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This second edition, which superseded ISO 235/1-1975, incorporates draft Amendment 1, which was circulated to the member bodies in August 1978, and which has been approved by the member bodies of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

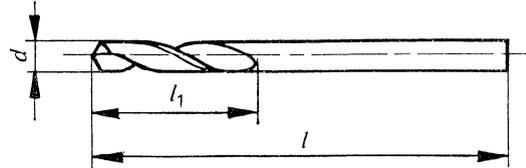
The numerical tables have been drawn up in such a way as to ensure that the standard dimensions in millimetres and inches correspond as closely as possible.

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

3.2 Dimensions in inches

<i>d</i>	<i>l</i> ₁	<i>l</i>	<i>d</i>	<i>l</i> ₁	<i>l</i>	<i>d</i>	<i>l</i> ₁	<i>l</i>
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		
1/16	13/32	1 11/32	9/16	2 7/32	4 3/8	1 1/16	3 3/16	6 3/8
5/64	15/32	1 1/2	37/64			1 5/64		
3/32	9/16	1 11/16	19/32	2 9/32	4 17/32	1 3/32	3 5/16	6 5/8
7/64	5/8	1 13/16	39/64			1 7/64		
1/8	11/16	1 15/16	5/8			1 1/8		
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	2 7/16	4 27/32	1 11/64		
3/16	1 1/32	2 7/16	11/16			1 3/16		
13/64			45/64			1 13/64		
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	2 19/32	5 5/32	1 1/4	3 17/32	7 3/32
17/64	1 5/16	2 29/32	49/64			1 17/64		
9/32			25/32			1 9/32		
19/64	1 7/16	3 1/8	51/64	2 11/16	5 11/32	1 19/64		
5/16			13/16			1 5/16		
21/64			53/64			1 21/64		
11/32	1 9/16	3 5/16	27/32	2 3/4	5 9/16	1 11/32	3 21/32	7 5/16
23/64			55/64			1 23/64		
3/8	7/8	1 3/8						
25/64	1 11/16	3 1/2	57/64	2 27/32	5 3/4	1 25/64		
13/32			29/32			1 13/32		
27/64			59/64			1 27/64		
7/16	1 27/32	3 3/4	15/16	2 15/16	5 15/16	1 7/16	3 25/32	7 19/32
29/64			61/64			1 29/64		
15/32	31/32	1 15/32						
31/64	2	4	63/64	3 1/16	6 1/8	1 31/64		
1/2			1			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 <i>d</i>				Corresponding lengths			
over	incl.	over	incl.	<i>l</i> ₁	<i>l</i>	<i>l</i> ₁	<i>l</i>
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				
0,30	0,38	0.011 8	0.015 0				
0,38	0,48	0.015 0	0.018 9	2,0		3/32	
0,48	0,53	0.018 9	0.020 9	2,5		3/32	
0,53	0,60	0.020 9	0.023 6	3,0	20	1/8	25/32
0,60	0,67	0.023 6	0.026 4	3,5	21	1/8	13/16
0,67	0,75	0.026 4	0.029 5	4,0	22	5/32	7/8
0,75	0,85	0.029 5	0.033 5	4,5	23	3/16	29/32
0,85	0,95	0.033 5	0.037 4	5,0	24	3/16	15/16
0,95	1,06	0.037 4	0.041 7	5,5	25	7/32	31/32
1,06	1,18	0.041 7	0.046 4	6,0	26	1/4	1 1/32
1,18	1,32	0.046 4	0.052 0	7,0	28	9/32	1 3/32
1,32	1,50	0.052 0	0.059 1	8,0	30	5/16	1 3/16
1,50	1,70	0.059 1	0.066 9	9,0	32	11/32	1 1/4
1,70	1,90	0.066 9	0.074 8	10	34	13/32	1 11/32
1,90	2,12	0.074 8	0.083 5	11	36	7/16	1 7/16
2,12	2,36	0.083 5	0.092 9	12	38	15/32	1 1/2
2,36	2,65	0.092 9	0.104 3	13	40	1/2	1 9/16
2,65	3,00	0.104 3	0.118 1	14	43	9/16	1 11/16
3,00	3,35	0.118 1	0.131 9	16	46	5/8	1 13/16
3,35	3,75	0.131 9	0.147 6	18	49	11/16	1 15/16
3,75	4,25	0.147 6	0.167 3	20	52	25/32	1 1/16
4,25	4,75	0.167 3	0.187 0	22	55	7/8	2 5/32
4,75	5,30	0.187 0	0.208 7	24	58	15/16	2 9/32
5,30	6,00	0.208 7	0.236 2	26	62	1 1/32	2 7/16
6,00	6,70	0.236 2	0.263 8	28	66	1 1/8	2 19/32
6,70	7,50	0.263 8	0.295 3	31	70	1 7/32	2 3/4
7,50	8,50	0.295 3	0.334 6	34	74	1 5/16	2 29/32
8,50	9,50	0.334 6	0.374 0	37	79	1 7/16	3 1/8
9,50	10,60	0.374 0	0.417 3	40	84	1 9/16	3 5/16
10,60	11,80	0.417 3	0.464 6	43	89	1 11/16	3 1/2
11,80	13,20	0.464 6	0.519 7	47	95	1 27/32	3 3/4
13,20	14,00	0.519 7	0.551 2	51	102	2	4
14,00	15,00	0.551 2	0.590 6	54	107	2 1/8	4 7/32
15,00	16,00	0.590 6	0.629 9	56	111	2 7/32	4 3/8
16,00	17,00	0.629 9	0.669 3	58	115	2 9/32	4 17/32
17,00	18,00	0.669 3	0.708 7	60	119	2 3/8	4 11/16
18,00	19,00	0.708 7	0.748 0	62	123	2 7/16	4 27/32
19,00	20,00	0.748 0	0.787 4	64	127	2 1/2	5
20,00	21,20	0.787 4	0.834 6	66	131	2 19/32	5 5/32
21,20	22,40	0.834 6	0.881 9	68	136	2 11/16	5 11/32
22,40	23,60	0.881 9	0.929 1	70	141	2 3/4	5 9/16
23,60	25,00	0.929 1	0.984 2	72	146	2 27/32	5 3/4
25,00	26,50	0.984 2	1.043 3	75	151	2 15/16	5 15/16
26,50	28,00	1.043 3	1.102 4	78	156	3 1/16	6 1/8
28,00	30,00	1.102 4	1.181 1	81	162	3 3/16	6 3/8
30,00	31,50	1.181 1	1.240 2	84	168	3 5/16	6 5/8
31,50	33,50	1.240 2	1.318 9	87	174	3 7/16	6 27/32
33,50	35,50	1.318 9	1.397 6	90	180	3 17/32	7 3/32
35,50	37,50	1.397 6	1.476 6	93	186	3 21/32	7 5/16
37,50	40,00	1.476 6	1.574 8	96	193	3 25/32	7 19/32
		1.476 4	1.574 8	100	200	3 15/16	7 7/8

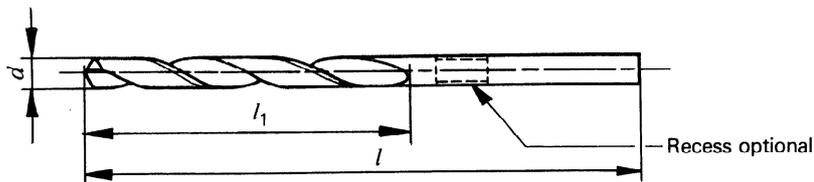
NOTES

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	30	1,55	20	43	4,10	47	80	8,10	81	125	12,10	101	151
0,30			1,60			4,20			8,20			12,20		
0,32	4	20	1,65	22	46	4,30	52	86	8,30	57	93	12,30	87	133
0,35			1,70			4,40			8,40			12,40		
0,38	5	22	1,75	24	49	4,50	27	53	8,50	30	57	12,50	33	61
0,40			1,80			4,60			8,60			12,60		
0,42			1,85			4,70			8,70			12,70		
0,45	6	24	1,90	26	53	4,80	30	57	8,80	33	61	12,80	36	65
0,48			1,95			4,90			8,90			12,90		
0,50	7	26	2,00	27	53	5,00	33	61	9,00	36	61	13,00	39	70
0,52			2,05			5,10			9,10			13,10		
0,55	8	28	2,10	30	57	5,20	36	65	9,20	39	70	13,20	40	70
0,58			2,15			5,30			9,30			13,30		
0,60	9	30	2,20	33	61	5,40	39	70	9,40	42	74	13,40	42	74
0,62			2,25			5,50			9,50			13,50		
0,65	10	32	2,30	36	65	5,60	42	74	9,60	45	78	13,60	45	78
0,68			2,35			5,70			9,70			13,70		
0,70	11	34	2,40	39	70	5,80	45	78	9,80	48	81	13,80	48	81
0,72			2,45			5,90			9,90			13,90		
0,75	12	36	2,50	42	74	6,00	48	81	10,00	51	85	14,00	51	85
0,78			2,55			6,10			10,10			14,10		
0,80	14	38	2,60	45	78	6,20	51	85	10,20	54	88	14,25	54	88
0,82			2,65			6,30			10,30			14,30		
0,85	16	40	2,70	48	81	6,40	54	88	10,40	57	91	15,00	57	91
0,88			2,75			6,50			10,50			15,25		
0,90	18	42	2,80	51	85	6,60	57	91	10,60	60	94	15,50	60	94
0,92			2,85			6,70			10,70			15,75		
0,95	14	36	2,90	54	88	6,80	60	94	10,80	63	97	16,00	63	97
0,98			2,95			6,90			10,90			16,50		
1,00	16	38	3,00	57	91	7,00	63	97	11,00	66	100	17,00	66	100
1,05			3,10			7,10			11,10			17,50		
1,10	18	40	3,20	60	94	7,20	66	100	11,20	69	103	18,00	69	103
1,15			3,30			7,30			11,30			18,50		
1,20	20	42	3,40	63	97	7,40	69	103	11,40	72	106	19,00	72	106
1,25			3,50			7,50			11,50			19,50		
1,30	22	44	3,60	66	100	7,60	72	106	11,60	75	109	20,00	75	109
1,35			3,70			7,70			11,70					

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	1/4	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

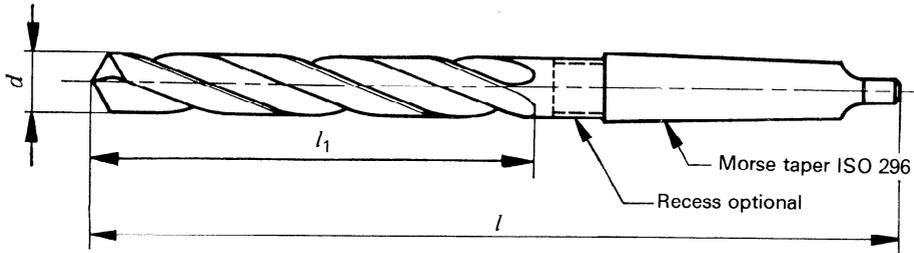
1 Tolerance on lengths

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

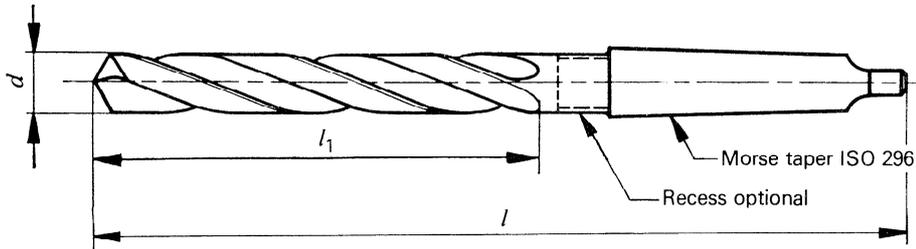


5.1 Dimensions in millimetres

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						21,75	150	248			271
4,00	43	124				13,00			1		2	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	69	150				16,00						25,00					
7,20						16,25						25,25					
7,50						16,50						25,50					
7,80						16,75	125	223				25,75					
8,00	75	156				17,00						26,00	165	286			
8,20						17,25						26,25					
8,50						17,50						26,50					
8,80						17,75	130	228	2			26,75			3		
9,00	81	162				18,00						27,00					
9,20						18,25						27,25					
9,50						18,50	135	233			256	27,50	170	291			319
9,80						18,75						27,75					
10,00	87	168				19,00						28,00					
10,20						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)

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.
30,00	175	296		324		44,00						69					
30,25						44,50	210	359		397		70	250	437		504	
30,50						45,00						71					
30,75	180	301	3	329	4	45,50						72			5		6
31,00						46,00						73	255	442		509	
31,25						46,50	215	364		402		74					
31,50						47,00					5	75					
31,75		306		334		47,50			4			76		447		514	
32,00						48,00						77					
32,50	185	334				48,50						78	260	514			
33,00						49,00	220	369		407		79					
33,50						49,50						80					
34,00						50,00						81					
34,50	190	339				50,50		374		412		82					
35,00						51	225					83	265	519			
35,50						52		412				84					
36,00						53						85					
36,50	195	344				54						86					
37,00						55	230	417				87					
37,50			4			56						88	270	524	6		
38,00						57						89					
38,50						58	235	422				90					
39,00	200	349				59			5			91					
39,50						60						92					
40,00						61						93	275	529			
40,50						62	240	427				94					
41,00						63						95					
41,50	205	354		392		64						96					
42,00					5	65	245	432		499	6	97					
42,50						66						98	280	534			
43,00	210	359		397		67						99					
43,50						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.	l
1/8	1 7/16	4 5/8				23/32	5 1/4	9 1/8				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				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				1 29/64						
9/32						7/8						1 15/32						
19/64						57/64		10				1 31/64						
5/16	2 15/16	6 1/8				29/32	6 1/8					1 1/2						
21/64			1			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	4	15 1/2		
29/64						1 5/8	6 5/8	11 3/8				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				1 1/8	6 7/8	11 5/8				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				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				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						