

Specification for

ISO metric screw threads —

Part 1: Principles and basic data

UDC 621.882.082.1

Cooperating organizations

The Mechanical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

Associated Offices Technical Committee	Department of Trade (Marine Division)
Association of Consulting Engineers	Department of Transport
Association of Hydraulic Equipment Manufacturers	Electricity Supply Industry in England and Wales
Association of Mining Electrical and Mechanical Engineers	Engineering Equipment Users' Association
British Compressed Air Society	Federation of Manufacturers of Construction Equipment and Cranes
British Electrical and Allied Manufacturers' Association (BEAMA)*	Health and Safety Executive
British Gas Corporation	Institution of Gas Engineers
British Gear Manufacturers' Association	Institution of Mechanical Engineers
British Internal Combustion Engine Manufacturers' Association*	Institution of Plant Engineers
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The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Agricultural Engineers' Association	Gauge and Tool Makers' Association
Bicycle Association of Great Britain	Screw Thread Tool Manufacturers' Association
British Industrial Fasteners Federation	Society of British Aerospace Companies Limited
British Railways Board	Individual manufacturer
Business Equipment Trade Association	
Fasteners and Turned Parts Institute	

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Foreword

This revised British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee. It is based on the following ISO standards relating to ISO metric screw threads prepared by Technical Committee ISO/TC 1, Screw threads, of the International Organization for Standardization (ISO). The clauses in this standard have been so arranged that each relates directly to the relevant ISO standard as indicated:

Clause 3: ISO 68-1963

Clause 4: ISO 261-1973

Clause 5: ISO 724-1968

Clause 6: ISO 965/1-1980

Clause 7: ISO 965/3-1980

ISO 965/2-1973 *“ISO general purpose metric screw threads — Tolerances — Part II Limits of sizes for commercial bolt and nut threads — Medium quality”*, has not been included as a separate clause in this standard as the limits of sizes listed are specified in BS 3643-2.

ISO 965 has been revised by ISO/TC 1 to include the tolerance position “f” and the modified bolt root profile. This information has been included in this standard.

Screw thread terms and definitions can be found in BS 6528 (identical with ISO 5408-1983) and these will be adopted in future standards and revised existing standards.

Some terms used in this standard, based on the established ISO standards, may be at variance with, or do not appear in, BS 6528; e.g. “crest diameter” is used in clause 6 but is not defined in BS 6528. However it has been decided to leave this descriptive term which is used to embrace the terms “major diameter of bolt thread” and “minor diameter of nut thread”. Moreover the term “nominal size or “nominal diameter” is often confused with basic size, whereas it is now defined in BS 6528 as “The size which is used for the purpose of general identification. It is generally the basic major diameter of the thread”.

ISO 262 “ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts”, has not been included as a separate clause in this standard as those sizes will be specified in the various product standards. However, its contents form part of Table 3 in clause 4.

In order to establish a recognized fine series, a selection of diameter/pitch combinations has been taken from ISO 261. For nominal diameters up to and including M7, one pitch only for each nominal diameter is included in ISO 261 (other than the coarse pitch) and therefore these pitches have been included in this standard. The pitches for nominal diameters larger than M7 have been extracted from ISO 262.

The information given in Appendix A has been given in this form rather than in the appropriate clauses in the standard, so that each clause maintains as far as possible the ISO format, to enable direct cross reference with the ISO standards and the standards of other countries that are also based on the ISO standards.

The information given in Appendix B for the calculation of limits of size for screw threads recognizes that the limitations of the ISO standards on nominal sizes, i.e. 1.0 mm (minimum) to 300 mm (maximum) diameters and also the diameter/pitch combinations may at times need to be exceeded.

When screw threads for aerospace purposes are specified to comply with the requirements of BS 3643, it is permissible for them to be manufactured to the MJ profile in BS 6293 and for their limits of size to be modified accordingly to suit the root radius of that profile. Attention is drawn to the fact that the MJ threads specified in BS 6293 is the preferred series for aerospace use.

Terminology and conventions. For ease of production it has been found convenient to reproduce the tables of the international standards with amendments, where necessary. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 52, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of this British Standard specifies the principles and basic data for single-start, parallel screw threads having the ISO basic profile for triangular screw threads. Data for 1,0 mm to 300 mm diameter threads is tabulated and Appendix B is included giving the information necessary to calculate the limits of size for exception to the tabulated data.

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

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

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:

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

The following British Standards will be found useful for reference:

BS 3382, *Electroplated coatings on threaded components*.

BS 4827, *ISO miniature screw threads*.

BS 5346, *ISO metric trapezoidal screw threads*.

3 Basic profile

3.1 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.

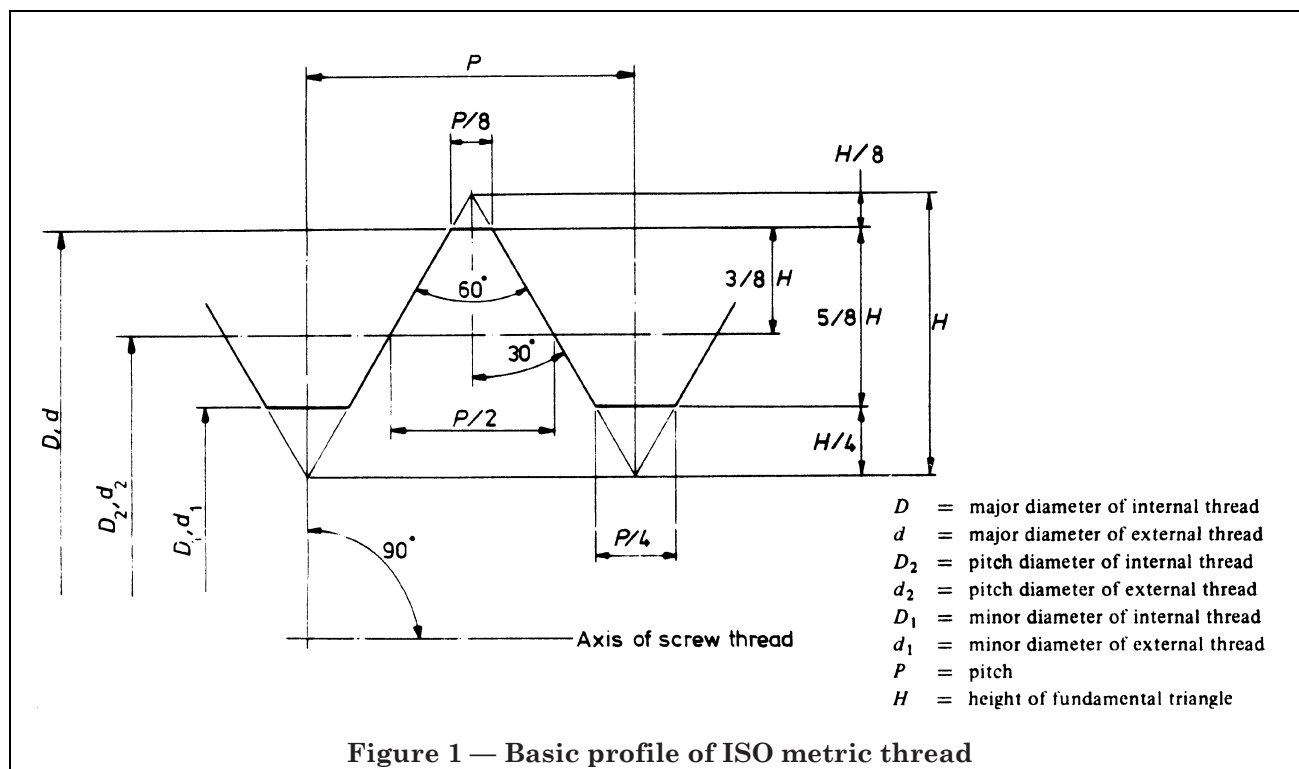


Table 1 — Basic profile dimensions

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

3.2 Definition

basic profile

the theoretical profile, associated with the basic sizes of the major, pitch, and minor diameters of the thread
the deviations are applied to these basic sizes

3.3 Dimensions

$$H = \frac{\sqrt{3}}{2}P = 0,866\,025\,404\,P$$

$$\frac{5}{8}H = 0,541\,265\,877\,P$$

$$\frac{3}{8}H = 0,324\,759\,526\,P$$

$$\frac{H}{4} = 0,216\,506\,351\,P$$

$$\frac{H}{8} = 0,108\,253\,175\,P$$

4 General plan

4.1 General. This clause specifies ISO general purpose metric screw threads having the basic profile as defined in clause 3.

4.2 Choice of diameter and pitch

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

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

Coarse pitches are the largest metric pitches used in current practice.

4.2.3 For the diameter (or the diameter range) selected, choose one of the pitches shown on the corresponding line (or lines), avoiding pitches in parentheses.

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

3 – 2 – 1,5 – 1 – 0,75 – 0,5 – 0,35 – 0,25 – 0,2

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.

NOTE It is suggested, for the time being, that diameters larger than those shown in Table 2 should generally not be used with the pitches indicated.

Table 2 — Maximum diameters

Dimensions in millimetres

Pitch	Maximum diameter
0,5	22
0,75	33
1	80
1,5	150
2	200
3	300

In cases where it is necessary to use a thread with a pitch larger than 6 mm, in the diameter range 150 to 300 mm, the pitch 8 mm should be used for preference.

4.3 Designation. For complete designation see 6.4.

A screw thread complying with the requirements of this British Standard shall be designated by the letter M followed by the values of the nominal diameter and of the pitch, expressed in millimetres and separated by the sign ×.

Example: M6 × 0,75

The absence of the indication of pitch means that a coarse pitch is specified.

Example: M6

Table 3 — Diameter/pitch combinations

Dimensions in millimetres

Nominal diameters			Pitches								
Col. 1 1st choice	Col. 2 2nd choice	Col. 3 3rd choice	coarse series	fine series	constant series						
					3	2	1,5	1,25	1	0,75	
1			0,25	0,2							
1,2	1,1		0,25	0,2							
	1,4		0,25	0,2							
			0,3	0,2							
1,6	1,8		0,35	0,2							
2			0,35	0,2							
			0,4	0,25							
2,5	2,2		0,45	0,25							
3			0,45	0,35							
			0,5	0,35							
4	3,5		0,6	0,35							
	4,5		0,7	0,5							
			0,75	0,5							
5		5,5	0,8	0,5							
6			1	(0,5) 0,75							
8	7	9	1	0,75							
			1,25	1					1	0,75	
			1,25							0,75	
10		11	1,5	1,25					1	0,75	
12			1,5					1			
			1,75	1,25		1,5		1		0,75	
16	14	15	2	1,5				1,25 ^a	1		
			2	1,5			1,5	1,25 ^a	1		
									1		
20	18	17	2,5	1,5			1,5		1		
			2,5	1,5		2		1		1	
24	22	25	2,5	1,5		2			1		
			3	2		2	1,5		1		
									1,5	1	
	27	26	3	2		2	1,5				
		28					1,5	1,5		1	
										1	
30		32	3,5	2	(3)	2	1,5		1		
36		32	3,5	2	(3)	2	1,5				
							1,5				
							1,5				
36		35 ^b	4			3	1,5				
		38					1,5				
			4			3	2	1,5			

^a Only for spark plugs for engines.^b Only for locking nuts for bearings.

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

Table 3 — Diameter/pitch combinations

Dimensions in millimetres

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

5 Basic dimensions

5.1 General. This clause specifies the basic dimensions, in millimetres, of ISO metric screw threads according to clause 4.

The values refer to the basic profile according to clause 3.

5.2 Basic dimensions

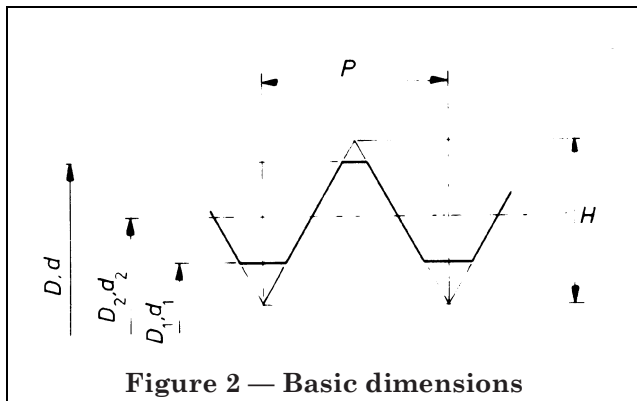


Figure 2 — Basic dimensions

D = basic major diameter of internal thread (nominal diameter)

d = basic major diameter of external thread (nominal diameter)

D_2 = basic pitch diameter of internal thread

d_2 = basic pitch diameter of external thread

D_1 = basic minor diameter of internal thread

d_1 = basic minor diameter of external thread

H = height of fundamental triangle

P = pitch

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

$$D_2 = D - 2 \times \frac{3}{8}H = D - 0,649\ 5\ P$$

$$d_2 = d - 2 \times \frac{3}{8}H = d - 0,649\ 5\ P$$

$$D_1 = D - 2 \times \frac{5}{8}H = D - 1,082\ 5\ P$$

$$d_1 = d - 2 \times \frac{5}{8}H = d - 1,082\ 5\ P$$

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
1	0,25 0,2	0,838 0,870	0,729 0,783
1,1	0,25 0,2	0,938 0,970	0,829 0,883
1,2	0,25 0,2	1,038 1,070	0,929 0,983
1,4	0,3 0,2	1,205 1,270	1,075 1,183
1,6	0,35 0,2	1,373 1,470	1,221 1,383
1,8	0,35 0,2	1,573 1,670	1,421 1,583
2	0,4 0,25	1,740 1,838	1,567 1,729
2,2	0,45 0,25	1,908 2,038	1,713 1,929
2,5	0,45 0,35	2,208 2,273	2,013 2,121
3	0,5 0,35	2,675 2,773	2,459 2,621
3,5	0,6 0,35	3,110 3,273	2,850 3,121
4	0,7 0,5	3,545 3,675	3,242 3,459
4,5	0,75 0,5	4,013 4,175	3,688 3,959
5	0,8 0,5	4,480 4,675	4,134 4,459
5,5	0,5	5,175	4,959
6	1 0,75	5,350 5,513	4,917 5,188
7	1 0,75	6,350 6,513	5,917 6,188
8	1,25 1 0,75	7,188 7,350 7,513	6,647 6,917 7,188
9	1,25 1 0,75	8,188 8,350 8,513	7,647 7,917 8,188
10	1,5 1,25 1 0,75	9,026 9,188 9,350 9,513	8,376 8,647 8,917 9,188

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
11	1,5 1 0,75	10,026 10,350 10,513	9,376 9,917 10,188
12	1,75 1,5 1,25 1	10,863 11,026 11,188 11,350	10,106 10,376 10,647 10,917
14	2 1,5 1,25 1	12,701 13,026 13,188 13,350	11,835 12,376 12,647 12,917
15	1,5 1	14,026 14,350	13,376 13,917
16	2 1,5 1	14,701 15,026 15,350	13,835 14,376 14,917
17	1,5 1	16,026 16,350	15,376 15,917
18	2,5 2 1,5 1	16,376 16,701 17,026 17,350	15,294 15,835 16,376 16,917
20	2,5 2 1,5 1	18,376 18,701 19,026 19,350	17,294 17,835 18,376 18,917
22	2,5 2 1,5 1	20,376 20,701 21,026 21,350	19,294 19,835 20,376 20,917
24	3 2 1,5 1	22,051 22,701 23,026 23,350	20,752 21,835 22,376 22,917
25	2 1,5 1	23,701 24,026 24,350	22,835 23,376 23,917
26	1,5	25,026	24,376
27	3 2 1,5 1	25,051 25,701 26,026 26,350	23,752 24,835 25,376 25,917
28	2 1,5 1	26,701 27,026 27,350	25,835 26,376 26,917

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
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
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

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
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
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

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
75	4	72,402	70,670
	3	73,501	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	76,701	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
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

Table 4 — Basic dimensions

Nominal diameter = Major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter <i>D₂, d₂</i>	Minor diameter <i>D₁, d₁</i>
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
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	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	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	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	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