INTERNATIONAL STANDARD

ISO 296

Second edition
1991-04-01

Machine tools — Self-holding tapers for tool shanks

Machines-outils — Cônes pour emmanchements d'outils à faible conicité

Reference number
ISO 296:1991(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 296 was prepared by Technical Committee ISO/TC 39, *Machine tools*.

This second edition cancels and replaces the first edition (ISO 296:1974), of which it constitutes a technical revision.

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Machine tools — Self-holding tapers for tool shanks

1 Scope

This International Standard specifies the dimensions of self-holding tapers for tool shanks with a small taper of about 4 % to 5 %, classified, according to their use, into the three following catergories:

a) tapers for general use;

b) smaller tapers;

c) larger tapers.

For the first category, tapers recommended by ISO are Nos. 1 to 6 Morse tapers. Their standard sizes in millimetres are given in table 2, and the corresponding sizes in inches are given in table 3.

For smaller and larger tapers, those recommended by ISO are, on the one hand, Nos. 4 and 6 metric 5 % tapers and No. 0 Morse taper, and on the other hand, Nos. 80 to 200 metric 5 % tapers, the sizes of which, in millimetres only, are given in table 2. However, it was agreed to include in parallel, in the category of small tapers, Nos. 1 to 3 Brown & Sharpe tapers, the sizes of which, in inches only, are given in table 3.

Consequently, as shown in table 1, the self-holding tapers dealt with in this International Standard include

a) for general use, only Nos. 1 to 6 Morse tapers;

b) for sizes below No. 1 Morse taper, two solutions, i.e. either Nos. 4 and 6 metric tapers and No. 0 Morse taper (without corresponding tapers in inches in table 3) or, alternatively, Nos. 1 to 3 Brown & Sharpe tapers (without corresponding tapers in millimetres in table 2);

c) for sizes above No. 6 Morse taper, only Nos. 80 to 200 metric tapers (without corresponding tapers in inches in table 3).

Table 1 — Tapers

Designation	Sizes in millimetres	Sizes in inches
Small tapers	Nos. 4 and 6 metric and No. 0 Morse	Nos. 1 to 3 Brown & Sharpe
Tapers for general use	Nos. 1 to 6 Morse[1)]	
Large tapers	Nos. 80 to 200 metric	—

1) Except for threads, Nos. 1 to 6 Morse tapers, manufactured either to metric values or to inch values, are strictly interchangeable, though not absolutely identical.

This International Standard provides, for those elements which are threaded, two entirely distinct types of product according to the type of thread, **M** or **UNC**.

In order to distinguish between those two types, it is important that the element itself be marked with the corresponding thread symbol and the type of taper symbol, as shown in the figures in clause 4.

Lastly, this International Standard specifies the dimensions of grooves and holes necessary for the design of tapers for applications where coolant supply is required.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1947:1973, *System of cone tolerances for conical workpieces from C = 1:3 to 1:500 and lengths from 6 to 630 mm.*

3 Conicity tolerances

The cone angle tolerances shall be those given in ISO 1947 for quality AT5, and shall be positive on the external taper and negative on the internal taper.

For special applications, other cone angle tolerances in accordance with ISO 1947 may be chosen.

4 Dimensions

Tolerances of symmetry in millimetres

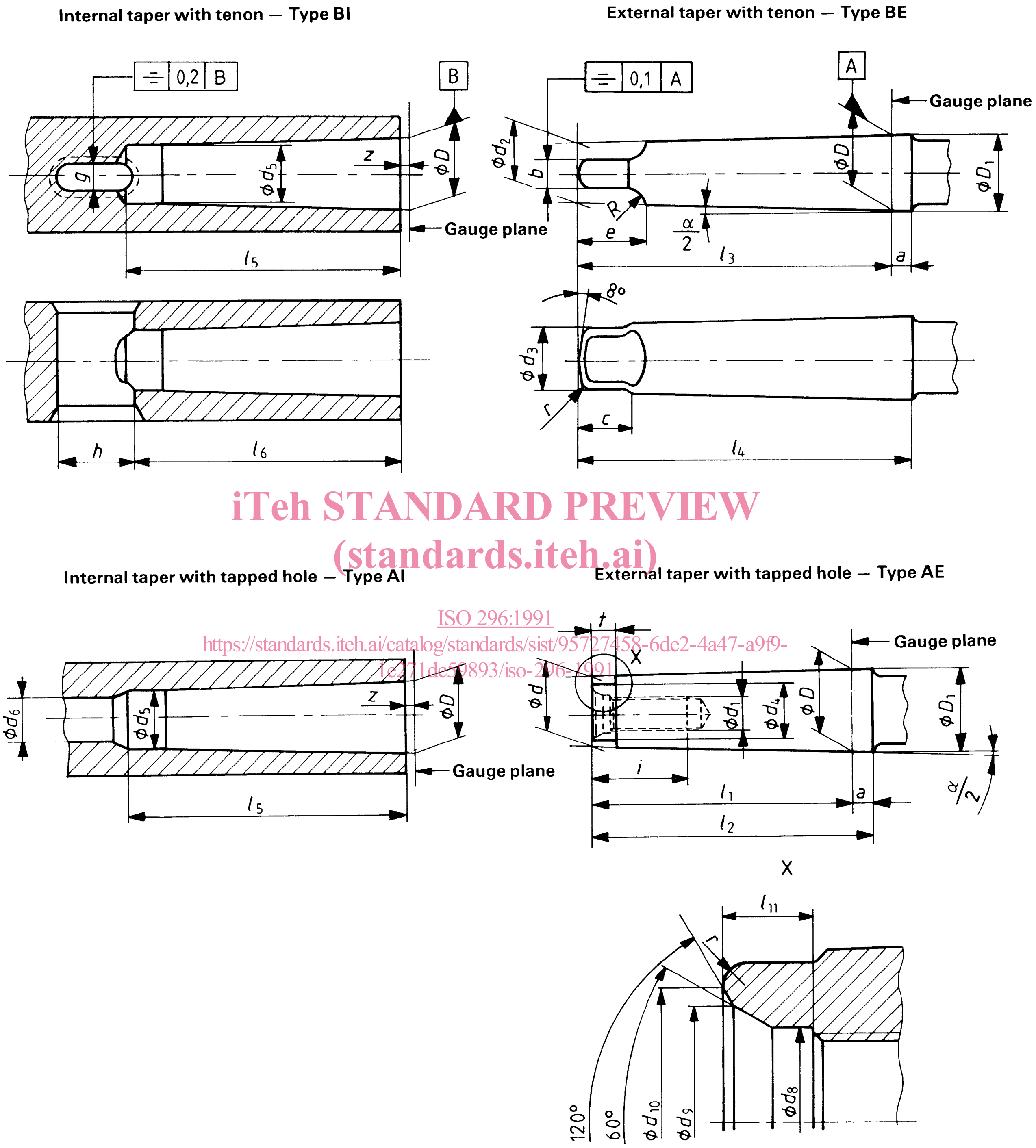
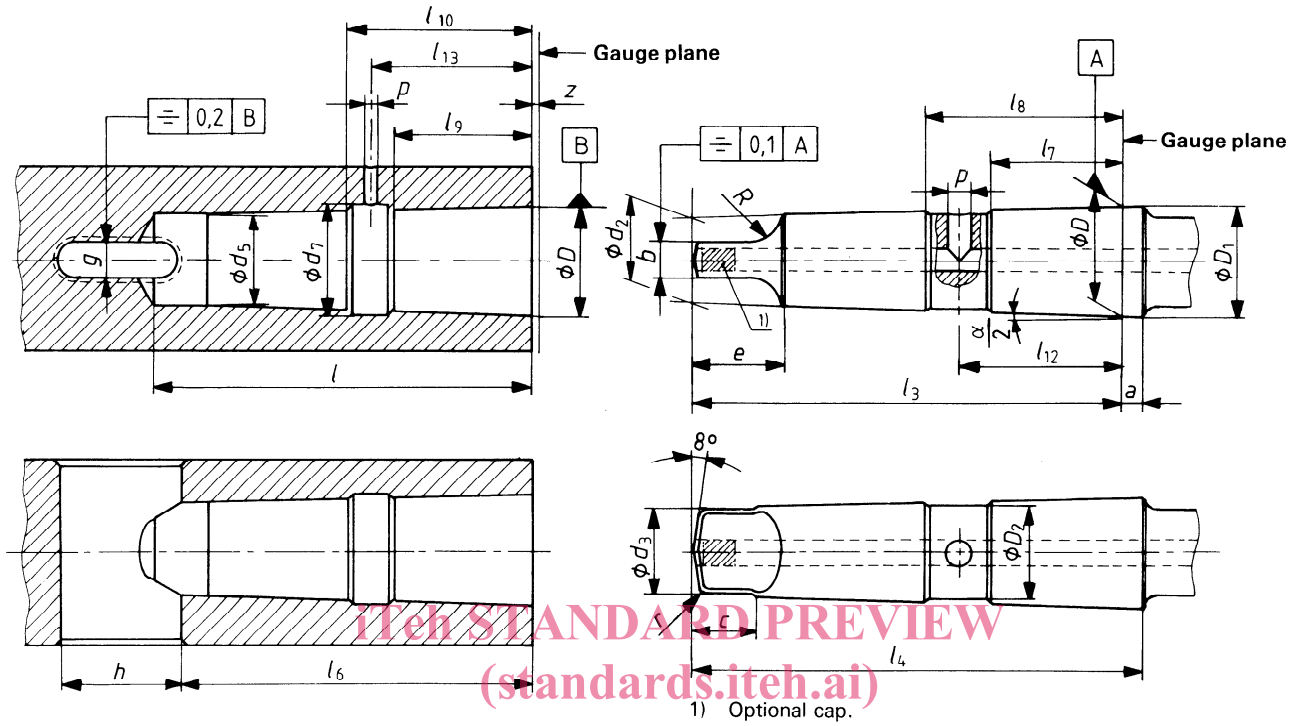


Figure 1

Tolerances of symmetry in millimetres

Internal taper with tenon and coolant supply — Type BIK

External taper with tenon and coolant supply — Type BEK



Internal taper with tapped hole and coolant supply — Type AIK

External taper with tapped hole and coolant supply — Type AEK

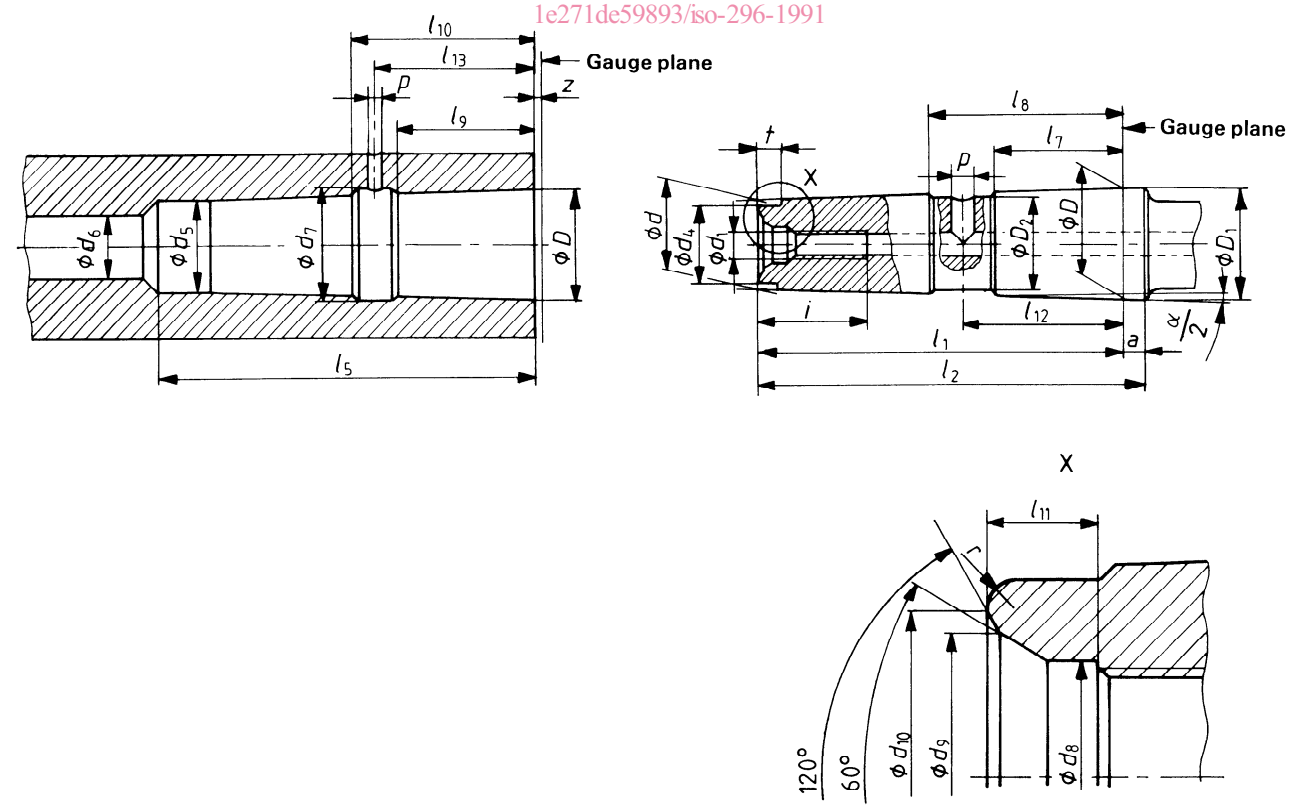


Figure 2

Table 2 — Nos. 0 to 6 Morse tapers and 5 % metric tapers

Dimensions in millimetres

Designation			Metric tapers		Morse tapers							Metric tapers				
			4	6	0	1	2	3	4	5	6	80	100	120	160	200
Taper ratio			1:20 = 0,05		0,624 6 : 12 = 1 : 19,212 = 0,052 05	0,598 58 : 12 = 1 : 20,047 = 0,049 88	0,599 41 : 12 = 1 : 20,02 = 0,049 95	0,602 35 : 12 = 1 : 19,922 = 0,050 2	0,623 26 : 12 = 1 : 19,254 = 0,051 94	0,631 51 : 12 = 1 : 19,002 = 0,052 63	0,625 65 : 12 = 1 : 19,18 = 0,052 14	1:20 = 0,05				
External taper	D		4	6	9,045	12,065	17,78	23,825	31,267	44,399	63,348	80	100	120	160	200
	a		2	3	3	3,5	5	5	6,5	6,5	8	8	10	12	16	20
	D_1	1)	4,1	6,2	9,2	12,2	18	24,1	31,6	44,7	63,8	80,4	100,5	120,6	160,8	201
	D_2		—	—	—	—	15	21	28	40	56	—	—	—	—	—
	d	1)	2,9	4,4	6,4	9,4	14,6	19,8	25,9	37,6	53,9	70,2	88,4	106,6	143	179,4
	d_1	2)	—	—	—	**M6**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**	**M36**	**M36**	**M48**	**M48**
	d_2	1)	—	—	6,1	9	14	19,1	25,2	36,5	52,4	69	87	105	141	177
	d_3	max.	—	—	6	8,7	13,5	18,5	24,5	35,7	51	67	85	102	138	174
	d_4	max.	2,5	4	6	9	14	19	25	35,7	51	67	85	102	138	174
	d_8		—	—	—	6,4	10,5	13	17	21	26	—	—	—	—	—
	d_9		—	—	—	8	12,5	15	20	26	31	—	—	—	—	—
	d_{10}	max.	—	—	—	8,5	13,2	17	22	30	11,5	—	—	—	—	—
	l_1	max.	23	32	50	53,5	64	81	102,5	129,5	182	196	232	268	340	412
	l_2	max.	25	35	53	57	69	86	109	136	190	204	242	280	356	432
	l_3	$^{0}_{-0,1}$	—	—	56,5	62	75	94	117,5	149,5	210	220	260	300	380	460
	l_4	max.	—	—	59,5	65,5	80	99	124	156	218	228	270	312	396	480
	l_7	$^{0}_{-0,1}$	—	—	—	—	20	29	39	51	81	—	—	—	—	—
	l_8	$^{0}_{-0,1}$	—	—	—	—	34	43	55	69	99	—	—	—	—	—
	l_{11}		—	—	—	4	5	5,5	8,2	10	11,5	—	—	—	—	—
	l_{12}		—	—	—	—	27	36	47	60	90	—	—	—	—	—
	p		—	—	—	3,3	4,2	5	6,8	8,5	10,2	—	—	—	—	—
	b	h13	—	—	3,9	5,2	6,3	7,9	11,9	15,9	19	26	32	38	50	62
	c	3)	—	—	6,5	8,5	10	13	16	19	27	24	28	32	40	48
	e	max.	—	—	10,5	13,5	16	20	24	29	40	48	58	68	88	108
	i	min.	—	—	—	16	24	24	32	40	47	59	70	70	92	92
	R	max.	—	—	4	5	6	7	8	12	18	24	30	36	48	60
	r		—	—	1	1,2	1,6	2	2,5	3	4	5	5	6	8	10
	t	max.	2	3	4	5	5	7	9	10	16	24	30	36	48	60
Internal taper	d_5	H11	3	4,6	6,7	9,7	14,9	20,2	26,5	38,2	54,8	71,5	90	108,5	145,5	182,5
	d_6	min.	—	—	—	7	11,5	14	18	23	27	33	39	39	52	52
	d_7		—	—	—	—	19,5	24,5	32	44	63	—	—	—	—	—
	l_5	min.	25	34	52	56	67	84	107	135	188	202	240	276	350	424
	l_6		21	29	49	52	62	78	98	125	177	186	220	254	321	388
	l_9		—	—	—	—	22	31	41	53	83	—	—	—	—	—
	l_{10}		—	—	—	—	32	41	53	67	97	—	—	—	—	—
	l_{13}		—	—	—	—	27	36	47	60	90	—	—	—	—	—
	g	A13	2,2	3,2	3,9	5,2	6,3	7,9	11,9	15,9	19	26	32	38	50	62
	h		8	12	15	19	22	27	32	38	47	52	60	70	90	110
	p		—	—	—	—	4,2	5	6,8	8,5	10,2	—	—	—	—	—
	z	4)	0,5	0,5	1	1	1	1	1	1	1	1,5	1,5	1,5	2	2

1) For D_1 and d or d_2, approximate values are given for guidance.

(The actual values result from the actual values of a and l_1 or l_3 respectively, taking into account the taper ratio and the basic size D.)

2) d_1 is the nominal thread diameter: either a metric thread **M** with standard pitch or, if expressly stated, a **UNC** thread (see table 3 for inch sizes). In every case, the appropriate symbol **M** or **UNC** shall be marked on the component.

3) It is permissible to increase the length c over which the tenon is turned to diameter d_3, but without exceeding e.

4) z is the maximum permissible deviation, outwards only, of the position of the gauge plane related to the basic size D from the nominal position of coincidence with the leading face.

Table 3 — Nos. 1 to 6 Morse tapers and Nos. 1 to 3 Brown & Sharpe tapers

Dimensions in inches

Designation			Brown & Sharpe tapers 1	Brown & Sharpe tapers 2	Brown & Sharpe tapers 3	Morse tapers 1	Morse tapers 2	Morse tapers 3	Morse tapers 4	Morse tapers 5	Morse tapers 6
Taper ratio			**0,502 : 12 = 1 : 23,904 = 0,041 83**	**0,502 : 12 = 1 : 23,904 = 0,041 83**	**0,502 : 12 = 1 : 23,904 = 0,041 83**	**0,598 58 : 12 = 1 : 20,047 = 0,049 88**	**0,599 41 : 12 = 1 : 20,02 = 0,049 95**	**0,602 35 : 12 = 1 : 19,922 = 0,050 2**	**0,623 26 : 12 = 1 : 19,254 = 0,051 94**	**0,631 51 : 12 = 1 : 19,002 = 0,052 63**	**0,625 65 : 12 = 1 : 19,18 = 0,052 14**
External taper	D		0,239 22	0,299 68	0,375 25	0,475	0,7	0,938	1,231	1,748	2,494
	a		3/32	3/32	3/32	1/8	3/16	3/16	1/4	1/4	1/16
	D_1	1)	0,243 14	0,303 6	0,379 17	0,481 2	0,709 4	0,947 4	1,244	1,761 2	2,510 3
	D_2		—	—	—	0,393 7	0,590 6	0,826 8	1,102 4	1,574 8	2,204 7
	d	1)	0,2	0,25	0,312 5	0,369	0,572	0,778	1,02	1,475	2,116
	d_1	2)	—	—	—	**UNC** 1/4	**UNC** 3/8	**UNC** 1/2	**UNC** 5/8	**UNC** 5/8	**UNC** 1
	d_2	1)	0,189 54	0,236 93	0,296 81	0,353 4	0,553 3	0,752 9	0,990 8	1,438 8	2,063 9
	d_3	max.	11/64	7/32	9/32	11/32	17/32	23/32	31/32	1 13/32	2
	d_4	max.	11/64	7/32	9/32	11/32	17/32	23/32	31/32	1 13/32	2
	d_8		—	—	—	0,251 97	0,413 38	0,511 81	0,669 29	0,826 77	1,023 62
	d_9		—	—	—	0,314 96	0,492 12	0,590 55	0,787 4	1,023 62	1,220 47
	d_{10}	max.	—	—	—	0,334 64	0,519 68	0,689 29	0,866 14	1,181 1	1,417 32
	l_1	max.	15/16	1 3/16	1 1/2	2 1/8	2 9/16	3 3/16	4 1/16	5 3/16	7 1/4
	l_2	max.	1 1/32	1 9/32	1 19/32	2 1/4	2 3/4	3 3/8	4 5/16	5 7/16	7 9/16
	l_3	$^{0}_{-0,004}$	1 3/16	1 1/2	1 7/8	2 7/16	2 15/16	3 11/16	4 5/8	5 7/8	8 1/4
	l_4	max.	1 9/32	1 19/32	1 31/32	2 9/16	3 1/8	3 7/8	4 7/8	6 1/8	8 9/16
	l_7	$^{0}_{-0,004}$	—	—	—	19/32	25/32	1 9/64	1 17/32	2	3 3/16
	l_8	$^{0}_{-0,004}$	—	—	—	1 3/16	1 11/32	1 19/64	2 3/16	2 23/32	3 29/32
	l_{11}		—	—	—	0,157 48	0,196 85	0,216 53	0,322 83	0,393 7	0,452 75
	l_{12}		—	—	—	—	1,062 99	1,417 32	1,850 39	2,362 2	3,543 3
	p		—	—	—	1/8	11/64	13/64	9/32	21/64	13/32
	b	h12	0,125	0,156 2	0,187 5	0,203 1	0,25	0,312 5	0,468 7	0,625	0,75
	c	3)	1/4	5/16	3/8	11/32	13/32	17/32	5/8	3/4	1 1/16
	e	max.	0,381	0,455	0,532	0,52	0,66	0,83	0,96	1,15	1,58
	i	min.	—	—	—	1/2	3/4	0,944 88	1 1/4	1 1/4	1,850 4
	R	max.	3/16	3/16	3/16	3/16	1/4	9/32	5/16	0,472 44	0,708 66
	r		1/32	1/32	3/64	3/64	1/16	5/64	3/32	1/8	5/32
	t	max.	1/8	1/8	1/8	3/16	3/16	1/4	1/4	5/16	3/8
Internal taper	d_5	H11	0,203	0,255	0,319	0,378	0,588	0,797	1,044	1,502	2,157 48
	d_6	min.	—	—	—	9/32	7/16	9/16	11/16	11/16	1 1/8
	d_7		—	—	—	17/32	49/64	31/32	1 17/64	1 47/64	2 31/64
	l_5	min.	1	1 1/4	1 9/16	2 3/16	2 21/32	3 9/32	4 5/32	5 5/16	7 3/8
	l_6		29/32	1 1/8	1 13/32	2 1/16	2 1/2	3 1/16	3 7/8	4 15/16	7
	l_9		—	—	—	43/64	7/8	17/32	1 39/64	2 3/32	3 17/64
	l_{10}		—	—	—	1 1/16	1 17/64	1 39/64	2 3/32	2 41/64	3 13/16
	l_{13}		—	—	—	—	1,062 99	1,417 32	1,850 39	2,362 2	3,543 3
	g	H12	0,141	0,172	0,203	0,223	0,27	0,333	0,493	0,65	0,78
	h		13/32	9/16	23/32	3/4	7/8	1 1/8	1 1/4	1 1/2	1 7/8
	p		—	—	—	1/8	11/64	13/64	9/32	21/64	13/32
	z	4)	0,04	0,04	0,04	0,039 3	0,039 3	0,039 3	0,039 3	0,039 3	0,039 3

1) For D_1 and d or d_2, approximate values are given for guidance.

(The actual values result from the actual values of a and l_1 or l_3 respectively, taking into account the taper ratio and the basic size D.)

2) d_1 is the nominal thread diameter: either a **UNC** thread or, if expressly stated, a metric thread **M** with standard pitch (see table 2 for metric sizes). In every case, the appropriate symbol **UNC** or **M** shall be marked on the component.

3) It is permissible to increase the length c over which the tenon is turned to diameter d_3, but without exceeding e.

4) z is the maximum permissible deviation, outwards only, of the position of the gauge plane related to the basic size D from the nominal position of coincidence with the leading face.

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