200	250	315
		2	132	170	212	265	335
		2.5	140	180	224	280	355
22.4	45	1	106	132	170	212	—
		1.5	125	160	200	250	315
		2	140	180	224	280	355
		3	170	212	265	335	425
		3.5	180	224	280	355	450
		4	190	236	300	375	475
		4.5	200	250	315	400	500
45	90	1.5	132	170	212	265	335
		2	150	190	236	300	375
		3	180	224	280	355	450
		4	200	250	315	400	500
		5	212	265	335	425	530
		5.5	224	280	355	450	560
		6	236	300	375	475	600
90	180	2	160	200	250	315	400
		3	190	236	300	375	475
		4	212	265	335	425	530
		6	250	315	400	500	630
		8	280	355	450	560	710
180	355	3	212	265	335	425	530
		4	236	300	375	475	600
		6	265	335	425	530	670
		8	300	375	475	600	750

Table 10 **Pitch diameter tolerances of external threads** (T_{d2})

Basic major diameter d		**Pitch** P	**Tolerance grade**						
over	**up to and including**		**3**	**4**	**5**	**6**	**7**	**8**	**9**
mm	mm	mm	µm	µm	µm	µm	µm	µm	µm
0.99	1.4	0.2	24	30	38	48	—	—	—
		0.25	26	34	42	53	—	—	—
		0.3	28	36	45	56	—	—	—
1.4	2.8	0.2	25	32	40	50	—	—	—
		0.25	28	36	45	56	—	—	—
		0.35	32	40	50	63	80	—	—
		0.4	34	42	53	67	85	—	—
		0.45	36	45	56	71	90	—	—
2.8	5.6	0.35	34	42	53	67	85	—	—
		0.5	38	48	60	75	95	—	—
		0.6	42	53	67	85	106	—	—
		0.7	45	56	71	90	112	—	—
		0.75	45	56	71	90	112	—	—
		0.8	48	60	75	95	118	150	190
5.6	11.2	0.75	50	63	80	100	125	—	—
		1	56	71	90	112	140	180	224
		1.25	60	75	95	118	150	190	236
		1.5	67	85	106	132	170	212	265
11.2	22.4	1	60	75	95	118	150	190	236
		1.25	67	85	106	132	170	212	265
		1.5	71	90	112	140	180	224	280
		1.75	75	95	118	150	190	236	300
		2	80	100	125	160	200	250	315
		2.5	85	106	132	170	212	265	335
22.4	45	1	63	80	100	125	160	200	250
		1.5	75	95	118	150	190	236	300
		2	85	106	132	170	212	265	335
		3	100	125	160	200	250	315	400
		3.5	106	132	170	212	265	335	425
		4	112	140	180	224	280	355	450
		4.5	118	150	190	236	300	375	475
45	90	1.5	80	100	125	160	200	250	315
		2	90	112	140	180	224	280	355
		3	106	132	170	212	265	335	425
		4	118	150	190	236	300	375	475
		5	125	160	200	250	315	400	500
		5.5	132	170	212	265	335	425	530
		6	140	180	224	280	355	450	560
90	180	2	95	118	150	190	236	300	375
		3	112	140	180	224	280	355	450
		4	125	160	200	250	315	400	500
		6	150	190	236	300	375	475	600
		8	170	212	265	335	425	530	670
180	355	3	125	160	200	250	315	400	500
		4	140	180	224	280	355	450	560
		6	160	200	250	315	400	500	630
		8	180	224	280	355	450	560	710

7.9 Root contours

For internal threads as well as for external threads, the actual root contours shall not at any point transgress the basic profile.

For external threads on fasteners of property class 8.8 and higher (see BS EN ISO 898-1), the root profile shall have a non-reversing curvature, no portion of which shall have a radius of less than $0.125 \times P$ (see Figure 8 and Table 11).

In the maximum minor diameter position, d_3, the two radii of $R_{min} = 0.125 \times P$ will go through the points of intersection between the maximum material flanks and the minor diameter cylinder of the GO gauges in accordance with BS 919-3 and blend tangentially into the minimum material flanks.

The maximum truncation, C_{max}, is calculated according to the following formula:

$$C_{max} = \frac{H}{4} - R_{min}\left\{1 - \cos\left[\frac{\pi}{3} - \arccos\left(1 - \frac{T_{d2}}{4 \times R_{min}}\right)\right]\right\} + \frac{T_{d2}}{2}$$

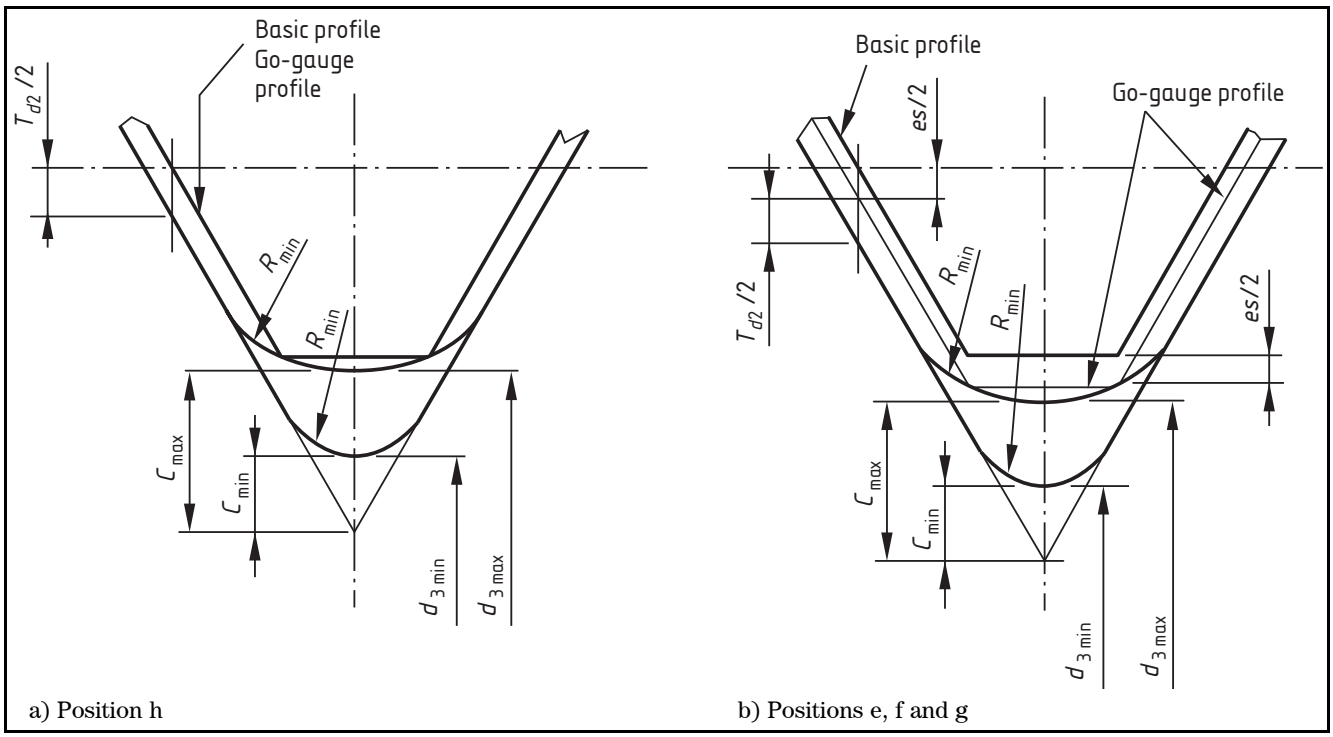
It is, however, advisable to attempt to obtain a truncation of $\frac{H}{6}$ ($R = 0.144\ 34 \times P$) and to take $\frac{H}{6}$ as the basis for stress calculation of the minor diameter, d_3, of external threads (for corresponding values see Clause **8**).

The minimum truncation, C_{min}, is calculated according to the following formula:

$$C_{min} = 0.125P \approx \frac{H}{7}$$

External threads on fasteners of property classes below 8.8 should preferably conform to the requirements stated above. This is particularly important for fasteners or other screwed connections that are subjected to fatigue or impact. However, there are, in principle, no restrictions other than that the maximum minor diameter, $d_{3\,max}$, of the external thread shall be less than the minimum minor diameter of the GO gauges in accordance with BS 919-3.

Figure 8 **External root profile**



a) Position h

b) Positions e, f and g

Table 11 **Minimum root radii**

Pitch P mm	R_{min} µm
0.2	25
0.25	31
0.3	38
0.35	44
0.4	50
0.45	56
0.5	63
0.6	75
0.7	88
0.75	94
0.8	100
1	125
1.25	156
1.5	188
1.75	219
2	250
2.5	313
3	375
3.5	438
4	500
4.5	563
5	625
5.5	688
6	750
8	1 000

7.10 Recommended tolerance classes

In order to reduce the numbers of gauges and tools the tolerance classes should preferably be chosen from Table 12 and Table 13.

The following general rules can be formulated for the choice of tolerance quality:

- fine: for precision threads, when little variation of fit character is needed;
- medium: for general use;
- coarse: for cases where manufacturing difficulties can arise, for example when threading hot-rolled bars and long blind holes.

If the actual length of thread engagement is unknown (as in the manufacturing of standard bolts), group N is recommended.

Tolerance classes in boxes with heavy outlines are selected for commercial external and internal threads.

Tolerance classes in bold type are first choice.

Tolerance classes in ordinary type are second choice.

Tolerance classes in parentheses are third choice.

Any of the recommended tolerance classes for internal threads can be combined with any of the recommended tolerance classes for external threads. However, in order to guarantee a sufficient overlap, the finished components should preferably be made to form the fits H/g, H/h or G/h. For thread sizes M1.4 and smaller the combinations 5H/6h, 4H/6h or finer shall be chosen.

For coated threads, the tolerances apply to the parts **before** coating, unless otherwise stated. After coating, the actual thread profile shall not at any point transgress the maximum material limits for positions H or h.

NOTE *These provisions are intended for thin coatings, e.g. those obtained by electroplating.*

Table 12 **Recommended tolerance classes for internal threads**

Tolerance quality	**Tolerance position G**			**Tolerance position H**		
	S	**N**	**L**	**S**	**N**	**L**
Fine	—	—	—	4H	5H	6H
Medium	(5G)	**6G**	(7G)	**5H**	**6H**	**7H**
Coarse	—	(7G)	(8G)	—	7H	8H

Table 13 **Recommended tolerance classes for external threads**

Tolerance quality	**Tolerance position e**			**Tolerance position f**			**Tolerance position g**			**Tolerance position h**		
	S	**N**	**L**	**S**	**N**	**L**	**S**	**N**	**L**	**S**	**N**	**L**
Fine	—	—	—	—	—	—	—	(4g)	(5g4g)	(3h4h)	**4h**	(5h4h)
Medium	—	**6e**	(7e6e)	—	**6f**	—	(5g6g)	**6g**	(7g6g)	(5h6h)	6h	(7h6h)
Coarse	—	(8e)	(9e8e)	—	—	—	—	8g	(9g8g)	—	—	—

7.11 Formulae

7.11.1 General

The values given in this clause are based on experience. In order to obtain a consistent system, mathematical formulae have been developed.

The values for pitch and crest diameter tolerances and for fundamental deviations have been calculated from the formulae and then rounded off to the nearest value in the R 40 series of preferred numbers. However, when decimals occur, the value has been further rounded off to the nearest whole number.

In order to reproduce a smooth progression, these rules of rounding off have not always been used.

The root radii specified in Table 11 are equal to $0.125P$.

7.11.2 Fundamental deviations

The fundamental deviations for external and internal threads have been calculated according to the following formulae:

$EI_G = +(15 + 11P)$

$EI_H = 0$

$es_e = -(50 + 11P)$[1)]

$es_f = -(30 + 11P)$[2)]

$es_g = -(15 + 11P)$

$es_h = 0$

where EI and es are expressed in micrometres and P is expressed in millimetres.

7.11.3 Length of thread engagement

For the calculation of the limits of the normal length of thread engagement l_N in Table 6, the following rule has been applied.

For each pitch within a certain diameter range, d has been set equal to the smallest diameter (within the range) which appears in the general plan (see Clause **5**).

$l_{N\,min}$ (approximate) $= 2.24Pd^{0.2}$

$l_{N\,max}$ (approximate) $= 6.7Pd^{0.2}$

where l_N, P and d are expressed in millimetres.

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1) Exceptions are values for threads with $P \leqslant 0.45$ mm.

2) Does not apply for $P \leqslant 0.3$ mm.

7.11.4 Crest diameter tolerances

7.11.4.1 Tolerances for major diameter of external threads (T_d), grade 6

These tolerances have been calculated according to the following formula:

$$T_d(6) = 180\sqrt[3]{P^2} - \frac{3.15}{\sqrt{P}}$$

where T_d is expressed in micrometres and P is expressed in millimetres.

T_d-tolerances for the other grades are obtained from the $T_d(6)$-values (see Table 8) according to the table below.

Tolerance grade		
4	**6**	**8**
$0.63T_d(6)$	$T_d(6)$	$1.6T_d(6)$

7.11.4.2 Tolerances for minor diameter of internal threads (T_{D1}), grade 6

T_{D1}-tolerances for grade 6 are calculated according to the following formulae:

a) Pitches 0.2 mm to 0.8 mm:

$T_{D1}(6) = 433P - 190P^{1.22}$

b) Pitch 1 mm and coarser:

$T_{D1}(6) = 230P^{0.7}$

where T_{D1} is expressed in micrometres and P is expressed in millimetres.

The values for the other grades are obtained from the $T_{D1}(6)$-values (in Table 7) according to the table below.

Tolerance grade				
4	**5**	**6**	**7**	**8**
$0.63T_{D1}(6)$	$0.8T_{D1}(6)$	$T_{D1}(6)$	$1.25T_{D1}(6)$	$1.6T_{D1}(6)$

7.11.5 Pitch diameter tolerances

7.11.5.1 Tolerances for pitch diameter of external threads (T_{d2})

$T_{d2}(6)$-values in Table 10 are calculated according to the following formula (d being equal to the geometrical mean value of the diameter range limits):

$$T_{d2}(6) = 90P^{0.4}d^{0.1}$$

where $T_{d2}(6)$ is expressed in micrometres and P and d are expressed in millimetres.

The values for the other grades are obtained from the $T_{d2}(6)$-values (see Table 10) according to the table below.

Tolerance grade						
3	**4**	**5**	**6**	**7**	**8**	**9**
$0.5T_{d2}(6)$	$0.63T_{d2}(6)$	$0.8T_{d2}(6)$	$T_{d2}(6)$	$1.25T_{d2}(6)$	$1.6T_{d2}(6)$	$2T_{d2}(6)$

No T_{d2}-values are given in Table 10 when values calculated according to the given formulae exceed the T_d-values in the tolerance grades which are combined in the tables for recommended tolerance classes.

7.11.5.2 Tolerances for pitch diameter of internal thread (T_{D2})

T_{D2}-values are obtained from the $T_{d2}(6)$-values (see Table 10) according to the table below.

Tolerance grade				
4	**5**	**6**	**7**	**8**
$0.85T_{d2}(6)$	$1.06T_{d2}(6)$	$1.32T_{d2}(6)$	$1.7T_{d2}(6)$	$2.12T_{d2}(6)$

No T_{D2}-values are given in the Table 9 when values calculated according to the given formulae exceed $0.25P$.

8 Tolerances – Deviations for constructional threads

8.1 General

This clause specifies deviations for pitch and crest diameters for ISO general purpose metric screw threads conforming to Clause **5** having a basic profile in accordance with Clause **4**.

The deviations specified are derived from the fundamental deviations and tolerances specified in Clause **7**.

The values for the deviations are given in Table 14.

8.2 Deviations

For internal threads as well as external threads, the actual root contour shall not in any point transgress the basic profile.

The tabulated deviation values for the minor diameter of the external thread are calculated on the basis of an $\frac{H}{6}$ truncation and may be used for stress calculations $\left[\text{deviation} = -\left(|\text{es}| + \frac{H}{6}\right)\right]$.

For coated threads, the tolerances apply to the parts before coating, unless otherwise stated. After coating, the actual thread profile shall not at any point transgress the maximum material limits for position H or h respectively.

NOTE These provisions are intended for thin coatings, for example those obtained by electroplating.

Table 14 **Deviations**

ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation –(|es| +H/6) for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
0.99	1.4	0.2	—	—	—	—	—	3h4h	0	–24	0	–36	–29
			4H	+40	0	+38	0	4h	0	–30	0	–36	–29
			5G	—	—	—	—	5g6g	–17	–55	–17	–73	–46
			5H	—	—	—	—	5h4h	0	–38	0	–36	–29
			—	—	—	—	—	5h6h	0	–38	0	–56	–29
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	—	—	—	—	—
			6G	—	—	—	—	6g	–17	–65	–17	–73	–46
			6H	—	—	—	—	6h	0	–48	0	–56	–29
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	—	—	—	—	—
			7H	—	—	—	—	7h6h	—	—	—	—	—
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.25	—	—	—	—	—	3h4h	0	–26	0	–42	–36
			4H	+45	0	+45	0	4h	0	–34	0	–42	–36
			5G	+74	+18	+74	+18	5g6g	–18	–60	–18	–85	–54
			5H	+56	0	+56	0	5h4h	0	–42	0	–42	–36
			—	—	—	—	—	5h6h	0	–42	0	–67	–36
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	—	—	—	—	—
			6G	—	—	—	—	6g	–18	–71	–18	–85	–54
			6H	—	—	—	—	6h	0	–53	0	–67	–36
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	—	—	—	—	—
			7H	—	—	—	—	7h6h	—	—	—	—	—
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.3	—	—	—	—	—	3h4h	0	–28	0	–48	–43
			4H	+48	0	+53	0	4h	0	–36	0	–48	–43
			5G	+78	+18	+85	+18	5g6g	–18	–63	–18	–93	–61
			5H	+60	0	+67	0	5h4h	0	–45	0	–48	–43
			—	—	—	—	—	5h6h	0	–45	0	–75	–43
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	—	—	—	—	—
			6G	+93	+18	+103	+18	6g	–18	–74	–18	–93	–61
			6H	+75	0	+85	0	6h	0	–56	0	–75	–43
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	—	—	—	—	—
			7H	—	—	—	—	7h6h	—	—	—	—	—
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation –(|es| +H/6) for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
1.4	2.8	0.2	—	—	—	—	—	3h4h	0	–25	0	–36	–29
			4H	+42	0	+38	0	4h	0	–32	0	–36	–29
			5G	—	—	—	—	5g6g	–17	–57	–17	–73	–46
			5H	—	—	—	—	5h4h	0	–40	0	–36	–29
			—	—	—	—	—	5h6h	0	–40	0	–56	–29
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–32	–82	–32	–88	–61
			6G	—	—	—	—	6g	–17	–67	–17	–73	–46
			6H	—	—	—	—	6h	0	–50	0	–56	–29
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	—	—	—	—	—
			7H	—	—	—	—	7h6h	—	—	—	—	—
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.25	—	—	—	—	—	3h4h	0	–28	0	–42	–36
			4H	+48	0	+45	0	4h	0	–36	0	–42	–36
			5G	+78	+18	+74	+18	5g6g	–18	–63	–18	–85	–54
			5H	+60	0	+56	0	5h4h	0	–45	0	–42	–36
			—	—	—	—	—	5h6h	0	–45	0	–67	–36
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–33	–89	–33	–100	–69
			6G	—	—	—	—	6g	–18	–74	–18	–85	–54
			6H	—	—	—	—	6h	0	–56	0	–67	–36
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	—	—	—	—	—
			7H	—	—	—	—	7h6h	—	—	—	—	—
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.35	—	—	—	—	—	3h4h	0	–32	0	–53	–51
			4H	+53	0	+63	0	4h	0	–40	0	–53	–51
			5G	+86	+19	+99	+19	5g6g	–19	–69	–19	–104	–70
			5H	+67	0	+80	0	5h4h	0	–50	0	–53	–51
			—	—	—	—	—	5h6h	0	–50	0	–85	–51
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–34	–97	–34	–119	–85
			6G	+104	+19	+119	+19	6g	–19	–82	–19	–104	–70

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
1.4	2.8	0.35	6H	+85	0	+100	0	6h	0	–63	0	–85	–51
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	–19	–99	–19	–104	–70
			7H	—	—	—	—	7h6h	0	–80	0	–85	–51
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.4	—	—	—	—	—	3h4h	0	–34	0	–60	–58
			4H	+56	0	+71	0	4h	0	–42	0	–60	–58
			5G	+90	+19	+109	+19	5g6g	–19	–72	–19	–114	–77
			5H	+71	0	+90	0	5h4h	0	–53	0	–60	–58
			—	—	—	—	—	5h6h	0	–53	0	–95	–58
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–34	–101	–34	–129	–92
			6G	+109	+19	+131	+19	6g	–19	–86	–19	–114	–77
			6H	+90	0	+112	0	6h	0	–67	0	–95	–58
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	–19	–104	–19	–114	–77
			7H	—	—	—	—	7h6h	0	–85	0	–95	–58
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.45	—	—	—	—	—	3h4h	0	–36	0	–63	–65
			4H	+60	0	+80	0	4h	0	–45	0	–63	–65
			5G	+95	+20	+120	+20	5g6g	–20	–76	–20	–120	–85
			5H	+75	0	+100	0	5h4h	0	–56	0	–63	–65
			—	—	—	—	—	5h6h	0	–56	0	–100	–65
			—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–35	–106	–35	–135	–100
			6G	+115	+20	+145	+20	6g	–20	–91	–20	–120	–85
			6H	+95	0	+125	0	6h	0	–71	0	–100	–65
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	–20	–110	–20	–120	–85
			7H	—	—	—	—	7h6h	0	–90	0	–100	–65
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
2.8	5.6	0.35	—	—	—	—	—	3h4h	0	–34	0	–53	–51
			4H	+56	0	+63	0	4h	0	–42	0	–53	–51
			5G	+90	+19	+99	+19	5g6g	–19	–72	–19	–104	–70
			5H	+71	0	+80	0	5h4h	0	–53	0	–53	–51
			—	—	—	—	—	5h6h	0	–53	0	–85	–51

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
2.8	5.6	0.35	—	—	—	—	—	6e	—	—	—	—	—
			—	—	—	—	—	6f	–34	–101	–34	–119	–85
			6G	+109	+19	+119	+19	6g	–19	–86	–19	–104	–70
			6H	+90	0	+100	0	6h	0	–67	0	–85	–51
			—	—	—	—	—	7e6e	—	—	—	—	—
			7G	—	—	—	—	7g6g	–19	–104	–19	–104	–70
			7H	—	—	—	—	7h6h	0	–85	0	–85	–51
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.5	—	—	—	—	—	3h4h	0	–38	0	–67	–72
			4H	+63	0	+90	0	4h	0	–48	0	–67	–72
			5G	+100	+20	+132	+20	5g6g	–20	–80	–20	–126	–92
			5H	+80	0	+112	0	5h4h	0	–60	0	–67	–72
			—	—	—	—	—	5h6h	0	–60	0	–106	–72
			—	—	—	—	—	6e	–50	–125	–50	–156	–122
			—	—	—	—	—	6f	–36	–111	–36	–142	–108
			6G	+120	+20	+160	+20	6g	–20	–95	–20	–126	–92
			6H	+100	0	+140	0	6h	0	–75	0	–106	–72
			—	—	—	—	—	7e6e	–50	–145	–50	–156	–122
			7G	+145	+20	+200	+20	7g6g	–20	–115	–20	–126	–92
			7H	+125	0	+180	0	7h6h	0	–95	0	–106	–72
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.6	—	—	—	—	—	3h4h	0	–42	0	–80	–87
			4H	+71	0	+100	0	4h	0	–53	0	–80	–87
			5G	+111	+21	+146	+21	5g6g	–21	–88	–21	–146	–108
			5H	+90	0	+125	0	5h4h	0	–67	0	–80	–87
			—	—	—	—	—	5h6h	0	–67	0	–125	–87
			—	—	—	—	—	6e	–53	–138	–53	–178	–140
			—	—	—	—	—	6f	–36	–121	–36	–161	–123
			6G	+133	+21	+181	+21	6g	–21	–106	–21	–146	–108
			6H	+112	0	+160	0	6h	0	–85	0	–125	–87
			—	—	—	—	—	7e6e	–53	–159	–53	–178	–140
			7G	+161	+21	+221	+21	7g6g	–21	–127	–21	–146	–108
			7H	+140	0	+200	0	7h6h	0	–106	0	–125	–87
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.7	—	—	—	—	—	3h4h	0	–45	0	–90	–101
			4H	+75	0	+112	0	4h	0	–56	0	–90	–101

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
2.8	5.6	0.7	5G	+117	+22	+162	+22	5g6g	–22	–93	–22	–162	–123
			5H	+95	0	+140	0	5h4h	0	–71	0	–90	–101
			—	—	—	—	—	5h6h	0	–71	0	–140	–101
			—	—	—	—	—	6e	–56	–146	–56	–196	–157
			—	—	—	—	—	6f	–38	–128	–38	–178	–139
			6G	+140	+22	+202	+22	6g	–22	–112	–22	–162	–123
			6H	+118	0	+180	0	6h	0	–90	0	–140	–101
			—	—	—	—	—	7e6e	–56	–168	–56	–196	–157
			7G	+172	+22	+246	+22	7g6g	–22	–134	–22	–162	–123
			7H	+150	0	+224	0	7h6h	0	–112	0	–140	–101
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.75	—	—	—	—	—	3h4h	0	–45	0	–90	–108
			4H	+75	0	+118	0	4h	0	–56	0	–90	–108
			5G	+117	+22	+172	+22	5g6g	–22	–93	–22	–162	–130
			5H	+95	0	+150	0	5h4h	0	–71	0	–90	–108
			—	—	—	—	—	5h6h	0	–71	0	–140	–108
			—	—	—	—	—	6e	–56	–146	–56	–196	–164
			—	—	—	—	—	6f	–38	–128	–38	–178	–146
			6G	+140	+22	+212	+22	6g	–22	–112	–22	–162	–130
			6H	+118	0	+190	0	6h	0	–90	0	–140	–108
			—	—	—	—	—	7e6e	–56	–168	–56	–196	–164
			7G	+172	+22	+258	+22	7g6g	–22	–134	–22	–162	–130
			7H	+150	0	+236	0	7h6h	0	–112	0	–140	–108
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		0.8	—	—	—	—	—	3h4h	0	–48	0	–95	–115
			4H	+80	0	+125	0	4h	0	–60	0	–95	–115
			5G	+124	+24	+184	+24	5g6g	–24	–99	–24	–174	–140
			5H	+100	0	+160	0	5h4h	0	–75	0	–95	–115
			—	—	—	—	—	5h6h	0	–75	0	–150	–115
			—	—	—	—	—	6e	–60	–155	–60	–210	–176
			—	—	—	—	—	6f	–38	–133	–38	–188	–153
			6G	+149	+24	+224	+24	6g	–24	–119	–24	–174	–140
			6H	+125	0	+200	0	6h	0	–95	0	–150	–115
			—	—	—	—	—	7e6e	–60	–178	–60	–210	–176
			7G	+184	+24	+274	+24	7g6g	–24	–142	–24	–174	–140
			7H	+160	0	+250	0	7h6h	0	–118	0	–150	–115

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
2.8	5.6	0.8	8G	+224	+24	+339	+24	8g	–24	–174	–24	–260	–140
			8H	+200	0	+315	0	9g8g	–24	–214	–24	–260	–140
5.6	11.2	0.75	—	—	—	—	—	3h4h	0	–50	0	–90	–108
			4H	+85	0	+118	0	4h	0	–63	0	–90	–108
			5G	+128	+22	+172	+22	5g6g	–22	–102	–22	–162	–130
			5H	+106	0	+150	0	5h4h	0	–80	0	–90	–108
			—	—	—	—	—	5h6h	0	–80	0	–140	–108
			—	—	—	—	—	6e	–56	–156	–56	–196	–164
			—	—	—	—	—	6f	–38	–138	–38	–178	–146
			6G	+154	+22	+212	+22	6g	–22	–122	–22	–162	–130
			6H	+132	0	+190	0	6h	0	–100	0	–140	–108
			—	—	—	—	—	7e6e	–56	–181	–56	–196	–164
			7G	+192	+22	+258	+22	7g6g	–22	–147	–22	–162	–130
			7H	+170	0	+236	0	7h6h	0	–125	0	–140	–108
			8G	—	—	—	—	8g	—	—	—	—	—
			8H	—	—	—	—	9g8g	—	—	—	—	—
		1	—	—	—	—	—	3h4h	0	–56	0	–112	–144
			4H	+95	0	+150	0	4h	0	–71	0	–112	–144
			5G	+144	+26	+216	+26	5g6g	–26	–116	–26	–206	–170
			5H	+118	0	+190	0	5h4h	0	–90	0	–112	–144
			—	—	—	—	—	5h6h	0	–90	0	–180	–144
			—	—	—	—	—	6e	–60	–172	–60	–240	–204
			—	—	—	—	—	6f	–40	–152	–40	–220	–184
			6G	+176	+26	+262	+26	6g	–26	–138	–26	–206	–170
			6H	+150	0	+236	0	6h	0	–112	0	–180	–144
			—	—	—	—	—	7e6e	–60	–200	–60	–240	–204
			7G	+216	+26	+326	+26	7g6g	–26	–166	–26	–206	–170
			7H	+190	0	+300	0	7h6h	0	–140	0	–180	–144
			8G	+262	+26	+401	+26	8g	–26	–206	–26	–306	–170
			8H	+236	0	+375	0	9g8g	–26	–250	–26	–306	–170
		1.25	—	—	—	—	—	3h4h	0	–60	0	–132	–180
			4H	+100	0	+170	0	4h	0	–75	0	–132	–180
			5G	+153	+28	+240	+28	5g6g	–28	–123	–28	–240	–208
			5H	+125	0	+212	0	5h4h	0	–95	0	–132	–180
			—	—	—	—	—	5h6h	0	–95	0	–212	–180
			—	—	—	—	—	6e	–63	–181	–63	–275	–243
			—	—	—	—	—	6f	–42	–160	–42	–254	–222
			6G	+188	+28	+293	+28	6g	–28	–146	–28	–240	–208
			6H	+160	0	+265	0	6h	0	–118	0	–212	–180

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
5.6	11.2	1.25	—	—	—	—	—	7e6e	–63	–213	–63	–275	–243
			7G	+228	+28	+363	+28	7g6g	–28	–178	–28	–240	–208
			7H	+200	0	+335	0	7h6h	0	–150	0	–212	–180
			8G	+278	+28	+453	+28	8g	–28	–218	–28	–363	–208
			8H	+250	0	+425	0	9g8g	–28	–264	–28	–363	–208
		1.5	—	—	—	—	—	3h4h	0	–67	0	–150	–217
			4H	+112	0	+190	0	4h	0	–85	0	–150	–217
			5G	+172	+32	+268	+32	5g6g	–32	–138	–32	–268	–249
			5H	+140	0	+236	0	5h4h	0	–106	0	–150	–217
			—	—	—	—	—	5h6h	0	–106	0	–236	–217
			—	—	—	—	—	6e	–67	–199	–67	–303	–284
			—	—	—	—	—	6f	–45	–177	–45	–281	–262
			6G	+212	+32	+332	+32	6g	–32	–164	–32	–268	–249
			6H	+180	0	+300	0	6h	0	–132	0	–236	–217
			—	—	—	—	—	7e6e	–67	–237	–67	–303	–284
			7G	+256	+32	+407	+32	7g6g	–32	–202	–32	–268	–249
			7H	+224	0	+375	0	7h6h	0	–170	0	–236	–217
			8G	+312	+32	+507	+32	8g	–32	–244	–32	–407	–249
			8H	+280	0	+475	0	9g8g	–32	–297	–32	–407	–249
11.2	22.4	1	—	—	—	—	—	3h4h	0	–60	0	–112	–144
			4H	+100	0	+150	0	4h	0	–75	0	–112	–144
			5G	+151	+26	+216	+26	5g6g	–26	–121	–26	–206	–170
			5H	+125	0	+190	0	5h4h	0	–95	0	–112	–144
			—	—	—	—	—	5h6h	0	–95	0	–180	–144
			—	—	—	—	—	6e	–60	–178	–60	–240	–204
			—	—	—	—	—	6f	–40	–158	–40	–220	–184
			6G	+186	+26	+262	+26	6g	–26	–144	–26	–206	–170
			6H	+160	0	+236	0	6h	0	–118	0	–180	–144
			—	—	—	—	—	7e6e	–60	–210	–60	–240	–204
			7G	+226	+26	+326	+26	7g6g	–26	–176	–26	–206	–170
			7H	+200	0	+300	0	7h6h	0	–150	0	–180	–144
			8G	+276	+26	+401	+26	8g	–26	–216	–26	–306	–170
			8H	+250	0	+375	0	9g8g	–26	–262	–26	–306	–170
		1.25	—	—	—	—	—	3h4h	0	–67	0	–132	–180
			4H	+112	0	+170	0	4h	0	–85	0	–132	–180
			5G	+168	+28	+240	+28	5g6g	–28	–134	–28	–240	–208
			5H	+140	0	+212	0	5h4h	0	–106	0	–132	–180
			—	—	—	—	—	5h6h	0	–106	0	–212	–180
			—	—	—	—	—	6e	–63	–195	–63	–275	–243

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
11.2	22.4	1.25	—	—	—	—	—	6f	–42	–174	–42	–254	–222
			6G	+208	+28	+293	+28	6g	–28	–160	–28	–240	–208
			6H	+180	0	+265	0	6h	0	–132	0	–212	–180
			—	—	—	—	—	7e6e	–63	–233	–63	–275	–243
			7G	+252	+28	+363	+28	7g6g	–28	–198	–28	–240	–208
			7H	+224	0	+335	0	7h6h	0	–170	0	–212	–180
			8G	+308	+28	+453	+28	8g	–28	–240	–28	–363	–208
			8H	+280	0	+425	0	9g8g	–28	–293	–28	–363	–208
		1.5	—	—	—	—	—	3h4h	0	–71	0	–150	–217
			4H	+118	0	+190	0	4h	0	–90	0	–150	–217
			5G	+182	+32	+268	+32	5g6g	–32	–144	–32	–268	–249
			5H	+150	0	+236	0	5h4h	0	–112	0	–150	–217
			—	—	—	—	—	5h6h	0	–112	0	–236	–217
			—	—	—	—	—	6e	–67	–207	–67	–303	–284
			—	—	—	—	—	6f	–45	–185	–45	–281	–262
			6G	+222	+32	+332	+32	6g	–32	–172	–32	–268	–249
			6H	+190	0	+300	0	6h	0	–140	0	–236	–217
			—	—	—	—	—	7e6e	–67	–247	–67	–303	–284
			7G	+268	+32	+407	+32	7g6g	–32	–212	–32	–268	–249
			7H	+236	0	+375	0	7h6h	0	–180	0	–236	–217
			8G	+332	+32	+507	+32	8g	–32	–256	–32	–407	–249
			8H	+300	0	+475	0	9g8g	–32	–312	–32	–407	–249
		1.75	—	—	—	—	—	3h4h	0	–75	0	–170	–253
			4H	+125	0	+212	0	4h	0	–95	0	–170	–253
			5G	+194	+34	+299	+34	5g6g	–34	–152	–34	–299	–287
			5H	+160	0	+265	0	5h4h	0	–118	0	–170	–253
			—	—	—	—	—	5h6h	0	–118	0	–265	–253
			—	—	—	—	—	6e	–71	–221	–71	–336	–324
			—	—	—	—	—	6f	–48	–198	–48	–313	–301
			6G	+234	+34	+369	+34	6g	–34	–184	–34	–299	–287
			6H	+200	0	+335	0	6h	0	–150	0	–265	–253
			—	—	—	—	—	7e6e	–71	–261	–71	–336	–324
			7G	+284	+34	+459	+34	7g6g	–34	–224	–34	–299	–287
			7H	+250	0	+425	0	7h6h	0	–190	0	–265	–253
			8G	+349	+34	+564	+34	8g	–34	–270	–34	–459	–287
			8H	+315	0	+530	0	9g8g	–34	–334	–34	–459	–287
		2	—	—	—	—	—	3h4h	0	–80	0	–180	–289
			4H	+132	0	+236	0	4h	0	–100	0	–180	–289
			5G	+208	+38	+338	+38	5g6g	–38	–163	–38	–318	–327

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
11.2	22.4	2	5H	+170	0	+300	0	5h4h	0	–125	0	–180	–289
			—	—	—	—	—	5h6h	0	–125	0	–280	–289
			—	—	—	—	—	6e	–71	–231	–71	–351	–360
			—	—	—	—	—	6f	–52	–212	–52	–332	–341
			6G	+250	+38	+413	+38	6g	–38	–198	–38	–318	–327
			6H	+212	0	+375	0	6h	0	–160	0	–280	–289
			—	—	—	—	—	7e6e	–71	–271	–71	–351	–360
			7G	+303	+38	+513	+38	7g6g	–38	–238	–38	–318	–327
			7H	+265	0	+475	0	7h6h	0	–200	0	–280	–289
			8G	+373	+38	+638	+38	8g	–38	–288	–38	–488	–327
			8H	+335	0	+600	0	9g8g	–38	–353	–38	–488	–327
		2.5	—	—	—	—	—	3h4h	0	–85	0	–212	–361
			4H	+140	0	+280	0	4h	0	–106	0	–212	–361
			5G	+222	+42	+397	+42	5g6g	–42	–174	–42	–377	–403
			5H	+180	0	+355	0	5h4h	0	–132	0	–212	–361
			—	—	—	—	—	5h6h	0	–132	0	–335	–361
			—	—	—	—	—	6e	–80	–250	–80	–415	–441
			—	—	—	—	—	6f	–58	–228	–58	–393	–419
			6G	+266	+42	+492	+42	6g	–42	–212	–42	–377	–403
			6H	+224	0	+450	0	6h	0	–170	0	–335	–361
			—	—	—	—	—	7e6e	–80	–292	–80	–415	–441
			7G	+322	+42	+602	+42	7g6g	–42	–254	–42	–377	–403
			7H	+280	0	+560	0	7h6h	0	–212	0	–335	–361
			8G	+397	+42	+752	+42	8g	–42	–307	–42	–572	–403
			8H	+355	0	+710	0	9g8g	–42	–377	–42	–572	–403
22.4	45	1	—	—	—	—	—	3h4h	0	–63	0	–112	–144
			4H	+106	0	+150	0	4h	0	–80	0	–112	–144
			5G	+158	+26	+216	+26	5g6g	–26	–126	–26	–206	–170
			5H	+132	0	+190	0	5h4h	0	–100	0	–112	–144
			—	—	—	—	—	5h6h	0	–100	0	–180	–144
			—	—	—	—	—	6e	–60	–185	–60	–240	–204
			—	—	—	—	—	6f	–40	–165	–40	–220	–184
			6G	+196	+26	+262	+26	6g	–26	–151	–26	–206	–170
			6H	+170	0	+236	0	6h	0	–125	0	–180	–144
			—	—	—	—	—	7e6e	–60	–220	–60	–240	–204
			7G	+238	+26	+326	+26	7g6g	–26	–186	–26	–206	–170
			7H	+212	0	+300	0	7h6h	0	–160	0	–180	–144
			8G	—	—	—	—	8g	–26	–226	–26	–306	–170
			8H	—	—	—	—	9g8g	–26	–276	–26	–306	–170

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation –(|es| +H/6) for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
22.4	45	1.5	—	—	—	—	—	3h4h	0	–75	0	–150	–217
			4H	+125	0	+190	0	4h	0	–95	0	–150	–217
			5G	+192	+32	+268	+32	5g6g	–32	–150	–32	–268	–249
			5H	+160	0	+236	0	5h4h	0	–118	0	–150	–217
			—	—	—	—	—	5h6h	0	–118	0	–236	–217
			—	—	—	—	—	6e	–67	–217	–67	–303	–284
			—	—	—	—	—	6f	–45	–195	–45	–281	–262
			6G	+232	+32	+332	+32	6g	–32	–182	–32	–268	–249
			6H	+200	0	+300	0	6h	0	–150	0	–236	–217
			—	—	—	—	—	7e6e	–67	–257	–67	–303	–284
			7G	+282	+32	+407	+32	7g6g	–32	–222	–32	–268	–249
			7H	+250	0	+375	0	7h6h	0	–190	0	–236	–217
			8G	+347	+32	+507	+32	8g	–32	–268	–32	–407	–249
			8H	+315	0	+475	0	9g8g	–32	–332	–32	–407	–249
		2	—	—	—	—	—	3h4h	0	–85	0	–180	–289
			4H	+140	0	+236	0	4h	0	–106	0	–180	–289
			5G	+218	+38	+338	+38	5g6g	–38	–170	–38	–318	–327
			5H	+180	0	+300	0	5h4h	0	–132	0	–180	–289
			—	—	—	—	—	5h6h	0	–132	0	–280	–289
			—	—	—	—	—	6e	–71	–241	–71	–351	–360
			—	—	—	—	—	6f	–52	–222	–52	–332	–341
			6G	+262	+38	+413	+38	6g	–38	–208	–38	–318	–327
			6H	+224	0	+375	0	6h	0	–170	0	–280	–289
			—	—	—	—	—	7e6e	–71	–283	–71	–351	–360
			7G	+318	+38	+513	+38	7g6g	–38	–250	–38	–318	–327
			7H	+280	0	+475	0	7h6h	0	–212	0	–280	–289
			8G	+393	+38	+638	+38	8g	–38	–307	–38	–488	–327
			8H	+355	0	+600	0	9g8g	–38	–373	–38	–488	–327
		3	—	—	—	—	—	3h4h	0	–100	0	–236	–433
			4H	+170	0	+315	0	4h	0	–125	0	–236	–433
			5G	+260	+48	+448	+48	5g6g	–48	–208	–48	–423	–481
			5H	+212	0	+400	0	5h4h	0	–160	0	–236	–433
			—	—	—	—	—	5h6h	0	–160	0	–375	–433
			—	—	—	—	—	6e	–85	–285	–85	–460	–518
			—	—	—	—	—	6f	–63	–263	–63	–438	–496
			6G	+313	+48	+548	+48	6g	–48	–248	–48	–423	–481
			6H	+265	0	+500	0	6h	0	–200	0	–375	–433
			—	—	—	—	—	7e6e	–85	–335	–85	–460	–518
			7G	+383	+48	+678	+48	7g6g	–48	–298	–48	–423	–481

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
22.4	45	3	7H	+335	0	+630	0	7h6h	0	–250	0	–375	–433
			8G	+473	+48	+848	+48	8g	–48	–363	–48	–648	–481
			8H	+425	0	+800	0	9g8g	–48	–448	–48	–648	–481
		3.5	—	—	—	—	—	3h4h	0	–106	0	–265	–505
			4H	+180	0	+355	0	4h	0	–132	0	–265	–505
			5G	+277	+53	+503	+53	5g6g	–53	–223	–53	–478	–558
			5H	+224	0	+450	0	5h4h	0	–170	0	–265	–505
			—	—	—	—	—	5h6h	0	–170	0	–425	–505
			—	—	—	—	—	6e	–90	–302	–90	–515	–595
			—	—	—	—	—	6f	–70	–282	–70	–495	–575
			6G	+333	+53	+613	+53	6g	–53	–265	–53	–478	–558
			6H	+280	0	+560	0	6h	0	–212	0	–425	–505
			—	—	—	—	—	7e6e	–90	–355	–90	–515	–595
			7G	+408	+53	+763	+53	7g6g	–53	–318	–53	–478	–558
			7H	+355	0	+710	0	7h6h	0	–265	0	–425	–505
			8G	+503	+53	+953	+53	8g	–53	–388	–53	–723	–558
			8H	+450	0	+900	0	9g8g	–53	–478	–53	–723	–558
		4	—	—	—	—	—	3h4h	0	–112	0	–300	–577
			4H	+190	0	+375	0	4h	0	–140	0	–300	–577
			5G	+296	+60	+535	+60	5g6g	–60	–240	–60	–535	–637
			5H	+236	0	+475	0	5h4h	0	–180	0	–300	–577
			—	—	—	—	—	5h6h	0	–180	0	–475	–577
			—	—	—	—	—	6e	–95	–319	–95	–570	–672
			—	—	—	—	—	6f	–75	–299	–75	–550	–652
			6G	+360	+60	+660	+60	6g	–60	–284	–60	–535	–637
			6H	+300	0	+600	0	6h	0	–224	0	–475	–577
			—	—	—	—	—	7e6e	–95	–375	–95	–570	–672
			7G	+435	+60	+810	+60	7g6g	–60	–340	–60	–535	–637
			7H	+375	0	+750	0	7h6h	0	–280	0	–475	–577
			8G	+535	+60	+1 010	+60	8g	–60	–415	–60	–810	–637
			8H	+475	0	+950	0	9g8g	–60	–510	–60	–810	–637
		4.5	—	—	—	—	—	3h4h	0	–118	0	–315	–650
			4H	+200	0	+425	0	4h	0	–150	0	–315	–650
			5G	+313	+63	+593	+63	5g6g	–63	–253	–63	–563	–713
			5H	+250	0	+530	0	5h4h	0	–190	0	–315	–650
			—	—	—	—	—	5h6h	0	–190	0	–500	–650
			—	—	—	—	—	6e	–100	–336	–100	–600	–750
			—	—	—	—	—	6f	–80	–316	–80	–580	–730
			6G	+378	+63	+733	+63	6g	–63	–299	–63	–563	–713

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
22.4	45	4.5	6H	+315	0	+670	0	6h	0	–236	0	–500	–650
			—	—	—	—	—	7e6e	–100	–400	–100	–600	–750
			7G	+463	+63	+913	+63	7g6g	–63	–363	–63	–563	–713
			7H	+400	0	+850	0	7h6h	0	–300	0	–500	–650
			8G	+563	+63	+1 123	+63	8g	–63	–438	–63	–863	–713
			8H	+500	0	+1 060	0	9g8g	–63	–538	–63	–863	–713
45	90	1.5	—	—	—	—	—	3h4h	0	–80	0	–150	–217
			4H	+132	0	+190	0	4h	0	–100	0	–150	–217
			5G	+202	+32	+268	+32	5g6g	–32	–157	–32	–268	–249
			5H	+170	0	+236	0	5h4h	0	–125	0	–150	–217
			—	—	—	—	—	5h6h	0	–125	0	–236	–217
			—	—	—	—	—	6e	–67	–227	–67	–303	–284
			—	—	—	—	—	6f	–45	–205	–45	–281	–262
			6G	+244	+32	+332	+32	6g	–32	–192	–32	–268	–249
			6H	+212	0	+300	0	6h	0	–160	0	–236	–217
			—	—	—	—	—	7e6e	–67	–267	–67	–303	–284
			7G	+297	+32	+407	+32	7g6g	–32	–232	–32	–268	–249
			7H	+265	0	+375	0	7h6h	0	–200	0	–236	–217
			8G	+367	+32	+507	+32	8g	–32	–282	–32	–407	–249
			8H	+335	0	+475	0	9g8g	–32	–347	–32	–407	–249
		2	—	—	—	—	—	3h4h	0	–90	0	–180	–289
			4H	+150	0	+236	0	4h	0	–112	0	–180	–289
			5G	+228	+38	+338	+38	5g6g	–38	–178	–38	–318	–327
			5H	+190	0	+300	0	5h4h	0	–140	0	–180	–289
			—	—	—	—	—	5h6h	0	–140	0	–280	–289
			—	—	—	—	—	6e	–71	–251	–71	–351	–360
			—	—	—	—	—	6f	–52	–232	–52	–332	–341
			6G	+274	+38	+413	+38	6g	–38	–218	–38	–318	–327
			6H	+236	0	+375	0	6h	0	–180	0	–280	–289
			—	—	—	—	—	7e6e	–71	–295	–71	–351	–360
			7G	+338	+38	+513	+38	7g6g	–38	–262	–38	–318	–327
			7H	+300	0	+475	0	7h6h	0	–224	0	–280	–289
			8G	+413	+38	+638	+38	8g	–38	–318	–38	–488	–327
			8H	+375	0	+600	0	9g8g	–38	–393	–38	–488	–327
		3	—	—	—	—	—	3h4h	0	–106	0	–236	–433
			4H	+180	0	+315	0	4h	0	–132	0	–236	–433
			5G	+272	+48	+448	+48	5g6g	–48	–218	–48	–423	–481
			5H	+224	0	+400	0	5h4h	0	–170	0	–236	–433
			—	—	—	—	—	5h6h	0	–170	0	–375	–433

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
45	90	3	—	—	—	—	—	6e	–85	–297	–85	–460	–518
			—	—	—	—	—	6f	–63	–275	–63	–438	–496
			6G	+328	+48	+548	+48	6g	–48	–260	–48	–423	–481
			6H	+280	0	+500	0	6h	0	–212	0	–375	–433
			—	—	—	—	—	7e6e	–85	–350	–85	–460	–518
			7G	+403	+48	+678	+48	7g6g	–48	–313	–48	–423	–481
			7H	+355	0	+630	0	7h6h	0	–265	0	–375	–433
			8G	+498	+48	+848	+48	8g	–48	–383	–48	–648	–481
			8H	+450	0	+800	0	9g8g	–48	–473	–48	–648	–481
		4	—	—	—	—	—	3h4h	0	–118	0	–300	–577
			4H	+200	0	+375	0	4h	0	–150	0	–300	–577
			5G	+310	+60	+535	+60	5g6g	–60	–250	–60	–535	–637
			5H	+250	0	+475	0	5h4h	0	–190	0	–300	–577
			—	—	—	—	—	5h6h	0	–190	0	–475	–577
			—	—	—	—	—	6e	–95	–331	–95	–570	–672
			—	—	—	—	—	6f	–75	–311	–75	–550	–652
			6G	+375	+60	+660	+60	6g	–60	–296	–60	–535	–637
			6H	+315	0	+600	0	6h	0	–236	0	–475	–577
			—	—	—	—	—	7e6e	–95	–395	–95	–570	–672
			7G	+460	+60	+810	+60	7g6g	–60	–360	–60	–535	–637
			7H	+400	0	+750	0	7h6h	0	–300	0	–475	–577
			8G	+560	+60	+1 010	+60	8g	–60	–435	–60	–810	–637
			8H	+500	0	+950	0	9g8g	–60	–535	–60	–810	–637
		5	—	—	—	—	—	3h4h	0	–125	0	–335	–722
			4H	+212	0	+450	0	4h	0	–160	0	–335	–722
			5G	+336	+71	+631	+71	5g6g	–71	–271	–71	–601	–793
			5H	+265	0	+560	0	5h4h	0	–200	0	–335	–722
			—	—	—	—	—	5h6h	0	–200	0	–530	–722
			—	—	—	—	—	6e	–106	–356	–106	–636	–828
			—	—	—	—	—	6f	–85	–335	–85	–615	–807
			6G	+406	+71	+781	+71	6g	–71	–321	–71	–601	–793
			6H	+335	0	+710	0	6h	0	–250	0	–530	–722
			—	—	—	—	—	7e6e	–106	–421	–106	–636	–828
			7G	+496	+71	+971	+71	7g6g	–71	–386	–71	–601	–793
			7H	+425	0	+900	0	7h6h	0	–315	0	–530	–722
			8G	+601	+71	+1 191	+71	8g	–71	–471	–71	–921	–793
			8H	+530	0	+1 120	0	9g8g	–71	–571	–71	–921	–793
		5.5	—	—	—	—	—	3h4h	0	–132	0	–355	–794
			4H	+224	0	+475	0	4h	0	–170	0	–355	–794

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
45	90	5.5	5G	+355	+75	+675	+75	5g6g	–75	–287	–75	–635	–869
			5H	+280	0	+600	0	5h4h	0	–212	0	–355	–794
			—	—	—	—	—	5h6h	0	–212	0	–560	–794
			—	—	—	—	—	6e	–112	–377	–112	–672	–906
			—	—	—	—	—	6f	–90	–355	–90	–650	–884
			6G	+430	+75	+825	+75	6g	–75	–340	–75	–635	–869
			6H	+355	0	+750	0	6h	0	–265	0	–560	–794
			—	—	—	—	—	7e6e	–112	–447	–112	–672	–906
			7G	+525	+75	+1 025	+75	7g6g	–75	–410	–75	–635	–869
			7H	+450	0	+950	0	7h6h	0	–335	0	–560	–794
			8G	+635	+75	+1 255	+75	8g	–75	–500	–75	–975	–869
			8H	+560	0	+1 180	0	9g8g	–75	–605	–75	–975	–869
		6	—	—	—	—	—	3h4h	0	–140	0	–375	–866
			4H	+236	0	+500	0	4h	0	–180	0	–375	–866
			5G	+380	+80	+710	+80	5g6g	–80	–304	–80	–680	–946
			5H	+300	0	+630	0	5h4h	0	–224	0	–375	–866
			—	—	—	—	—	5h6h	0	–224	0	–600	–866
			—	—	—	—	—	6e	–118	–398	–118	–718	–984
			—	—	—	—	—	6f	–95	–375	–95	–695	–961
			6G	+455	+80	+880	+80	6g	–80	–360	–80	–680	–946
			6H	+375	0	+800	0	6h	0	–280	0	–600	–866
			—	—	—	—	—	7e6e	–118	–473	–118	–718	–984
			7G	+555	+80	+1 080	+80	7g6g	–80	–435	–80	–680	–946
			7H	+475	0	+1 000	0	7h6h	0	–355	0	– 600	–866
			8G	+680	+80	+1 330	+80	8g	–80	–530	–80	–1 030	–946
			8H	+600	0	+1 250	0	9g8g	–80	–640	–80	–1 030	–946
90	180	2	—	—	—	—	—	3h4h	0	–95	0	–180	–289
			4H	+160	0	+236	0	4h	0	–118	0	–180	–289
			5G	+238	+38	+338	+38	5g6g	–38	–188	–38	–318	–327
			5H	+200	0	+300	0	5h4h	0	–150	0	–180	–289
			—	—	—	—	—	5h6h	0	–150	0	–280	–289
			—	—	—	—	—	6e	–71	–261	–71	–351	–360
			—	—	—	—	—	6f	–52	–242	–52	–332	–341
			6G	+288	+38	+413	+38	6g	–38	–228	–38	–318	–327
			6H	+250	0	+375	0	6h	0	–190	0	–280	–289
			—	—	—	—	—	7e6e	–71	–307	–71	–351	–360
			7G	+353	+38	+513	+38	7g6g	–38	–274	–38	–318	–327
			7H	+315	0	+475	0	7h6h	0	–236	0	–280	–289
			8G	+438	+38	+638	+38	8g	–38	–338	–38	–488	–327
			8H	+400	0	+600	0	9g8g	–38	–413	–38	–488	–327

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
90	180	3	—	—	—	—	—	3h4h	0	–112	0	–236	–433
			4H	+190	0	+315	0	4h	0	–140	0	–236	–433
			5G	+284	+48	+448	+48	5g6g	–48	–228	–48	–423	–481
			5H	+236	0	+400	0	5h4h	0	–180	0	–236	–433
			—	—	—	—	—	5h6h	0	–180	0	–375	–433
			—	—	—	—	—	6e	–85	–309	–85	–460	–518
			—	—	—	—	—	6f	–63	–287	–63	–438	–496
			6G	+348	+48	+548	+48	6g	–48	–272	–48	–423	–481
			6H	+300	0	+500	0	6h	0	–224	0	–375	–433
			—	—	—	—	—	7e6e	–85	–365	–85	–460	–518
			7G	+423	+48	+678	+48	7g6g	–48	–328	–48	–423	–481
			7H	+375	0	+630	0	7h6h	0	–280	0	–375	–433
			8G	+523	+48	+848	+48	8g	–48	–403	–48	–648	–481
			8H	+475	0	+800	0	9g8g	–48	–498	–48	–648	–481
		4	—	—	—	—	—	3h4h	0	–125	0	–300	–577
			4H	+212	0	+375	0	4h	0	–160	0	–300	–577
			5G	+325	+60	+535	+60	5g6g	–60	–260	–60	–535	–637
			5H	+265	0	+475	0	5h4h	0	–200	0	–300	–577
			—	—	—	—	—	5h6h	0	–200	0	–475	–577
			—	—	—	—	—	6e	–95	–345	–95	–570	–672
			—	—	—	—	—	6f	–75	–325	–75	–550	–652
			6G	+395	+60	+660	+60	6g	–60	–310	–60	–535	–637
			6H	+335	0	+600	0	6h	0	–250	0	–475	–577
			—	—	—	—	—	7e6e	–95	–410	–95	–570	–672
			7G	+485	+60	+810	+60	7g6g	–60	–375	–60	–535	–637
			7H	+425	0	+750	0	7h6h	0	–315	0	–475	–577
			8G	+590	+60	+1 010	+60	8g	–60	–460	–60	–810	–637
			8H	+530	0	+950	0	9g8g	–60	–560	–60	–810	–637
		6	—	—	—	—	—	3h4h	0	–150	0	–375	–866
			4H	+250	0	+500	0	4h	0	–190	0	–375	–866
			5G	+395	+80	+710	+80	5g6g	–80	–316	–80	–680	–946
			5H	+315	0	+630	0	5h4h	0	–236	0	–375	–866
			—	—	—	—	—	5h6h	0	–236	0	–600	–866
			—	—	—	—	—	6e	–118	–418	–118	–718	–984
			—	—	—	—	—	6f	–95	–395	–95	–695	–961
			6G	+480	+80	+880	+80	6g	–80	–380	–80	–680	–946
			6H	+400	0	+800	0	6h	0	–300	0	–600	–866
			—	—	—	—	—	7e6e	–118	–493	–118	–718	–984
			7G	+580	+80	+1 080	+80	7g6g	–80	–455	–80	–680	–946
			7H	+500	0	+1 000	0	7h6h	0	–375	0	–600	–866
			8G	+710	+80	+1 330	+80	8g	–80	–555	–80	–1 030	–946
			8H	+630	0	+1 250	0	9g8g	–80	–680	–80	–1 030	–946

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
90	180	8 [A)]	—	—	—	—	—	3h4h	0	–170	0	–450	–1 155
			4H	+280	0	+630	0	4h	0	–212	0	–450	–1 155
			5G	+380	+100	+900	+100	5g6g	–100	–365	–100	–810	–1 255
			5H	+355	0	+800	0	5h4h	0	–265	0	–450	–1 155
			—	—	—	—	—	5h6h	0	–265	0	–710	–1 155
			—	—	—	—	—	6e	–140	–475	–140	–850	–1 295
			—	—	—	—	—	6f	–118	–453	–118	–828	–1 273
			6G	+550	+100	+1 100	+100	6g	–100	–435	–100	–810	–1 255
			6H	+450	0	+1 000	0	6h	0	–335	0	–710	–1 155
			—	—	—	—	—	7e6e	–140	–565	–140	–850	–1 295
			7G	+660	+100	+1 350	+100	7g6g	–100	–525	–100	–810	–1 255
			7H	+560	0	+1 250	0	7h6h	0	–425	0	–710	–1 155
			8G	+810	+100	+1 700	+100	8g	–100	–630	–100	–1 280	–1 255
			8H	+710	0	+1 600	0	9g8g	–100	–770	–100	–1 280	–1 255
180	355	3	—	—	—	—	—	3h4h	0	–125	0	–236	–433
			4H	+212	0	+315	0	4h	0	–160	0	–236	–433
			5G	+313	+48	+448	+48	5g6g	–48	–248	–48	–423	–481
			5H	+265	0	+400	0	5h4h	0	–200	0	–236	–433
			—	—	—	—	—	5h6h	0	–200	0	–375	–433
			—	—	—	—	—	6e	–85	–335	–85	–460	–518
			—	—	—	—	—	6f	–63	–313	–63	–438	–496
			6G	+383	+48	+548	+48	6g	–48	–298	–48	–423	–481
			6H	+335	0	+500	0	6h	0	–250	0	–375	–433
			—	—	—	—	—	7e6e	–85	–400	–85	–460	–518
			7G	+473	+48	+678	+48	7g6g	–48	–363	–48	–423	–481
			7H	+425	0	+630	0	7h6h	0	–315	0	–375	–433
			8G	+578	+48	+848	+48	8g	–48	–448	–48	–648	–481
			8H	+530	0	+800	0	9g8g	–48	–548	–48	–648	–481
		4	—	—	—	—	—	3h4h	0	–140	0	–300	–577
			4H	+236	0	+375	0	4h	0	–180	0	–300	–577
			5G	+360	+60	+535	+60	5g6g	–60	–284	–60	–535	–637
			5H	+300	0	+475	0	5h4h	0	–224	0	–300	–577
			—	—	—	—	—	5h6h	0	–224	0	–475	–577
			—	—	—	—	—	6e	–95	–375	–95	–570	–672
			—	—	—	—	—	6f	–75	–355	–75	–550	–652
			6G	+435	+60	+660	+60	6g	–60	–340	–60	–535	–637
			6H	+375	0	+600	0	6h	0	–280	0	–475	–577
			—	—	—	—	—	7e6e	–95	–450	–95	–570	–672
			7G	+535	+60	+810	+60	7g6g	–60	–415	–60	–535	–637
			7H	+475	0	+750	0	7h6h	0	–355	0	–475	–577
			8G	+660	+60	+1 010	+60	8g	–60	–510	–60	–810	–637
			8H	+600	0	+950	0	9g8g	–60	–620	–60	–810	–637

[A)] Pitch 8 mm applies only to basic major diameters M125 and larger.

Table 14 **Deviations** (*continued*)
ES, *es* = upper deviation
EI, *ei* = lower deviation

Basic major diameter		**Pitch**	**Internal thread**					**External thread**					
Over	**Up to**		**Tolerance class**	**Pitch diameter**		**Minor diameter**		**Tolerance class**	**Pitch diameter**		**Major diameter**		**Minor diameter**
				ES	*EI*	*ES*	*EI*		*es*	*ei*	*es*	*ei*	**Deviation** –(|es| +H/6) **for stress calculation**
mm	mm	mm		µm	µm	µm	µm		µm	µm	µm	µm	µm
180	355	6	—	—	—	—	—	3h4h	0	–160	0	–375	–866
			4H	+265	0	+500	0	4h	0	–200	0	–375	–866
			5G	+415	+80	+710	+80	5g6g	–80	–330	–80	–680	–946
			5H	+335	0	+630	0	5h4h	0	–250	0	–375	–866
			—	—	—	—	—	5h6h	0	–250	0	–600	–866
			—	—	—	—	—	6e	–118	–433	–118	–718	–984
			—	—	—	—	—	6f	–95	–410	–95	–695	–961
			6G	+505	+80	+880	+80	6g	–80	–395	–80	–680	–946
			6H	+425	0	+800	0	6h	0	–315	0	–600	–866
			—	—	—	—	—	7e6e	–118	–518	–118	–718	–984
			7G	+610	+80	+1 080	+80	7g6g	–80	–480	–80	–680	–946
			7H	+530	0	+1 000	0	7h6h	0	–400	0	–600	–866
			8G	+750	+80	+1 330	+80	8g	–80	–580	–80	–1 030	–946
			8H	+670	0	+1 250	0	9g8g	–80	–710	–80	–1 030	–946
		8	—	—	—	—	—	3h4h	0	–180	0	–450	–1 155
			4H	+300	0	+630	0	4h	0	–224	0	–450	–1 155
			5G	+475	+100	+900	+100	5g6g	–100	–380	–100	–810	–1 255
			5H	+375	0	+800	0	5h4h	0	–280	0	–450	–1 155
			—	—	—	—	—	5h6h	0	–280	0	–710	–1 155
			—	—	—	—	—	6e	–140	–495	–140	–850	–1 295
			—	—	—	—	—	6f	–118	–473	–118	–828	–1 273
			6G	+575	+100	+1 100	+100	6g	–100	–455	–100	–810	–1 255
			6H	+475	0	+1 000	0	6h	0	–355	0	–710	–1 155
			—	—	—	—	—	7e6e	–140	–590	–140	–850	–1 295
			7G	+700	+100	+1 350	+100	7g6g	–100	–550	–100	–810	–1 255
			7H	+600	0	+1 250	0	7h6h	0	–450	0	–710	–1 155
			8G	+850	+100	+1 700	+100	8g	–100	–660	–100	–1 280	–1 255
			8H	+750	0	+1 600	0	9g8g	–100	–810	–100	–1 280	–1 255

9 Tolerances – Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing

9.1 General

This clause specifies deviations and limits of sizes for pitch and crest diameters for ISO general purpose metric external screw threads as listed in Table 3 having a basic profile in accordance with Clause **4**.

External screw threads in accordance with this clause are intended to mate with internal screw threads tapped with tolerance position H or G after hot-dip galvanizing.

The limits of sizes for the tolerance quality specified are derived from tolerances specified in Clause **7** and the fundamental deviations in accordance with the following formula:

$$es_{az} = -(300 + 20P)$$

where:

es is expressed in micrometres;

P is expressed in millimetres.

Products made with thread tolerances in accordance with this clause might show failure at lower ultimate tensile loads than those specified in BS EN ISO 898-1 due to reduction in the stress area.

It is essential that external screw threads with thread tolerances in accordance with this clause are not mated with internal screw threads with thread tolerances in accordance with Clause **10** because such combinations create a serious risk of thread stripping.

NOTE If the tolerance class 6az is not specified, the external screw threads are to mate with internal screw threads with tolerance position 6AZ if the products are centrifuged and with hot-dip galvanized internal screw threads with tolerance position 6AX if the products are not centrifuged.

9.2 Designation

The tolerance designation for hot-dip galvanized external screw threads is 6az.

EXAMPLE

M12 – 6az

9.3 Deviations

The deviations for hot-dip galvanized external screw threads as specified in Table 15 are derived from the following formula for fundamental deviations and from tolerances specified in Clause **7**.

The fundamental deviations, es_{az}, have been calculated in accordance with the following formula:

$$es_{az} = -(300 + 20P)$$

where:

es_{az} is expressed in micrometres;

P is expressed in millimetres.

Table 15 **Deviations for hot-dip galvanized external threads**

Thread	**Pitch**	**External thread tolerance class 6az**				
	P	**Pitch diameter**		**Major diameter**		**Minor diameter**
		es	*ei*	*es*	*ei*	**Deviations for stress calculation**
	mm	µm	µm	µm	µm	µm
M10	1.5	–330	–462	–330	–566	–547
M12	1.75	–335	–485	–335	–600	–588
M14, M16	2	–340	–500	–340	–620	–629
M18, M20, M22	2.5	–350	–520	–350	–685	–711
M24, M27	3	–360	–560	–360	–735	–793
M30, M33	3.5	–370	–582	–370	–795	–875
M36, M39	4	–380	–604	–380	–855	–957
M42, M45	4.5	–390	–626	–390	–890	–1 040
M48, M52	5	–400	–650	–400	–930	–1 122
M56, M60	5.5	–410	–675	–410	–970	–1 204
M64	6	–420	–700	–420	–1 020	–1 286

9.4 Limits of sizes – External screw threads – Coarse thread series

Tolerance quality: medium.

Thread engagement group: normal.

Tolerance class: 6az

The actual root contour shall not at any point transgress the basic profile.

For hot-dip galvanized screw threads, the tolerances apply to the parts before galvanizing. After galvanizing, the actual thread profile shall not at any point transgress the maximum material limits for tolerance position h and are intended to mate with internal screw threads of tolerance position H or G only.

Limits of sizes are given in Table 16.

Table 16 **External thread limits for tolerance class 6az**
Dimensions in millimetres

Thread	Length of thread engagement		Major diameter		Pitch diameter		Minor diameter (for stress calculation)	Root radius
	Over	Up to and including	Max.	Min.	Max.	Min.	Max.	Min.
M10	5	15	9.670	9.434	8.696	8.564	7.829	0.188
M12	6	18	11.665	11.400	10.528	10.378	9.518	0.219
M14	8	24	13.660	13.380	12.361	12.201	11.206	0.250
M16	8	24	15.660	15.380	14.361	14.201	13.206	0.250
M18	10	30	17.650	17.315	16.026	15.856	14.583	0.313
M20	10	30	19.650	19.315	18.026	17.856	16.583	0.313
M22	10	30	21.650	21.315	20.026	19.856	18.583	0.313
M24	12	36	23.640	23.265	21.691	21.491	19.959	0.375
M27	12	36	26.640	26.265	24.691	24.491	22.959	0.375
M30	15	45	29.630	29.205	27.357	27.145	25.336	0.438
M33	15	45	32.630	32.205	30.357	30.145	28.336	0.438
M36	18	53	35.620	35.145	33.022	32.798	30.713	0.500
M39	18	53	38.620	38.145	36.022	35.798	33.713	0.500
M42	21	63	41.610	41.110	38.687	38.451	36.089	0.563
M45	21	63	44.610	44.110	41.687	41.451	39.089	0.563
M48	24	71	47.600	47.070	44.352	44.102	41.465	0.625
M52	24	71	51.600	51.070	48.352	48.102	45.465	0.625
M56	28	85	55.590	55.030	52.018	51.753	48.842	0.688
M60	28	85	59.590	59.030	56.018	55.753	52.842	0.688
M64	32	95	63.580	62.980	59.683	59.403	56.219	0.750

10 Tolerances – Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing

10.1 General

This clause specifies deviations and limits of sizes for pitch and crest diameters for ISO general purpose metric internal screw threads as listed in Table 3 having a basic profile in accordance with Clause **4**.

Internal screw threads in accordance with this clause are intended to mate with external screw threads with maximum size of tolerance position h before hot-dip galvanizing.

The limits of sizes for the tolerance quality specified are derived from tolerances specified in Clause **7**.

The fundamental deviations for internal screw threads with a tolerance position AZ have been calculated in accordance with the following formula:

$$EI_{AZ} = +(300 + 20P)$$

where:

EI is expressed in micrometres;

P is expressed in millimetres.

The fundamental deviations for internal screw threads with a tolerance position AX have been calculated in accordance with the following formula:

$$EI_{AX} = +(220P - 20)$$

where:

EI is expressed in micrometres;

P is expressed in millimetres.

Products made with thread tolerances in accordance with this clause might show load failure when tested in accordance with BS EN 20898-2 without adjustment of other mechanical properties.

It is essential that internal screw threads with thread tolerances in accordance with this clause are not mated with external screw threads with thread tolerances in accordance with Clause **9** because such combinations create a serious risk of thread stripping.

NOTE Internal screw threads with tolerance class 6AZ are primarily intended to mate with external screw threads centrifuged after hot-dip galvanizing. Internal screw threads with tolerance class 6AX are primarily intended to mate with hot-dip galvanized external screw threads with heavy coating not centrifuged.

10.2 Designation

The tolerance designation for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing is 6AZ or 6AX.

EXAMPLES

M12 – 6AZ

M12 – 6AX

10.3 Deviations

The deviations for internal screw threads to mate with hot-dip galvanized external screw threads, as specified in Table 17 are derived from the following formulae for fundamental deviations and from tolerances specified in Clause **7**.

The fundamental deviations, EI_{AZ} and EI_{AX} have been calculated in accordance with the following formulae:

$$EI_{AZ} = +(300 + 20P)$$

$$EI_{AX} = +(220P - 20)$$

where:

EI is expressed in micrometres;

P is expressed in millimetres.

Table 17 **Deviations for internal threads to mate with hot-dip galvanized external threads**

Thread	**Pitch**	**Internal thread**				
	P	**Tolerance class**	**Pitch diameter**		**Minor diameter**	
			ES	*EI*	*ES*	*EI*
	mm		µm	µm	µm	µm
M10	1.5	6AZ 6AX	+510 +490	+330 +310	+630 +610	+330 +310
M12	1.75	6AZ 6AX	+535 +565	+335 +365	+670 +700	+335 +365
M14, M16	2	6AZ 6AX	+552 +632	+340 +420	+715 +795	+340 +420
M18, M20, M22	2.5	6AZ 6AX	+574 +754	+350 +530	+800 +980	+350 +530
M24, M27	3	6AZ 6AX	+625 +905	+360 +640	+860 +1 140	+360 +640
M30, M33	3.5	6AZ 6AX	+650 +1 030	+370 +750	+930 +1 310	+370 +750
M36, M39	4	6AZ 6AX	+680 +1 160	+380 +860	+980 +1 460	+380 +860
M42, M45	4.5	6AZ 6AX	+705 +1 285	+390 +970	+1 060 +1 640	+390 +970
M48, M52	5	6AZ 6AX	+735 +1 415	+400 +1 080	+1 110 +1 790	+400 +1 080
M56, M60	5.5	6AZ 6AX	+765 +1 545	+410 +1 190	+1 160 +1 940	+410 +1 190
M64	6	6AZ 6AX	+795 +1 675	+420 +1 300	+1 220 +2 100	+420 +1 300

10.4 Limits of sizes – Internal screw threads – Coarse thread series

Tolerance quality: medium.

Thread engagement group: normal.

Tolerance classes: 6AZ and 6AX.

Limits of sizes are given in Table 18 and Table 19.

Table 18 **Internal screw thread limits for tolerance class 6AZ**
Dimensions in millimetres

Thread	Length of thread engagement		Major diameter [A]	Pitch diameter [A]		Minor diameter [C]	
	Over	Up to and including	Min.[B]	Max.	Min.	Max.	Min.
M10	5	15	10.330	9.536	9.356	9.006	8.706
M12	6	18	12.335	11.398	11.198	10.776	10.441
M14	8	24	14.340	13.253	13.041	12.550	12.175
M16	8	24	16.340	15.253	15.041	14.550	14.175
M18	10	30	18.350	16.950	16.726	16.094	15.644
M20	10	30	20.350	18.950	18.726	18.094	17.644
M22	10	30	22.350	20.950	20.726	20.094	19.644
M24	12	36	24.360	22.676	22.411	21.612	21.112
M27	12	36	27.360	25.676	25.411	24.612	24.112
M30	15	45	30.370	28.377	28.097	27.141	26.581
M33	15	45	33.370	31.377	31.097	30.141	29.581
M36	18	53	36.380	34.082	33.782	32.650	32.050
M39	18	53	39.380	37.082	36.782	35.650	35.050
M42	21	63	42.390	39.782	39.467	38.189	37.519
M45	21	63	45.390	42.782	42.467	41.189	40.519
M48	24	71	48.400	45.487	45.152	43.697	42.987
M52	24	71	52.400	49.487	49.152	46.697	46.987
M56	28	85	56.410	53.193	52.838	51.206	50.456
M60	28	85	60.410	57.193	56.838	55.206	54.456
M64	32	95	64.420	60.898	60.523	58.725	57.925

[A] Dimensions apply to internal screw threads after galvanizing and tapping oversize.
[B] Refers to the imaginary coaxial cylinder through the points where the requirement with regard to straightness of flank ceases.
[C] Dimensions apply to internal screw threads before galvanizing or after galvanizing and removal of zinc fragments.

Table 19 **Internal screw thread limits for tolerance class 6AX**
Dimensions in millimetres

Thread	Length of thread engagement		Major diameter [A]	Pitch diameter [A]		Minor diameter [C]	
	Over	Up to and including	Min.[B]	Max.	Min.	Max.	Min.
M10	5	15	10.310	9.516	9.336	8.986	8.686
M12	6	18	12.365	11.428	11.228	10.806	10.471
M14	8	24	14.420	13.333	13.121	12.630	12.255
M16	8	24	16.420	15.333	15.121	14.630	14.255
M18	10	30	18.530	17.130	16.906	16.274	15.824
M20	10	30	20.530	19.130	18.906	18.274	17.824
M22	10	30	22.530	21.130	20.906	20.274	19.824
M24	12	36	24.640	22.956	22.691	21.892	21.392
M27	12	36	27.640	25.956	25.691	24.892	24.392
M30	15	45	30.750	28.757	28.477	27.521	26.961
M33	15	45	33.750	31.757	31.477	30.521	29.961
M36	18	53	36.860	34.562	34.262	33.130	32.530
M39	18	53	39.860	37.562	37.262	36.130	35.530
M42	21	63	42.970	40.362	40.047	38.769	38.099
M45	21	63	45.970	43.362	43.047	41.769	41.099
M48	24	71	49.080	46.167	45.832	44.377	43.667
M52	24	71	53.080	50.167	49.832	48.377	47.667
M56	28	85	57.190	53.973	53.618	51.986	51.236
M60	28	85	61.190	57.973	57.618	55.986	55.236
M64	32	95	65.300	61.778	61.403	59.605	58.805

[A] Dimensions apply to internal screw threads after galvanizing and tapping oversize.
[B] Refers to the imaginary coaxial cylinder through the points where the requirement with regard to straightness of flank ceases.
[C] Dimensions apply to internal screw threads before galvanizing or after galvanizing and removal of zinc fragments.

Annex A (informative) Notes for guidance

A.1 Maximum material profile

The maximum material profiles of an internal thread and an external thread are illustrated in Figure A.1. These profiles have been established from the basic profile given in Clause **4**.

A.2 Coatings

Information on tolerance positions G, e, f and g, which provide clearance fits which may be used to accommodate coatings is given in Clause **7**.

BS EN ISO 4042:2000 includes tables listing pitches and tolerance positions and the maximum thickness of coating that can be accommodated by each.

A.3 External threads – Stress areas

The stress area, A_s, for an external thread can be calculated from the following equation:

$$A_s = \frac{\pi}{4}\left(\frac{d_2 + d_3}{2}\right)^2$$

where:

d_2 is the basic pitch diameter;

d_3 is the minor diameter as given by the equation:

$$d_3 = d_1 - \frac{H}{6}$$

where:

d_1 is the basic minor diameter;

H is the height of the fundamental triangle.

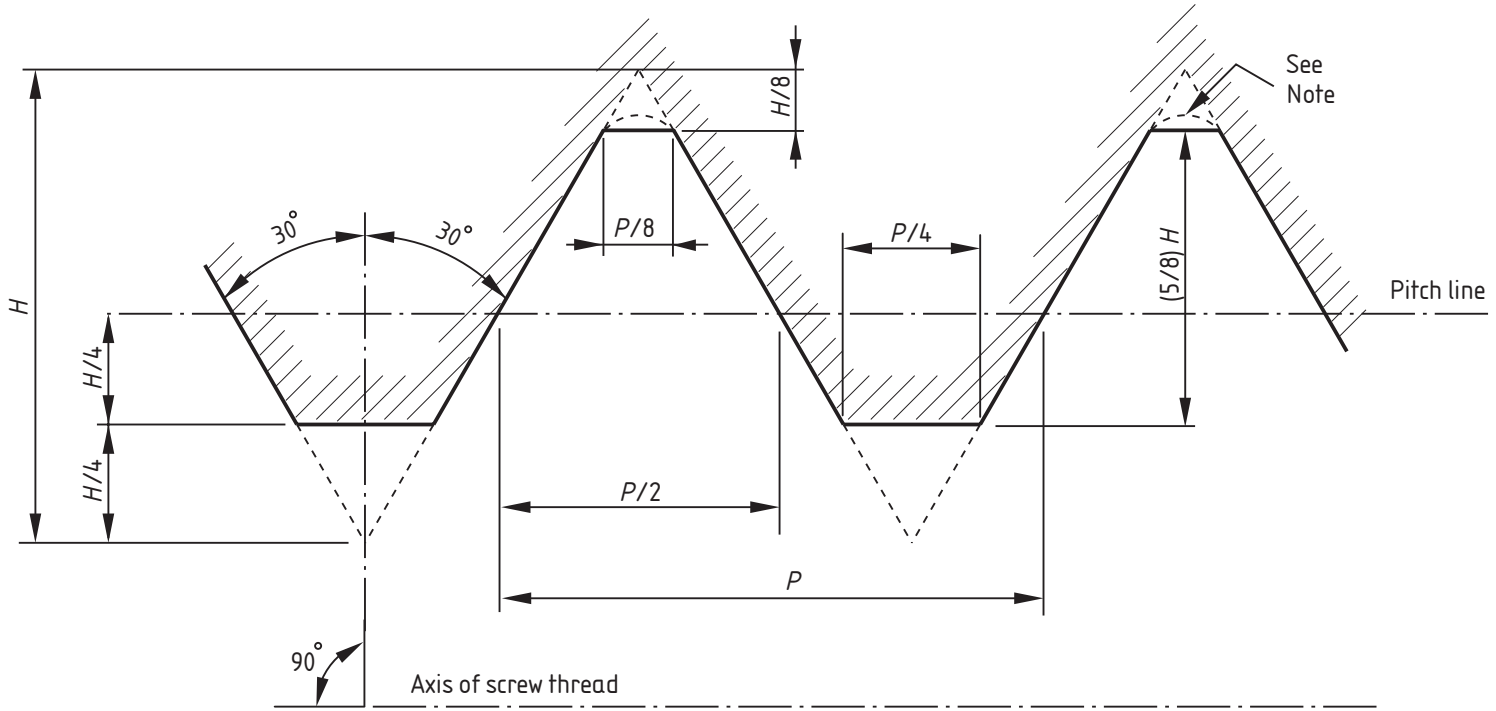
Nominal stress areas for external screw threads specified in this part of BS 3643 are given in Table A.1 and Table A.2.

A.4 External threads – Minor diameters

Minor diameters for external threads can be calculated using the information given in **7.9**.

The minimum minor diameters are given in the tables in BS 3643-2. In the case of the maximum minor diameters, it is essential that these are less than the minimum minor diameter of the GO gauges in accordance with BS 919-3.

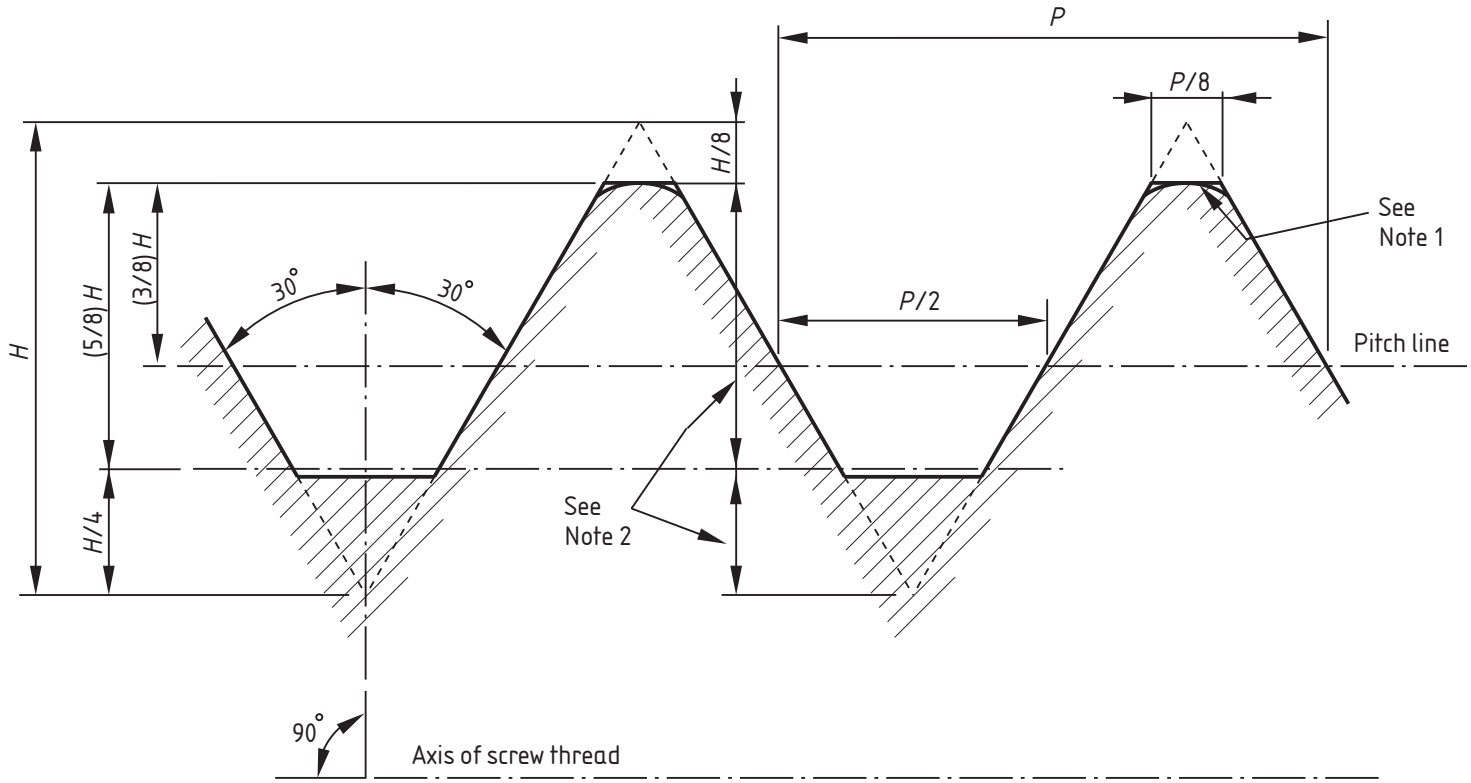
Figure A.1 **Maximum material profiles for internal and external threads**



NOTE In practice the root is rounded and cleared beyond a width of P/8.

a) Internal thread

Figure A.1 **Maximum material profiles for internal and external threads** *(continued)*



NOTE 1 In practice crests of external threads may be rounded inside the maximum profile.

NOTE 2 See ***7.9****.*

b) External thread

Table A.1 **Nominal stress areas for external screw threads – Coarse series**

Nominal thread diameter mm	**Pitch of the thread** mm	**Nominal stress area** mm^2
1	0.25	0.46
1.1	0.25	0.59
1.2	0.25	0.73
1.4	0.3	0.98
1.6	0.35	1.27
1.8	0.35	1.7
2	0.4	2.07
2.2	0.45	2.48
2.5	0.45	3.39
3	0.5	5.03
3.5	0.6	6.78
4	0.7	8.78
5	0.8	14.2
6	1	20.1
7	1	28.9
8	1.25	36.6
10	1.5	58.0
12	1.75	84.3
14	2	115
16	2	157
18	2.5	192
20	2.5	245
22	2.5	303
24	3	353
27	3	459
30	3.5	561
33	3.5	694
36	4	817
39	4	976
42	4.5	1 121
45	4.5	1 306
48	5	1 473
52	5	1 758
56	5.5	2 030
60	5.5	2 362
64	6	2 676
68	6	3 055

Table A.2 **Nominal stress areas for external screw threads – Fine series**

Nominal thread diameter mm	**Pitch of the thread** mm	**Nominal stress area** mm^2
1	0.2	0.52
1.1	0.2	0.65
1.2	0.2	0.81
1.4	0.2	1.16
1.6	0.2	1.57
1.8	0.2	2.04
2	0.25	2.45
2.2	0.25	3.03
2.5	0.35	3.71
3	0.35	5.61
3.5	0.35	7.90
4	0.5	9.79
4.5	0.5	12.8
5	0.5	16.1
6	0.75	22
7	0.75	31.3
8	1	39.2
10	1.25	61.2
12	1.25	92.1
14	1.5	125
16	1.5	167
18	1.5	216
20	1.5	272
22	1.5	333
24	2	384
27	2	496
30	2	621
33	2	761

Annex B (informative) Examples of calculations of limits of size for metric screw threads

The following examples are intended to illustrate the method of calculation of limits of size to use for threads which are not given in Tables 1 to 14. In cases where the data is not included in the referenced table, as indicated by a * next to the table number, the formula shown should be used. The limits of size for Example 1 (external thread) are illustrated in Figure B.1.

EXAMPLE 1:

External thread M30 × 1.25 5g6g

Parameter	Symbol	Table	Formula	Value
Basic major diameter	d	—	Nominal size	30.000
Basic pitch diameter	d_2	4*	d – 0.649 5 pitch	29.188
Basic minor diameter	d_1	4*	d – 1.082 5 pitch	28.647
Fundamental deviation for tolerance position g (see Note 1)	es	5	**7.11.2**	0.028
Maximum major diameter	d_{max}	—	$d - es$	29.972
Major diameter tolerance for tolerance grade 6 (see Note 2)	T_d	8	**7.11.4**	0.212
Minimum major diameter	d_{min}	—	$d_{max} - T_d$	29.760
Maximum pitch diameter	$d_{2\,max}$	—	$d_2 - es$	29.160
Pitch diameter tolerance for tolerance grade 5 (see Note 3)	T_{d2}	10*	**7.11.5**	0.108
Minimum pitch diameter	$d_{2\,min}$	—	$d_{2\,max} - T_{d2}$	29.052
Maximum minor diameter	$d_{3\,max}$	—	$d_3 - es - 2y$ (See Note 4)	28.568
Minimum root radius	R_{min}	11	0.125 pitch	0.156
Minimum minor diameter	$d_{3\,min}$	—	$d_3 - es - 2z$ (See Note 4)	28.282

NOTE 1 Table 5 covers tolerance positions e, f, g and h.

NOTE 2 Table 8 covers tolerance grades 4, 6 and 8.

NOTE 3 Table 10 covers tolerance grades 3, 4, 5, 6, 7, 8 and 9.

NOTE 4 Dimensions y and z are given by the following formulae:

$$y = R_{min}\left\{1 - \cos\left[\frac{\pi}{3} - \text{arc}\cos\left(1 - \frac{T_{d2}}{4 \times R_{min}}\right)\right]\right\}$$

$$z = \frac{H}{4} + \frac{T_{d2}}{2} - \frac{P}{8}$$

The maximum root profile shown in Figure 8 (see **7.9**) and used for the calculation of the maximum minor diameter is theoretically possible but unlikely to occur in practice, since it would require the combination of maximum truncation at minor diameter and minimum material position on the thread flanks.

The maximum minor diameter is not normally specified as part of the thread summary.

Summary:

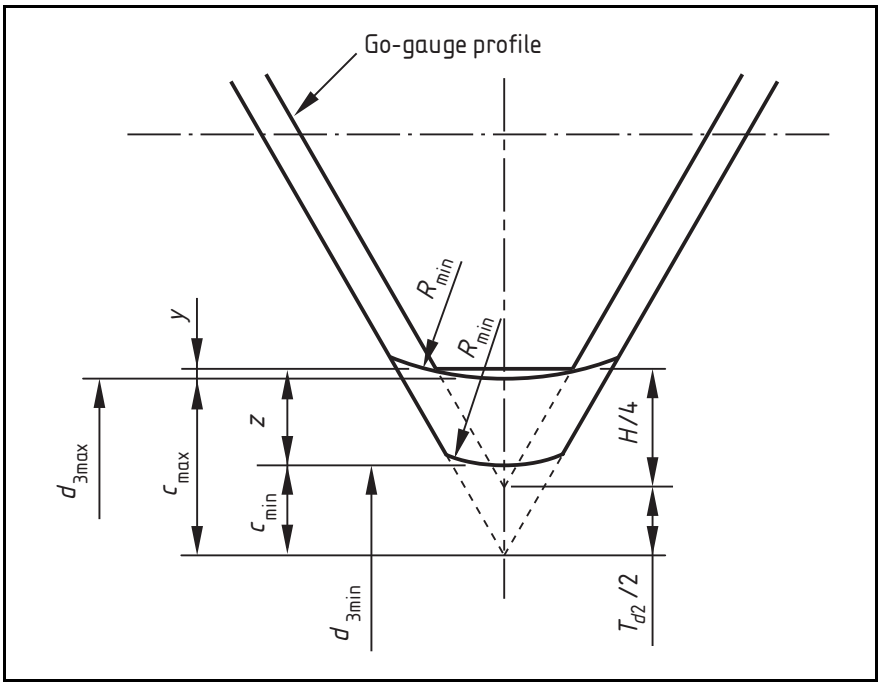
External thread M30 × 1.25 – 5g6g

Major diameter 29.972 – 29.760

Pitch diameter 29.160 – 29.052

Minor diameter 28.568 – 28.282

Figure B.1 **Illustration of limits of size for external thread (see Example 1)**



EXAMPLE 2:

Internal thread M345 × 4-8G

Parameter	Symbol	Table	Formula	Value
Basic major diameter	D	—	Nominal size	345.000
Basic pitch diameter	D_2	—	D – 0.649 5 pitch	342.402
Basic minor diameter	D_1	—	D – 1.082 5 pitch	340.670
Fundamental deviation for tolerance position G (see Note 5)	EI	5	—	0.060
Minimum major diameter	D_{min}	—	$D + EI$	345.060
Maximum major diameter	D_{max}	—	Not required	—
Minimum pitch diameter	$D_{2\,min}$		$D_2 + EI$	342.462
Pitch diameter tolerance for tolerance grade 8 (see Note 6)	T_{D2}	9*	**7.11.5** (See Note 8)	0.600
Maximum pitch diameter	$D_{2\,max}$		$D_{2\,min} + EI$	343.062
Minimum minor diameter	$D_{1\,min}$	—	$D_1 + EI$	340.730
Minor diameter tolerance for tolerance grade 8 (see Note 7)	T_{D1}	7	—	0.950
Maximum minor diameter	$D_{1\,max}$	—	$D_{1\,min} + T_{D1}$	341.680

NOTE 5 Table 5 covers tolerance positions G and H.

NOTE 6 Table 9 covers tolerance grades 4, 5, 6, 7 and 8.

NOTE 7 Table 7 covers tolerance grades 4, 5, 6, 7 and 8.

NOTE 8 It is important to note that where pitch diameter tolerances require calculation that it will be necessary firstly to calculate the equivalent T_{D2} grade 6 for external threads.

Summary:

Internal thread M345 × 4 – 8G

Major diameter 345.060 min.

Pitch diameter 342.462 – 343.062

Minor diameter 340.730 – 341.680

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3643-2, *ISO metric screw threads – Part 2: Specification for selected limits of size*

BS EN 20898-2, *Mechanical properties of fasteners – Part 2: Nuts with specified proof load values – Coarse thread*

BS ISO 68-1, *ISO general purpose screw threads – Basic profile – Part 1: Metric screw threads*

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BS ISO 965-1, *ISO general purpose metric screw threads – Tolerances – Part 1: Principles and basic data*

BS ISO 965-3, *ISO general purpose metric screw threads – Tolerances – Part 3: Deviations for constructional screw threads*

BS ISO 965-4, *ISO general purpose metric screw threads – Tolerances – Part 4: Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing*

BS ISO 965-5, *ISO general purpose metric screw threads – Tolerances – Part 5: Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing*

BS EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs*

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ISO 724, *ISO general purpose metric screw threads – Basic dimensions*

PD 6494, *Mismatch of screw thread systems*

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