

International Standard



235

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Parallel shank jobber and stub series drills and Morse taper shank drills

Forets à queue cylindrique courts et extra-courts et forets à queue cône Morse

Second edition — 1980-11-01

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Descriptors : tools, twist drills, shanks, parallel shanks, Morse taper shanks, dimensions.

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 235 was developed by Technical Committee ISO/TC 29, *Small tools*. The first edition (ISO 235/1-1975) had been approved by the member bodies of the following countries :

Austria	India	Romania
Belgium	Italy	Sweden
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France	Netherlands	United Kingdom
Germany, F. R.	Pakistan	USSR
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Canada
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This second edition, which superseded ISO 235/1-1975, incorporates draft Amendment 1, which was circulated to the member bodies in August 1978, and which has been approved by the member bodies of the following countries :

Australia	Israel	Spain
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Hungary	Romania	
India	South Africa, Rep. of	

The member body of the following country expressed disapproval of the document on technical grounds :

Germany, F. R.

Parallel shank jobber and stub series drills and Morse taper shank drills

1 Scope and field of application

This International Standard lays down the dimensions of the following three types of drills :

- 1) parallel shank drills, stub series;
- 2) parallel shank drills, jobber series;
- 3) Morse taper shank drills.

It comprises, for each type of drill mentioned above, three tables giving respectively :

- a) the dimensions in millimetres;
- b) the dimensions in inches;
- c) the corresponding lengths, in millimetres and in inches, set out as functions of diameter steps.

2 Interchangeability

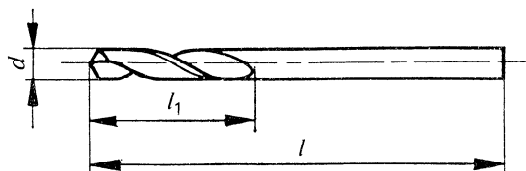
The numerical tables have been drawn up in such a way as to ensure that the standard dimensions in millimetres and inches correspond as closely as possible.

To this end, the complete range of diameters has been subdivided into a number of steps, the limits of which have been derived from the preferred number series for the metric values and converted directly from those for the inch values; the lengths and taper shank dimensions remain the same for the metric and the inch values within a given step.

The recommended diameters in the two systems of units of measurement differ, however, and the number of recommended diameters, in a given step, also differs in one system from that in the other.

Finally, the tolerance on the diameter of the cutting portion has been standardized solely on the basis of the metric values of h8, converted directly into inches for inch drills.

3 Parallel shank twist drills, stub series



3.1 Dimensions in millimetres

d	l_1	l	d	l_1	l	d	l_1	l	d	l_1	l
0,50	3	20	9,50	40	84	18,50	64	127	27,50	81	162
0,80	5	24	9,80	43	89	18,75			27,75		
1,00	6	26	10,00			19,00			28,00		
1,20	8	30	10,20	47	95	19,25	66	131	28,25	84	168
1,50	9	32	10,50			19,50			28,50		
1,80	11	36	10,80			19,75			28,75		
2,00	12	38	11,00	51	102	20,00	68	136	29,00	87	174
2,20	13	40	11,20			20,25			29,25		
2,50	14	43	11,50			20,50			29,50		
2,80	16	46	11,80	54	107	20,75	72	146	29,75	90	180
3,00			12,00			21,00			30,00		
3,20	18	49	12,20			21,25	70	141	30,25	87	174
3,50	20	52	12,50	56	111	21,50			30,50		
3,80	22	55	12,80			21,75			30,75		
4,00			13,00	58	115	22,00	75	151	31,00	93	186
4,20	24	58	13,20			22,25			31,25		
4,50			13,50			22,50	72	146	31,50	96	193
4,80	26	62	13,80	60	119	22,75			31,75		
5,00			14,00			23,00	78	156	32,00	100	200
5,20	28	66	14,25			23,25			32,50		
5,50			14,50	62	123	23,50			33,00		
5,80	31	70	14,75			23,75	81	162	33,50		
6,00			15,00			24,00			34,00		
6,20	34	74	15,25	64	127	24,25			34,50		
6,50			15,50			24,50			35,00		
6,80	37	79	15,75			24,75			35,50		
7,00			16,00			25,00			36,00		
7,20	40	84	16,25			25,25			36,50		
7,50			16,50			25,50			37,00		
7,80			16,75			25,75			37,50		
8,00			17,00			26,00			38,00		
8,20			17,25			26,25			38,50		
8,50			17,50			26,50			39,00		
8,80			17,75			26,75			39,50		
9,00			18,00			27,00			40,00		
9,20			18,25			27,25					

3.2 Dimensions in inches

d	l_1	l	d	l_1	l	d	l_1	l
1/32	3/16	15/16	17/32	2 1/8	4 7/32	1 1/32	3 1/16	6 1/8
3/64	5/16	1 3/16	35/64			1 3/64	3 3/16	6 3/8
1/16	13/32	1 11/32	9/16	2 7/32	4 3/8	1 1/16		
5/64	15/32	1 1/2	37/64			1 5/64		
3/32	9/16	1 11/16	19/32			1 3/32		
7/64	5/8	1 13/16	39/64	2 9/32	4 17/32	1 7/64		
1/8	11/16	1 15/16	5/8			1 1/8	3 5/16	6 5/8
9/64	25/32	2 1/16	41/64	2 3/8	4 11/16	1 9/64		
5/32	7/8	2 5/32	21/32			1 5/32		
11/64	15/16	2 9/32	43/64			1 11/64		
3/16	1 1/32	2 7/16	11/16	2 7/16	4 27/32	1 3/16		
13/64			45/64			1 13/64	3 7/16	6 27/32
7/32	1 1/8	2 19/32	23/32	2 1/2	5	1 7/32		
15/64			47/64			1 15/64		
1/4	1 7/32	2 3/4	3/4			1 1/4		
17/64	1 5/16	2 29/32	49/64	2 19/32	5 5/32	1 17/64		
9/32			25/32			1 9/32	3 17/32	7 3/32
19/64			51/64			1 19/64		
5/16	1 7/16	3 1/8	13/16	2 11/16	5 11/32	1 5/16		
21/64			53/64			1 21/64		
11/32	1 9/16	3 5/16	27/32			1 11/32		
23/64			55/64	2 3/4	5 9/16	1 23/64	3 21/32	7 5/16
3/8			7/8			1 3/8		
25/64	1 11/16	3 1/2	57/64			1 25/64		
13/32			29/32	2 27/32	5 3/4	1 13/32		
27/64			59/64			1 27/64		
7/16	1 27/32	3 3/4	15/16			1 7/16	3 25/32	7 19/32
29/64			61/64	2 15/16	5 15/16	1 29/64		
15/32			31/32			1 15/32		
31/64			63/64			1 31/64	3 15/16	7 7/8
1/2	2	4	1	3 1/16	6 1/8	1 1/2		
33/64			1 1/64					

NOTES relating to the tables in 3.1 and 3.2.

1 Intermediate sizes

When intermediate sizes are needed, reference should be made to the general table in 3.3 for the corresponding lengths.

2 Cutting portion

- Tolerance on diameter d measured near the point : h8.

For dimensions in inches, direct conversion into inches of the metric values of the tolerance h8.

- Back taper : at the manufacturer's discretion.
- Hand of cutting, unless otherwise specified : right.

3 Shank

These drills are normally made without driving tenon.

4 Tolerance on lengths

See general table in 3.3.

3.3 General table : Corresponding lengths, in millimetres and in inches, set out as functions of diameter steps

Diameter ranges d				Corresponding lengths			
over	incl.	over	incl.	l_1	l	l_1	l
mm		in		mm		in	
0,19	0,24	0.007 5	0.009 4	1,5	19	1/16	3/4
0,24	0,30	0.009 4	0.011 8	2,0		3/32	
0,30	0,38	0.011 8	0.015 0	2,5		3/32	
0,38	0,48	0.015 0	0.018 9	3,0	20	1/8	25/32
0,48	0,53	0.018 9	0.020 9	3,5	21	1/8	13/16
0,53	0,60	0.020 9	0.023 6	4,0	22	5/32	7/8
0,60	0,67	0.023 6	0.026 4	4,5	23	3/16	29/32
0,67	0,75	0.026 4	0.029 5	5,0	24	3/16	15/16
0,75	0,85	0.029 5	0.033 5	5,5	25	7/32	31/32
0,85	0,95	0.033 5	0.037 4	6,0	26	1/4	1 1/32
0,95	1,06	0.037 4	0.041 7	7,0	28	9/32	1 3/32
1,06	1,18	0.041 7	0.046 4	8,0	30	5/16	1 3/16
1,18	1,32	0.046 4	0.052 0	9,0	32	11/32	1 1/4
1,32	1,50	0.052 0	0.059 1	10	34	13/32	1 11/32
1,50	1,70	0.059 1	0.066 9	11	36	7/16	1 7/16
1,70	1,90	0.066 9	0.074 8	12	38	15/32	1 1/2
1,90	2,12	0.074 8	0.083 5	13	40	1/2	1 9/16
2,12	2,36	0.083 5	0.092 9	14	43	9/16	1 11/16
2,36	2,65	0.092 9	0.104 3	16	46	5/8	1 13/16
2,65	3,00	0.104 3	0.118 1	18	49	11/16	1 15/16
3,00	3,35	0.118 1	0.131 9	20	52	25/32	1 1/16
3,35	3,75	0.131 9	0.147 6	22	55	7/8	2 5/32
3,75	4,25	0.147 6	0.167 3	24	58	15/16	2 9/32
4,25	4,75	0.167 3	0.187 0	26	62	1 1/32	2 7/16
4,75	5,30	0.187 0	0.208 7	28	66	1 1/8	2 19/32
5,30	6,00	0.208 7	0.236 2	31	70	1 7/32	2 3/4
6,00	6,70	0.236 2	0.263 8	34	74	1 5/16	2 29/32
6,70	7,50	0.263 8	0.295 3	37	79	1 7/16	3 1/8
7,50	8,50	0.295 3	0.334 6	40	84	1 9/16	3 5/16
8,50	9,50	0.334 6	0.374 0	43	89	1 11/16	3 1/2
9,50	10,60	0.374 0	0.417 3	47	95	1 27/32	3 3/4
10,60	11,80	0.417 3	0.464 6	51	102	2	4
11,80	13,20	0.464 6	0.519 7	54	107	2 1/8	4 7/32
13,20	14,00	0.519 7	0.551 2	56	111	2 7/32	4 3/8
14,00	15,00	0.551 2	0.590 6	58	115	2 9/32	4 17/32
15,00	16,00	0.590 6	0.629 9	60	119	2 3/8	4 11/16
16,00	17,00	0.629 9	0.669 3	62	123	2 7/16	4 27/32
17,00	18,00	0.669 3	0.708 7	64	127	2 1/2	5
18,00	19,00	0.708 7	0.748 0	66	131	2 19/32	5 5/32
19,00	20,00	0.748 0	0.787 4	68	136	2 11/16	5 11/32
20,00	21,20	0.787 4	0.834 6	70	141	2 3/4	5 9/16
21,20	22,40	0.834 6	0.881 9	72	146	2 27/32	5 3/4
22,40	23,60	0.881 9	0.929 1	75	151	2 15/16	5 15/16
23,60	25,00	0.929 1	0.984 2	78	156	3 1/16	6 1/8
25,00	26,50	0.984 2	1.043 3	81	162	3 3/16	6 3/8
26,50	28,00	1.043 3	1.102 4	84	168	3 5/16	6 5/8
28,00	30,00	1.102 4	1.181 1	87	174	3 7/16	6 27/32
30,00	31,50	1.181 1	1.240 2	90	180	3 17/32	7 3/32
31,50	33,50	1.240 2	1.318 9	93	186	3 21/32	7 5/16
33,50	35,50	1.318 9	1.397 6	96	193	3 25/32	7 19/32
35,50	37,50	1.397 6	1.476 4	100	200	3 15/16	7 7/8

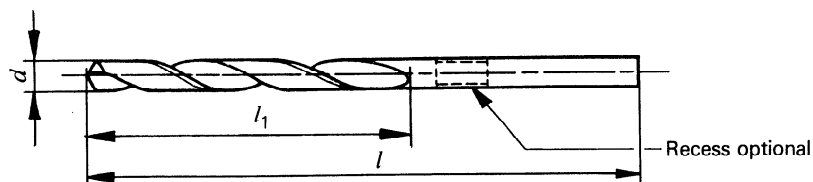
NOTES

1 Tolerance on lengths

Lengths l and l_1 may vary, within one diameter step, between the minimum and maximum limits corresponding respectively to the figures given for the nearest lower or upper step. (See as examples the note under 4.3 and 5.3.)

2 Standardized diameters in millimetres and in inches : see the tables in 3.1 and 3.2.

4 Parallel shank twist drills, jobber series



4.1 Dimensions in millimetres

d	l_1	l	d	l_1	l	d	l_1	l	d	l_1	l	d	l_1	l				
0,20	2,5	30	1,40	18	40	3,80	43	75	7,80	75	117	11,80	94	142				
0,22			1,45			3,90			7,90			11,90						
0,25			1,50			4,00			8,00			12,00						
0,28	3		1,55	20	43	4,10			8,10			12,10	101	151				
0,30			1,60			4,20			8,20			12,20						
0,32	4		1,65			4,30	47	80	8,30			12,30						
0,35			1,70			4,40			8,40			12,40						
0,38			1,75			4,50			8,50			12,50						
0,40	5	20	1,80	22	46	4,60			81	125	12,60							
0,42			1,85			4,70					8,60	12,70						
0,45			1,90			4,80	8,70	12,80										
0,48			1,95	4,90	8,80	12,90												
0,50	6	22	2,00	24	49	5,00	52	86			9,00	81	125	13,00				
0,52			2,05			5,10					9,10			13,10				
0,55			2,10			5,20					9,20			13,20				
0,58	7	24	2,15	27	53	5,30			57	93	9,30			87	133	13,30		
0,60			2,20			5,40					9,40					13,40		
0,62	8	26	2,25			5,50	9,50	63			101	9,60	94			142	13,50	
0,65			2,30			5,60	9,70					13,60						
0,68	9	28	2,35			5,70	9,80					9,90					13,70	
0,70			2,40	5,80	10,00	13,80												
0,72			2,45	5,90	10,10	13,90												
0,75	10	30	2,50	30	57	6,00	69	109	10,20	94	142	14,00						
0,78			2,55			6,10			10,30			14,25						
0,80			2,60			6,20			10,40			14,50						
0,82	2,65	6,30	10,50			14,75												
0,85	11	32	2,70			33			61			6,40	75	117	10,60	94	142	15,00
0,88			2,75	6,50	10,70		15,25											
0,90			2,80	6,60	10,80		15,50											
0,92	2,85	6,70	10,90	15,75														
0,95	2,90	6,80	11,00	16,00														
0,98	12	34	2,95	36	65	6,90	75	117	11,10	94	142	16,50						
1,00			3,00			7,00			11,20			17,00						
1,05			3,10			7,10			11,30			17,50						
1,10	14	36	3,20			39			70			7,20	75	117	11,40	94	142	18,00
1,15			3,30									7,30			11,50			18,50
1,20			3,40	7,40	11,60		19,00											
1,25	3,50	7,50	11,70	19,50														
1,30	3,60	7,60	7,70	20,00														
1,35	18	40	3,70															

4.2 Dimensions in inches

d	l_1	l
1/64	3/16	13/16
1/32	13/32	1 3/16
3/64	5/8	1 1/2
1/16	25/32	1 11/16
5/64	15/16	1 15/16
3/32	1 3/16	2 1/4
7/64	1 5/16	2 13/32
1/8	1 7/16	2 9/16
9/64	1 17/32	2 3/4
5/32	1 11/16	2 15/16
11/64	1 27/32	3 5/32
3/16	2 1/16	3 3/8
13/64		
7/32	2 1/4	3 21/32
15/64		
1/4	2 1/2	3 31/32
17/64	2 23/32	4 9/32
9/32		
19/64	2 15/16	4 19/32
5/16		
21/64		
11/32	3 3/16	4 29/32
23/64		
3/8	3 7/16	5 1/4
25/64		
13/32		
27/64	3 11/16	5 19/32
7/16		
29/64		
15/32	3 31/32	5 15/16
31/64		
1/2		

NOTES relating to the tables in 4.1 and 4.2.

1 **Intermediate sizes**

When intermediate sizes are needed, reference should be made to the general table in 4.3 for the corresponding lengths.

2 **Cutting portion**

— Tolerance on diameter d measured near the point : h8.

For dimensions in inches, direct conversion into inches of the the metric values of the tolerance h8.

- Back taper : at the manufacturer's discretion.
- Hand of cutting, unless otherwise specified : right.

3 **Shank**

These drills are normally made without driving tenon.

4 **Tolerance on lengths**

See general table in 4.3.

4.3 General table : Corresponding lengths, in millimetres and in inches, set out as functions of diameter steps

Diameter ranges d				Corresponding lengths			
over	incl.	over	incl.	l_1	l	l_1	l
mm		in		mm		in	
0,19	0,24	0.007 5	0.009 4	2,5	19	3/32	3/4
0,24	0,30	0.009 4	0.011 8	3		1/8	
0,30	0,38	0.011 8	0.015 0	4		5/32	
0,38	0,48	0.015 0	0.018 9	5	20	3/16	13/16
0,48	0,53	0.018 9	0.020 9	6	22	7/4	7/8
0,53	0,60	0.020 9	0.023 6	7	24	9/32	15/16
0,60	0,67	0.023 6	0.026 4	8	26	5/16	1
0,67	0,75	0.026 4	0.029 5	9	28	11/32	1 1/8
0,75	0,85	0.029 5	0.033 5	10	30	13/32	1 3/16
0,85	0,95	0.033 5	0.037 4	11	32	7/16	1 1/4
0,95	1,06	0.037 4	0.041 7	12	34	15/32	1 5/16
1,06	1,18	0.041 7	0.046 4	14	36	9/16	1 7/16
1,18	1,32	0.046 4	0.052 0	16	38	5/8	1 1/2
1,32	1,50	0.052 0	0.059 1	18	40	11/16	1 9/16
1,50	1,70	0.059 1	0.066 9	20	43	25/32	1 11/16
1,70	1,90	0.066 9	0.074 8	22	46	7/8	1 13/16
1,90	2,12	0.074 8	0.083 5	24	49	15/16	1 15/16
2,12	2,36	0.083 5	0.092 9	27	53	1 1/16	2 3/32
2,36	2,65	0.092 9	0.104 3	30	57	1 3/16	2 1/4
2,65	3,00	0.104 3	0.118 1	33	61	1 5/16	2 13/32
3,00	3,35	0.118 1	0.131 9	36	65	1 7/16	2 9/16
3,35	3,75	0.131 9	0.147 6	39	70	1 17/32	2 3/4
3,75	4,25	0.147 6	0.167 3	43	75	1 11/16	2 15/16
4,25	4,75	0.167 3	0.187 0	47	80	1 27/32	3 5/32
4,75	5,30	0.187 0	0.208 7	52	86	2 1/16	3 3/8
5,30	6,00	0.208 7	0.236 2	57	93	2 1/4	3 21/32
6,00	6,70	0.236 2	0.263 8	63	101	2 1/2	3 31/32
6,70	7,50	0.263 8	0.295 3	69	109	2 23/32	4 9/32
7,50	8,50	0.295 3	0.334 6	75	117	2 15/16	4 19/32
8,50	9,50	0.334 6	0.374 0	81	125	3 3/16	4 29/32
9,50	10,60	0.374 0	0.417 3	87	133	3 7/16	5 1/4
10,60	11,80	0.417 3	0.464 6	94	142	3 11/16	5 19/32
11,80	13,20	0.464 6	0.519 7	101	151	3 31/32	5 15/16
13,20	14,00	0.519 7	0.551 2	108	160	4 1/4	6 5/16
14,00	15,00	0.551 2	0.590 6	114	169	4 1/2	6 5/8
15,00	16,00	0.590 6	0.629 9	120	178	4 3/4	7
16,00	17,00	0.629 9	0.669 3	125	184	4 7/8	7 1/4
17,00	18,00	0.669 3	0.708 7	130	191	5 1/8	7 1/2
18,00	19,00	0.708 7	0.748 0	135	198	5 1/4	7 13/16
19,00	20,00	0.748 0	0.787 4	140	205	5 1/2	8 1/16

NOTES

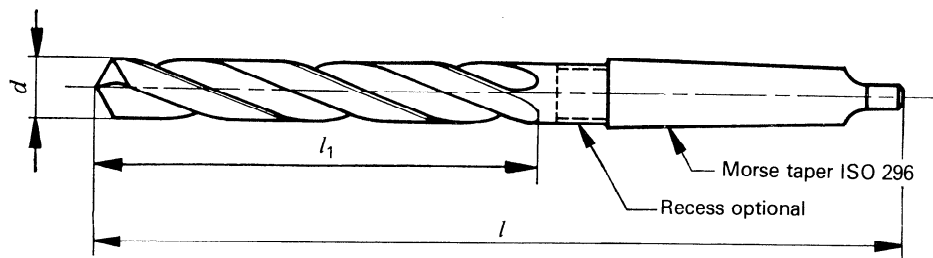
1 Tolerance on lengths

Lengths l and l_1 may vary, within one diameter step, between the minimum and maximum limits corresponding respectively to the figures given for the nearest lower or upper step.

Example : For the diameter 4 mm, length l_1 may vary between 39 and 47 from the nominal value 43 mm, and length l may vary between 70 and 80 from the nominal value 75 mm.

2 Standardized diameters in millimetres and in inches : see the tables in 4.1 and 4.2.

5 Morse taper shank twist drills

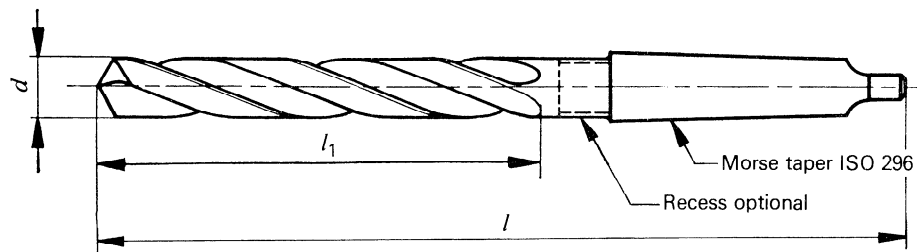


5.1 Dimensions in millimetres

d	l ₁	Standard shank		Oversize shank		d	l ₁	Standard shank		Oversize shank		d	l ₁	Standard shank		Oversize shank	
		l	M.T.	l	M.T.			l	M.T.	l	M.T.			l	M.T.	l	M.T.
3,00	33	114				12,00						21,00	145	243		266	
3,20	36	117				12,20						21,25					
3,50	39	120				12,50	101	182		199		21,50					
3,80						12,80			1		2	21,75	150	248		271	
4,00	43	124				13,00						22,00			2		3
4,20						13,20						22,25					
4,50	47	128				13,50						22,50					
4,80						13,80	108	189		206		22,75		253		276	
5,00	52	133				14,00						23,00	155				
5,20						14,25						23,25		276			
5,50						14,50	114	212				23,50					
5,80	57	138				14,75						23,75					
6,00						15,00						24,00					
6,20	63	144				15,25						24,25	160	281			
6,50						15,50	120	218				24,50					
6,80						15,75						24,75					
7,00						16,00						25,00					
7,20	69	150				16,25						25,25					
7,50						16,50	125	223				25,50					
7,80						16,75						25,75	165	286			
8,00	75	156				17,00						26,00					
8,20						17,25						26,25					
8,50						17,50	130	228	2			26,50			3		
8,80						17,75						26,75					
9,00	81	162				18,00						27,00					
9,20						18,25						27,25	170	291		319	
9,50						18,50	135	233		256		27,50					
9,80						18,75						27,75					
10,00						19,00						28,00					
10,20	87	168				19,25						28,25					
10,50						19,50	140	238		261	3	28,50					4
10,80						19,75						28,75					
11,00						20,00						29,00	175	296		324	
11,20	94	175				20,25						29,25					
11,50						20,50	145	243		266		29,50					
11,80						20,75						29,75					

Dimensions in millimetres (*end*)

<i>d</i>		<i>l</i> ₁	Standard shank		Oversize shank		<i>d</i>		<i>l</i> ₁	Standard shank		Oversize shank		<i>d</i>		<i>l</i> ₁	Standard shank		Oversize shank	
<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	<i>l</i>	M.T.	
30,00	175	296	3	324	4	44,00	210	359	4	397	5	69	250	437	5	504	6			
30,25	180	301		329		44,50		215		364		402		70		255		442	509	
30,50						45,00								71						
30,75						45,50								72						
31,00						46,00								73						
31,25						46,50								74						
31,50						47,00								75						
31,75						306								47,50						76
32,00	185	334	4	48,00	220	369	407	77	260	514	6									
32,50				48,50				78												
33,00				49,00				79												
33,50				49,50				80												
34,00				50,00				81												
34,50	190	339		50,50	374	412	82	265	519											
35,00				51	225	412	83													
35,50				52			84													
36,00				53			85													
36,50				54			86													
37,00	195	344		55			230	417	87	270		524								
37,50				56	88															
38,00				57	89															
38,50				58	235	422			90											
39,00				59					91											
39,50	60	92																		
40,00	61	240		427			93													
40,50	62						94													
41,00	63				245	432	95													
41,50	64						499	6	96											
42,00	65								97											
42,50	66	98																		
43,00	67	99																		
43,50	210	359		397	68	250			437	504		100								



5.2 Dimensions in inches

d	l_1	Standard shank		Oversize shank		d	l_1	Standard shank		Oversize shank		d	l_1	Standard shank		Oversize shank	
		l	M.T.	l	M.T.			l	M.T.	l	M.T.			l	M.T.	l	M.T.
1/8	1 7/16	4 5/8				23/32	5 1/4	9 1/8		10		1 5/16	7 1/4	13 1/8			
9/64	1 17/32	4 3/4				47/64						1 21/64					
5/32	1 11/16	4 27/32				3/4						1 1/32					
11/64	1 27/32	5 1/32				49/64	5 1/2	9 3/8		10 1/4		1 23/64	7 1/2	13 3/8			
3/16	2 1/16	5 1/4				25/32						1 3/8					
13/64						51/64						1 25/64					
7/32	2 1/4	5 7/16				13/16	5 3/4	9 5/8	2	10 1/2	3	1 13/32					
15/64						53/64						1 27/64					
1/4	2 1/2	5 11/16				27/32						1 7/16	7 5/8	13 1/2			
17/64	2 23/32	5 29/32				55/64	5 7/8	9 3/4		10 5/8		1 29/64					
9/32						7/8						1 15/32					
19/64						57/64		10		10 7/8		1 31/64					
5/16	2 15/16	6 1/8				29/32	6 1/8					1 1/2					
21/64						59/64		10 7/8				1 33/64	7 7/8	13 3/4			
11/32	3 3/16	6 3/8				15/16						1 17/32					
23/64						61/64	6 1/4	11				1 35/64					
3/8						31/32						1 9/16					
25/64	3 7/16	6 7/8				63/64						1 37/64					
13/32						1	6 1/2	11 1/4				1 19/32					
27/64						1 1/64						1 39/64					
7/16	3 11/16	6 7/8				1 1/32						1 5/8	8 1/8	14		15 1/2	
29/64						1 5/8	6 5/8	11 3/8		12 1/2		1 41/64					
15/32						1 1/16						1 21/32					
31/64	3 31/32	7 5/32				1 5/64			3			1 43/64					
1/2						1 3/32						1 11/16					
33/64						1 7/64						1 45/64					
17/32	4 1/4	7 7/16		8 1/8		1 1/8	6 7/8	11 5/8		12 3/4		1 23/32	8 1/4	14 1/8		15 5/8	5
35/64						1 9/64						1 47/64					
9/16	4 1/2	8 3/8				1 5/32						1 3/4					
37/64						1 11/64						1 49/64					
19/32						1 3/16						1 25/32					
39/64	4 3/4	8 5/8				1 13/64	7 1/8	11 7/8		13		1 51/64					
5/8						1 7/32						1 13/16					
41/64	4 7/8	8 3/4				1 15/64						1 53/64	8 1/2	14 3/8		15 7/8	
21/32						1 1/4		12		13 1/8		1 27/32					
43/64						1 17/64	7 1/4					1 55/64					
11/16	5 1/8	9				1 9/32		13 1/8	4			1 7/8	8 5/8	14 1/2		16	
45/64						1 19/64						1 57/64					