DEUTSCHE NORM June 1997

Metric taper external and mating parallel internal screw threads

Part 1: Dimensions, tolerances and inspection

DIN 158-1

ICS 21.040.10

Supersedes DIN 158, August 1986 edition.

Descriptors: Metric taper external screw threads, parallel internal screw threads, dimensions, tolerances, inspection.

Metrisches kegeliges Außengewinde mit zugehörigem zylindrischem Innengewinde – Teil 1: Nennmaße, Grenzabmaße, Grenzmaße und Prüfung

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Foreword

This standard has been prepared by the Section *Gewinde* of the *Normenausschuß Technische Grundlagen* (Fundamentals in Technology Standards Committee).

Amendments

The following amendments have been made to the August 1986 edition of DIN 158.

a) The number of the standard has been changed.

b) The values of thread height, h_3, have been amended (cf. table 2), taking into consideration the limit deviations specified in table 3.

c) The designation of taper external threads has been amended to include the letters 'keg' (taper) to distinguish them from parallel external threads.

d) The standard has been editorially revised.

Previous editions

DIN 158-1: 1954-06; DIN 158: 1971-04, 1986-08.

Dimensions in mm

1 Scope and field of application

This standard specifies profiles, dimensions and methods of verification for general purpose metric taper external threads intended to be mated with parallel internal threads with a basic profile as specified in ISO/DIS 68-1.

Taper external threads as specified in this standard are intended for self-sealing joints, such as those employed on pipe plugs, compression couplings and lubricating nipples. They can be used in all cases where a parallel threaded joint with washer is unsatisfactory for technical or economic reasons.

For fluids such as oils, other liquids and gases, no thread sealants are required for joints where the nominal size is small. For joints of greater nominal size, it is recommended that sealants be applied, since the leaktightness of such joints decreases as the diameter increases.

A short design taper external thread has been specified along with the standard design both to be mated with general purpose ISO metric parallel internal threads of tolerance class 4H for the pitch diameter and 5H for the minor diameter (as in ISO/DIS 965-1).

Continued on pages 2 to 10.

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original should be consulted as the authoritative text.

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Ref. No. DIN 158-1 : 1997-06
English price group 09 *Sales No. 0109*
03.99

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

DIN 13-1	ISO metric screw threads – 1 mm to 68 mm diameter coarse pitch threads – Nominal sizes*)
DIN 13-5	ISO metric screw threads – 1 mm and 1,25 mm fine pitch threads with diameters from 7,5 mm to 200 mm – Nominal sizes*)
DIN 13-6	ISO metric screw threads – 1,5 mm fine pitch threads with diameters from 12 mm to 300 mm – Nominal sizes*)
DIN 13-7	ISO metric screw threads – 2 mm fine pitch threads with diameters from 17 mm to 300 mm – Nominal sizes*)
DIN 13-19	ISO metric screw threads – Basic profile and manufacturing profiles*)
DIN 158-2	Metric taper external screw threads and mating internal parallel screw threads – Part 2: Gauges and gauging
DIN 2244	Screw threads – Terminology
ISO/DIS 68-1 : 1998	ISO general purpose screw threads – Basic profile
ISO/DIS 965-1 : 1998	ISO general purpose metric screw threads – Tolerances – Part 1: Principles and basic data
ISO/DIS 965-3 : 1998	ISO general purpose metric screw threads – Tolerances – Part 3: Deviations for constructional threads
ISO 1502 : 1996	ISO general-purpose metric screw threads – Gauges and gauging

3 Concepts amd symbols

3.1 Concepts

For the purposes of this standard, the concepts specified in DIN 2244 shall apply.

3.2 Symbols

For symbols, see table 1.

Table 1: Symbols

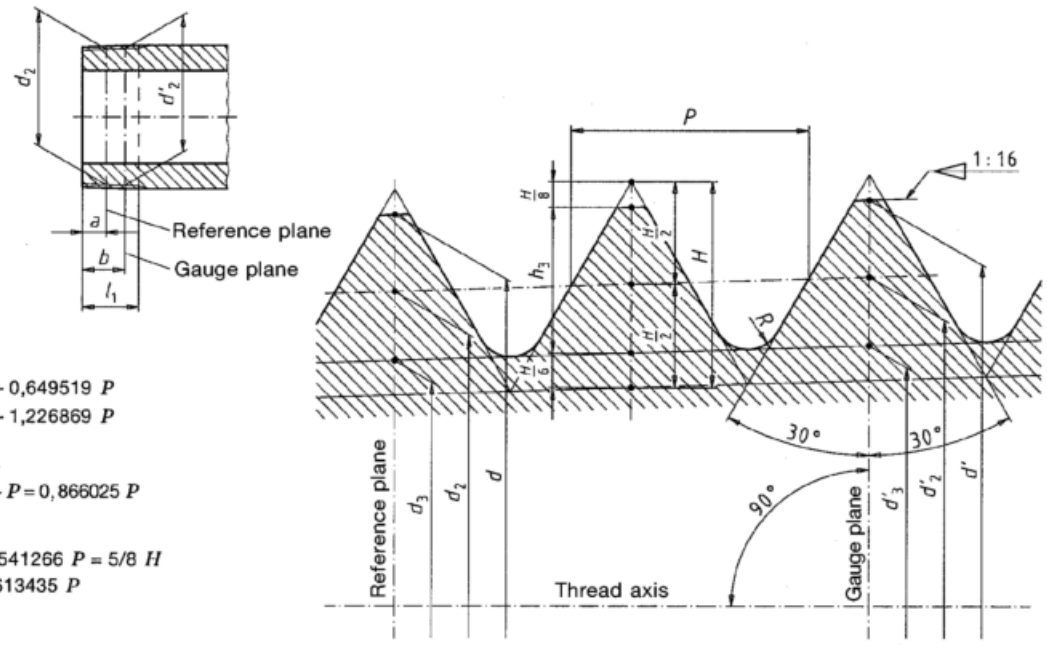
Symbol	Quantity
a	Distance from reference plane to external thread end
b	Gauge length
d	Major diameter of external thread at gauge plane
d_2	Pitch diameter of external thread at gauge plane
d_3	Minor diameter of external thread at gauge plane
D	Major diameter of internal thread
D_1	Minor diameter of internal thread
D_2	Pitch diameter of internal thread
d'	Major diameter of external thread at gauge plane
d'_2	Pitch diameter of external thread at gauge plane
d'_3	Minor diameter of external thread at gauge plane
H	Height of triangle of thread profile perpendicular to thread axis
H_1	Flank overlapping
h_3	Height of thread
l_1	Useful length of external thread
l_2	Useful length of internal thread
R	Root radius
P	Pitch
x	Thread run-out

*) At present at the stage of draft.

4 Design profiles and designation

4.1 Taper external threads

The nominal sizes, limit deviations and limits of size are given in tables 2, 3 and 4, respectively.



$d_2 = d - 0{,}649519\ P$
$d_3 = d - 1{,}226869\ P$

$H = \frac{\sqrt{3}}{2} P = 0{,}866025\ P$

$H_1 = 0{,}541266\ P = 5/8\ H$
$h_3 = 0{,}613435\ P$

$R = \frac{H}{6} = 0{,}144338\ P$

Figure 1: Design profile of a metric taper external thread

Designation of a standard design M 30 × 2 keg external thread:

Thread DIN 158 – M 30 × 2 keg

Designation of a short design (short) M 30 × 2 keg external thread:

Thread DIN 158 – M 30 × 2 keg short

Table 2: Nominal sizes for taper external threads

Thread size	Pitch, P	Useful thread length, l_1		Maximum height of thread, h_3		Dimensions at reference plane					Dimensions at gauge plane				
						Dimension a		Thread dimensions at gauge plane			Gauge length b		Thread dimensions		
		Standard design	Short design	Standard design	Short design	Standard design	Short design	Major diameter, d	Pitch diameter, d_2	Minor diameter, d_3	Standard design	Short design	d'	d'_2	d'_3
M 5 keg	0,8	5	–	0,521	–	2	–	5	4,48	4,019	2,8	–	5,05	4,53	4,069
M 6 keg	1	5,5	4	0,659	0,644	2,5	2	6	5,35	4,773	3,5	3	6,063	5,413	4,836
M 8 × 1 keg								8	7,35	6,773			8,063	7,413	6,836
M 10 × 1 keg								10	9,35	8,773			10,063	9,413	8,836
M 12 × 1 keg								12	11,35	10,773			12,063	11,413	10,836
M 10 × 1,25 keg	1,25	7	6	0,823	0,807	3	2,2	10	9,188	8,466	5	4,2	10,125	9,313	8,591
M 12 × 1,25 keg								12	11,188	10,466			12,125	11,313	10,591
M 12 × 1,5 keg	1,5	8,5	7,5	0,983	0,967	3,5	2,5	12	11,026	10,16	6,5	5,5	12,188	11,214	10,348
M 14 × 1,5 keg								14	13,026	12,16			14,188	13,214	12,348
M 16 × 1,5 keg								16	15,026	14,16			16,188	15,214	14,348
M 18 × 1,5 keg								18	17,026	16,16			18,188	17,214	16,348
M 20 × 1,5 keg								20	19,026	18,16			20,188	19,214	18,348
M 22 × 1,5 keg								22	21,026	20,16			22,188	21,214	20,348
M 24 × 1,5 keg								24	23,026	22,16			24,188	23,214	22,348
M 26 × 1,5 keg								26	25,026	24,16			26,188	25,214	24,348
(M 27 × 1,5 keg)								27	26,026	25,16			27,188	26,214	25,348
M 30 × 1,5 keg								30	29,026	28,16			30,188	29,214	28,348

(continued)

Table 2 (concluded)

Thread size	Pitch, P	Useful thread length, l_1		Maximum height of thread, h_3		Dimensions at reference plane					Dimensions at gauge plane				
						Dimension a		Thread dimensions at gauge plane			Gauge length b		Thread dimensions		
		Standard design	Short design	Standard design	Short design	Standard design	Short design	Major diameter, d	Pitch diameter, d_2	Minor diameter, d_3	Standard design	Short design	d'	d'_2	d'_3
(M 33 × 1,5 keg)	1,5	10,5	9	1,014	0,983	4,5	3,4	33	32,026	31,16	8	6,9	33,219	32,245	31,379
M 36 × 1,5 keg								36	35,026	34,16			36,219	35,245	34,379
M 38 × 1,5 keg								38	37,026	36,16			38,219	37,245	36,379
(M 39 × 1,5 keg)								39	38,026	37,16			39,219	38,245	37,379
M 42 × 1,5 keg								42	41,026	40,16			42,219	41,245	40,379
M 45 × 1,5 keg								45	44,026	43,16			45,219	44,245	43,379
M 48 × 1,5 keg								48	47,026	46,16			48,219	47,245	46,379
M 52 × 1,5 keg								52	51,026	50,16			52,219	51,245	50,379
M 27 × 2 keg	2	12	10	1,321	1,290	5	4	27	25,701	24,546	9	8	27,25	25,951	24,796
M 30 × 2 keg								30	28,701	27,546			30,25	28,951	27,796
M 33 × 2 keg								33	31,701	30,546			33,25	31,951	30,796
M 36 × 2 keg		13	11,5	1,342	1,302	6	4,8	36	34,701	33,546	10	8,8	36,25	34,951	33,796
M 39 × 2 keg								39	37,701	36,546			39,25	37,951	36,796
M 42 × 2 keg								42	40,701	39,546			42,25	40,951	39,796
M 45 × 2 keg								45	43,701	42,546			45,25	43,951	42,796
M 48 × 2 keg								48	46,701	45,546			48,25	46,951	45,796
M 52 × 2 keg								52	50,701	49,546			52,25	50,951	49,796
M 56 × 2 keg								56	54,701	53,546			56,25	54,951	53,796
M 60 × 2 keg								60	58,701	57,546			60,25	58,951	57,796

Bracketed sizes should be avoided where possible.

4.2 Parallel internal threads

Parallel internal threads shall have the basic profile specified in ISO/DIS 68-1. The maximum and minimum material profiles shall be as given in DIN 13-19*).

The nominal sizes of coarse pitch threads shall conform to DIN 13-1*), those of fine pitch threads with pitches of 1 mm or 1,25 mm to DIN 13-5*), with a pitch of 1,5 mm to DIN 13-6*), and those with a pitch of 2 mm, to DIN 13-7*).

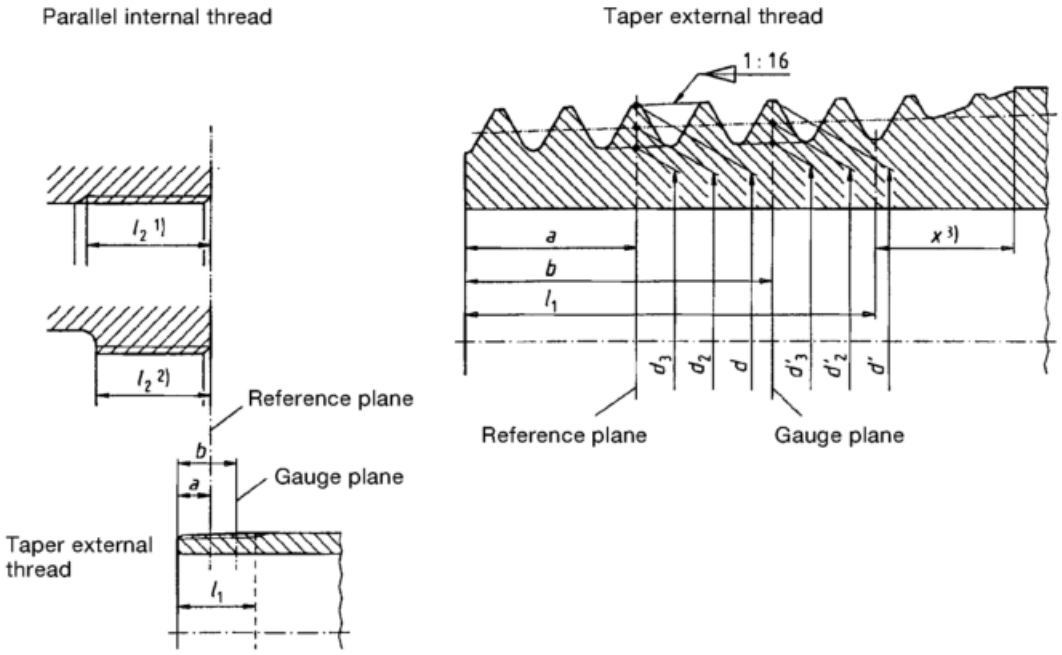
Limit deviations shall be as given in ISO/DIS 965-3. Limits of size and the useful length, l_2, shall be as given in table 5 and clause 5, respectively.

The thread designation shall conform to ISO/DIS 965-1.

Example of designation for a metric parallel internal thread (M), with a nominal diameter of 30 mm and a pitch of 2 mm (fine pitch thread), of tolerance class 4H for the pitch diameter and tolerance class 5H for the minor diameter:

Thread DIN 158 M 30 × 2 – 4H 5H

5 Tolerances, limit deviations and limits of size



1) Internally threaded parts shall be capable of receiving external threaded parts up to the useful length, l_1, making full use of dimension *a*.

2) Assuming a free thread run-out, length l_2 of the internal thread shall not be less than 80 % of l_1.

3) It is recommended that the thread run-out, x, be 1,5 P.

Figure 2: Internal and external threads (notation)

*) At present at the stage of draft.

Table 3: Limit deviations for external threads

Thread size	Dimensions a, b and l_1*)		Major, pitch and minor diameters**)	
	Standard design	Short design	Standard design	Short design
M 5 keg	± 0,5	–	± 0,03	–
M 6 keg **M 8 × 1 keg** **M 10 × 1 keg** **M 12 × 1 keg**	± 0,7	± 0,5	± 0,045	± 0,03
M 10 × 1,25 keg **M 12 × 1,25 keg**	± 0,9	± 0,65	± 0,056	± 0,04
M 12 × 1,5 keg **M 14 × 1,5 keg** **M 16 × 1,5 keg** **M 18 × 1,5 keg** **M 20 × 1,5 keg** **M 22 × 1,5 keg** **M 24 × 1,5 keg** **M 26 × 1,5 keg** **M 27 × 1,5 keg** **M 30 × 1,5 keg**	± 1	± 0,75	± 0,063	± 0,047
M 33 × 1,5 keg **M 36 × 1,5 keg** **M 38 × 1,5 keg** **M 39 × 1,5 keg** **M 42 × 1,5 keg** **M 45 × 1,5 keg** **M 48 × 1,5 keg** **M 52 × 1,5 keg** **M 27 × 2 keg** **M 30 × 2 keg** **M 33 × 2 keg**	± 1,5	± 1	± 0,094	± 0,063
M 36 × 2 keg **M 39 × 2 keg** **M 42 × 2 keg** **M 45 × 2 keg** **M 48 × 2 keg** **M 52 × 2 keg** **M 56 × 2 keg** **M 60 × 2 keg**	± 1,8	± 1,2	± 0,115	± 0,075

*) The limit deviations for a and b are only applicable to the basic thread sizes listed in table 2.

**) The limit deviations apply at any cross section (perpendicular to the thread axis) and within length l_1. (The tolerance zone thus lies parallel to the generatrix of the basic taper.)
These limit deviations apply only when the threads are measured, in which case it shall be assumed that dimensions a and b are nominal sizes (cf. clause 6).

Table 4: Limits of size for taper external threads at gauge plane

Thread size	Standard design						Short design					
	Major diameter, d'		Pitch diameter, d'_2		Minor diameter, d'_3		Major diameter, d'		Pitch diameter, d'_2		Minor diameter, d'_3	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
M 5 keg	5,08	5,02	4,56	4,5	4,099	4,039	–	–	–	–	–	–
M 6 keg	6,108	6,018	5,458	5,368	4,881	4,791	6,093	6,033	5,443	5,383	4,866	4,806
M 8 × 1 keg	8,108	8,018	7,458	7,368	6,881	6,791	8,093	8,033	7,443	7,383	6,866	6,806
M 10 × 1 keg	10,108	10,018	9,458	9,368	8,881	8,791	10,093	10,033	9,443	9,383	8,866	8,806
M 12 × 1 keg	12,108	12,018	11,458	11,368	10,881	10,791	12,093	12,033	11,443	11,383	10,866	10,806
M 10 × 1,25 keg	10,181	10,069	9,369	9,257	8,647	8,535	10,165	10,085	9,353	9,273	8,631	8,551
M 12 × 1,25 keg	12,181	12,069	11,369	11,257	10,647	10,535	12,165	12,085	11,353	11,273	10,631	10,551
M 12 × 1,5 keg	12,251	12,125	11,277	11,151	10,411	10,285	12,235	12,141	11,261	11,167	10,395	10,301
M 14 × 1,5 keg	14,251	14,125	13,277	13,151	12,411	12,285	14,235	14,141	13,261	13,167	12,395	12,301
M 16 × 1,5 keg	16,251	16,125	15,277	15,151	14,411	14,285	16,235	16,141	15,261	15,167	14,395	14,301
M 18 × 1,5 keg	18,251	18,125	17,277	17,151	16,411	16,285	18,235	18,141	17,261	17,167	16,395	16,301
M 20 × 1,5 keg	20,251	20,125	19,277	19,151	18,411	18,285	20,235	20,141	19,261	19,167	18,395	18,301
M 22 × 1,5 keg	22,251	22,125	21,277	21,151	20,411	20,285	22,235	22,141	21,261	21,167	20,395	20,301
M 24 × 1,5 keg	24,251	24,125	23,277	23,151	22,411	22,285	24,235	24,141	23,261	23,167	22,395	22,301
M 26 × 1,5 keg	26,251	26,125	25,277	25,151	24,411	24,285	26,235	26,141	25,261	25,167	24,395	24,301
M 27 × 1,5 keg	27,251	27,125	26,277	26,151	25,411	25,285	27,235	27,141	26,261	26,167	25,395	25,301
M 30 × 1,5 keg	30,251	30,125	29,277	29,151	28,411	28,285	30,235	30,141	29,261	29,167	28,395	28,301
M 33 × 1,5 keg	33,313	33,125	32,339	32,151	31,473	31,285	33,282	33,156	32,308	32,182	31,442	31,316
M 36 × 1,5 keg	36,313	36,125	35,339	35,151	34,473	34,285	36,282	36,156	35,308	35,182	34,442	34,316
M 38 × 1,5 keg	38,313	38,125	37,339	37,151	36,473	36,285	38,282	38,156	37,308	37,182	36,442	36,316
M 39 × 1,5 keg	39,313	39,125	38,339	38,151	37,473	37,285	39,282	39,156	38,308	38,182	37,442	37,316
M 42 × 1,5 keg	42,313	42,125	41,339	41,151	40,473	40,285	42,282	42,156	41,308	41,182	40,442	40,316
M 45 × 1,5 keg	45,313	45,125	44,339	44,151	43,473	43,285	45,282	45,156	44,308	44,182	43,442	43,316
M 48 × 1,5 keg	48,313	48,125	47,339	47,151	46,473	46,285	48,282	48,156	47,308	47,182	46,442	46,316
M 52 × 1,5 keg	52,313	52,125	51,339	51,151	50,473	50,285	52,282	52,156	51,308	51,182	50,442	50,316
M 27 × 2 keg	27,344	27,156	26,045	25,857	24,89	24,702	27,313	27,187	26,014	25,888	24,859	24,733
M 30 × 2 keg	30,344	30,156	29,045	28,857	27,89	27,702	30,313	30,187	29,014	28,888	27,859	27,733
M 33 × 2 keg	33,344	33,156	32,045	31,857	30,89	30,702	33,313	33,187	32,014	31,888	30,859	30,733
M 36 × 2 keg	36,365	36,135	35,066	34,836	33,911	33,681	36,325	36,175	35,026	34,876	33,871	33,721
M 39 × 2 keg	39,365	39,135	38,066	37,836	36,911	36,681	39,325	39,175	38,026	37,876	36,871	36,721
M 42 × 2 keg	42,365	42,135	41,066	40,836	39,911	39,681	42,325	42,175	41,026	40,876	39,871	39,721
M 45 × 2 keg	45,365	45,135	44,066	43,836	42,911	42,681	45,325	45,175	44,026	43,876	42,871	42,721
M 48 × 2 keg	48,365	48,135	47,066	46,836	45,911	45,681	48,325	48,175	47,026	46,876	45,871	45,721
M 52 × 2 keg	52,365	52,135	51,066	50,836	49,911	49,681	52,325	52,175	51,026	50,876	49,871	49,721
M 56 × 2 keg	56,365	56,135	55,066	54,836	53,911	53,681	56,325	56,175	55,026	54,876	53,871	53,721
M 60 × 2 keg	60,365	60,135	59,066	58,836	57,911	57,681	60,325	60,175	59,026	58,876	57,871	57,721

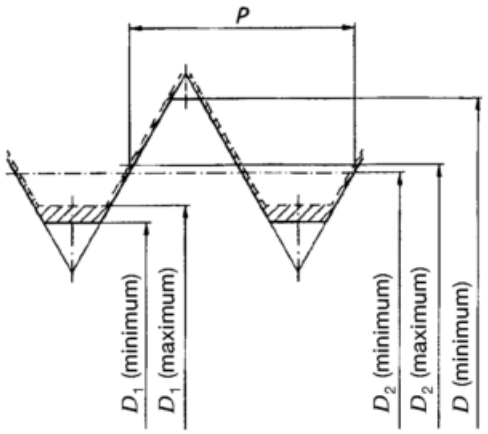


Figure 3: Parallel internal thread (tolerance position H)

Table 5: Limits of size for parallel internal threads (with tolerance class 4H for pitch diameter and 5H for minor diameter) (derived from ISO/DIS 965-3)

Thread size	Minimum major diameter, D	Pitch diameter, D_2 4H		Minor diameter, D_1 5H	
		Minimum	Maximum	Minimum	Maximum
M 5	5	4,48	4,56	4,134	4,294
M 6	6	5,35	5,445	4,917	5,107
M 8 × 1	8	7,35	7,445	6,917	7,107
M 10 × 1	10	9,35	9,445	8,917	9,107
M 12 × 1	12	11,35	11,45	10,917	11,107
M 10 × 1,25	10	9,188	9,288	8,647	8,859
M 12 × 1,25	12	11,188	11,3	10,647	10,859
M 12 × 1,5	12	11,026	11,144	10,376	10,612
M 14 × 1,5	14	13,026	13,144	12,376	12,612
M 16 × 1,5	16	15,026	15,144	14,376	14,612
M 18 × 1,5	18	17,026	17,144	16,376	16,612
M 20 × 1,5	20	19,026	19,144	18,376	18,612
M 22 × 1,5	22	21,026	21,144	20,376	20,612
M 24 × 1,5	24	23,026	23,151	22,376	22,612
M 26 × 1,5	26	25,026	25,151	24,376	24,612
M 27 × 1,5	27	26,026	26,151	25,376	25,612
M 30 × 1,5	30	29,026	29,151	28,376	28,612
M 33 × 1,5	33	32,026	32,151	31,376	31,612
M 36 × 1,5	36	35,026	35,151	34,376	34,612
M 38 × 1,5	38	37,026	37,151	36,376	36,612
M 39 × 1,5	39	38,026	38,151	37,376	37,612
M 42 × 1,5	42	41,026	41,151	40,376	40,612
M 45 × 1,5	45	44,026	44,151	43,376	43,612
M 48 × 1,5	48	47,026	47,158	46,376	46,612
M 52 × 1,5	52	51,026	51,158	50,376	50,612
M 27 × 2	27	25,701	25,841	24,835	25,135
M 30 × 2	30	28,701	28,841	27,835	28,135
M 33 × 2	33	31,701	31,841	30,835	31,135
M 36 × 2	36	34,701	34,841	33,835	34,135
M 39 × 2	39	37,701	37,841	36,835	37,135
M 42 × 2	42	40,701	40,841	39,835	40,135
M 45 × 2	45	43,701	43,841	42,835	43,135
M 48 × 2	48	46,701	46,851	45,835	46,135
M 52 × 2	52	50,701	50,851	49,835	50,135
M 56 × 2	56	54,701	54,851	53,835	54,135
M 60 × 2	60	58,701	58,851	57,835	58.135

6 Inspection

In practice, taper external threads are mostly checked using commercial screw gauges. The end face of the threaded portion is pressed against a step in the gauge (tolerance step), and the limits of size of the thread at the gauge plane are determined, disregarding dimensions *a* and *b* (since these dimensions may be taken as theoretically exact).

Normally, thread diameters are measured at the gauge plane. However, in order to detect any crowning of the thread, the thread dimensions may be checked at the reference plane (or any other plane along the useful thread length).

Gauges should be selected according to the thread parameters that are being checked. For instance, taper screw ring gauges are suitable when checking all thread parameters, whereas parallel screw ring gauges are adequate when only the function of the thread is being checked. In both cases, however, the width of the gauge ring has to be adjusted for the thread design (standard or short). The ring is then screwed on the workpiece and the distance between the end faces of the workpiece and gauge is established. When the ring gauge is provided with a step face, the end face of the workpiece thread is not to protrude beyond this step. (DIN 158-2 specifies parallel ring gauges with tolerance steps, in accordance with ISO 1502.)

Although the incomplete thread of parallel ring gauges must be removed, this may influence the inspection results. For this reason, such gauges are to be regularly checked for wear using taper screw check plugs.

Since gauging and measuring threads may lead to different results, there is a risk of rejection in marginal cases. It is therefore recommended that manufacturers and their clients agree on the method to be used. Where no agreement has been made, results of gauging in accordance with DIN 158-2 shall be decisive.

Explanatory notes

This standard specifies taper external threads with a basic taper of 1 : 16 and a thread profile that is perpendicular to the thread axis. It is more economical to mate taper external threads with the parallel internal threads specified here rather than with taper internal threads, as the former are easier to manufacture.

To cater for thin-walled components that require short thread lengths, a short design of taper external thread has been specified along with the standard design.

The nominal sizes given in table 2 are based on the assumption that the dimensions lie perpendicular to the thread axis at the reference or gauge plane. The limit deviations for the thread diameters have been calculated from the following formula:

$A_g = \pm A_a \times C$, where $C = 1 : 16$, i.e.

$$A_g = \frac{\pm A_a}{16}$$

where

A_g is the thread diameter;

A_a is the deviation for dimensions *a* or *b*;

C is the taper.