ASME B1.20.2M-2006

Pipe Threads, 60 deg, General Purpose

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

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This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this edition.

Periodically, certain actions of the ASME B1 Committee may be published as Cases. Cases are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

This Standard is a metric conversion of the data for NPT inch series taper pipe threads and NPSC inch series straight internal pipe threads. The NPT and NPSC inch threads are included in ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch). Threads and gages delineated herein are interchangeable with those in ANSI/ASME B1.20.1. Tabulated metric values have been converted from values in ANSI/ASME B1.20.1 and rounded in accordance with ASME B1.30, Screw Threads: Standard Practice for Calculating and Rounding Dimensions. Values are given in millimeters.

When compared to values calculated from formulas in this Standard, there may be a difference in the last decimal place but this will not affect interchangeability. The ASME B1 Subcommittee 20 prepared this metric Standard in order to encourage global use of the NPT Pipe Thread. For ease of use, both product threads and gauging are contained in this one Standard. Nonmandatory Appendices A and B are informative only and are not considered a part of this Standard.

ASME B1.20.2M was approved by the American National Standards Institute on December 21, 2006.

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Standardization and Unification of Screw Threads

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B1 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the standard to which the proposed Case applies.

Attending Committee Meetings. The B1 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B1 Standards Committee.

PIPE THREADS, 60 deg, GENERAL PURPOSE

1 SCOPE

This Standard specifies the designations, dimensions, and tolerances and establishes a verification system for 60 deg included angle pipe threads. It is applicable for general purpose pipe and fitting connections. Where pressure-tight joints are required, it is intended that taper pipe threads conforming to this Standard be made up wrench-tight with a sealant. To prevent galling on certain piping materials such as stainless steel, the sealant should contain a lubricant.

Internal parallel (straight) pipe threads, series NPSC, are used with external taper pipe threads, series NPT. Internal taper pipe threads, series NPT, are used with external taper pipe threads, series NPT.

2 REFERENCE AND SYMBOLS

2.1 Reference Standard

The following publication is referenced in this Standard. The latest edition shall apply.

ASME B1.20.1, Pipe Threads, General Purpose (Inch)

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5900; Order Department: 22 Law Drive, P.O. Box 2300, Fairfield, NJ 07007-2300

2.2 Symbols

The following symbols are used (see Fig. 1):

D = outside diameter of pipe
E_0 = basic pitch diameter at small end of external thread (or end of pipe)
E_1 = basic pitch diameter at plane of hand-tight engagement length (L_1), external thread, large end of internal thread
E_2 = basic pitch diameter at plane of effective thread length (L_2), external thread
E_3 = basic pitch diameter at plane of wrench-tight engagement
E_5 = basic pitch diameter at L_5
K_0 = basic minor diameter at small end of external thread (or end of pipe)
L_1 = length of hand-tight engagement between internal and external threads
L_2 = length of effective thread, external thread
L_3 = length of thread beyond L_1 allowing wrench-tight engagement, internal thread; also *wrench makeup*
L_4 = overall length of thread, including vanish thread, external thread
L_5 = length of complete threads, external thread
V = vanish thread(s), allowance for chamfer on tooling or other process of thread production

3 TAPER PIPE THREAD FORM

3.1 Thread Profile

The form of thread profile specified in this Standard shall be known as the Standard Taper Pipe Thread Form. The relations as specified herein for form of thread and general notation are shown in Fig. 2.

3.2 Angle of Thread

The angle between the sides of the thread is 60 deg when measured in an axial plane. The line bisecting this angle is perpendicular to the axis.

3.3 Truncation and Thread Height

The height, H, of the sharp V thread is

$$H = 0{,}866025P$$

where
P = pitch of thread

The basic maximum height of the truncated thread, h, (see Fig. 2) is based on factors entering into the manufacture of cutting tools and the making of tight joints.

$$\text{Maximum } h = 0{,}800000P$$

The crest and root of pipe threads are truncated a minimum of $0{,}033000P$. The maximum depth of truncation for the crest and root of these pipe threads will be found in Table 1. The crest and roots of external and internal threads may be truncated either parallel to the pitch line or parallel to the axis.

The illustration in Fig. 2, giving a sectional view of this standard thread form, represents the truncated thread form by a straight line. However, when closely examined, the crests and roots of commercially manufactured pipe threads appear slightly rounded. When crests and roots of threading tools or chasers lie within the limits shown in Table 1, the pipe threads of products produced by such means are acceptable on the basis of in-process control.

Fig. 1 Standard Taper Pipe Thread Notation

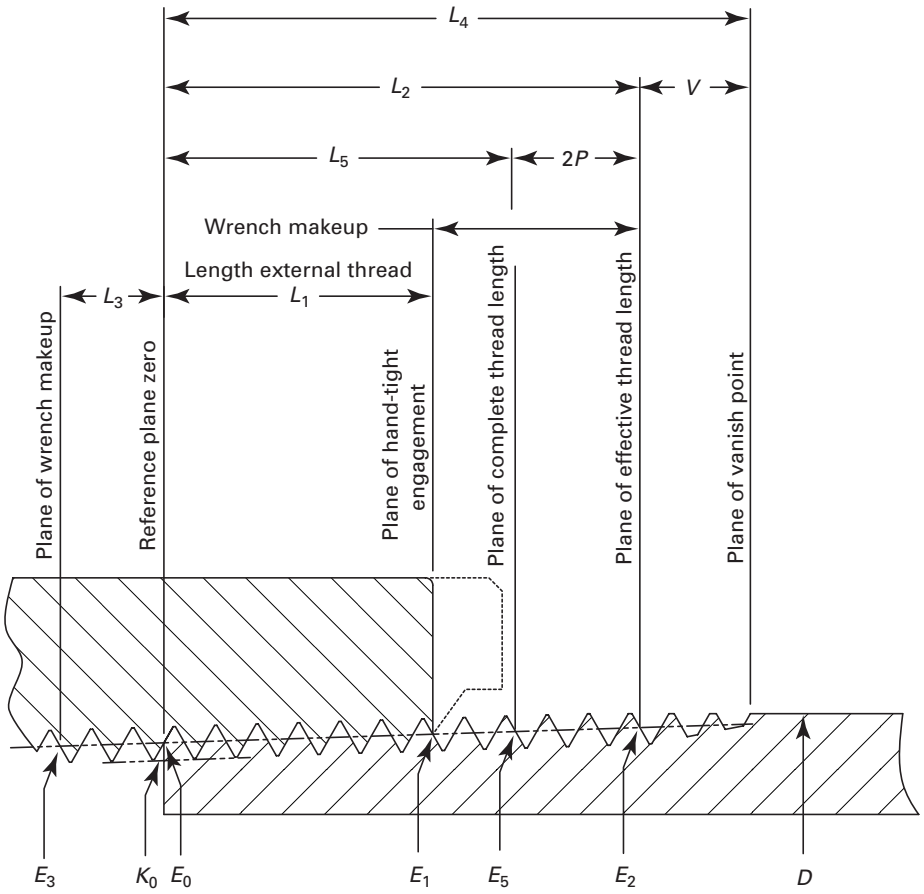
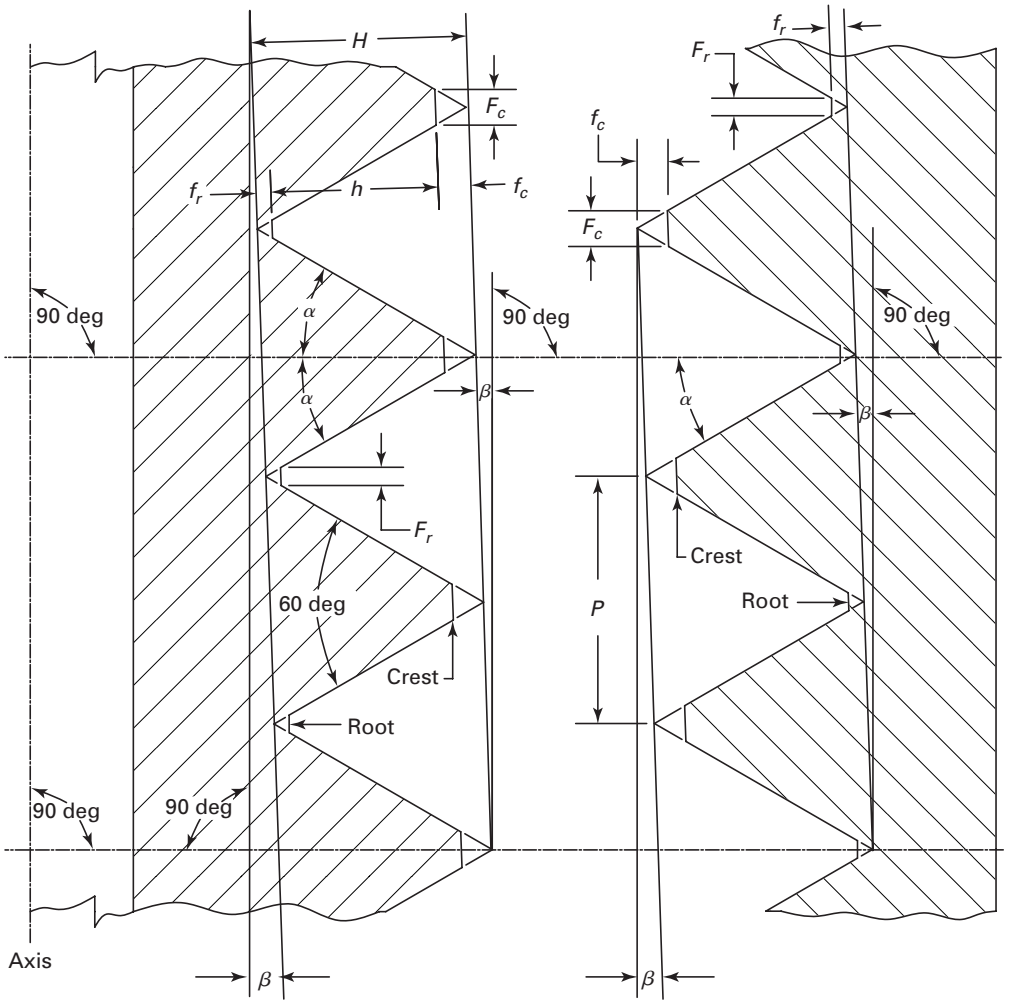


Fig. 2 Basic Profile of Standard Taper Pipe Thread



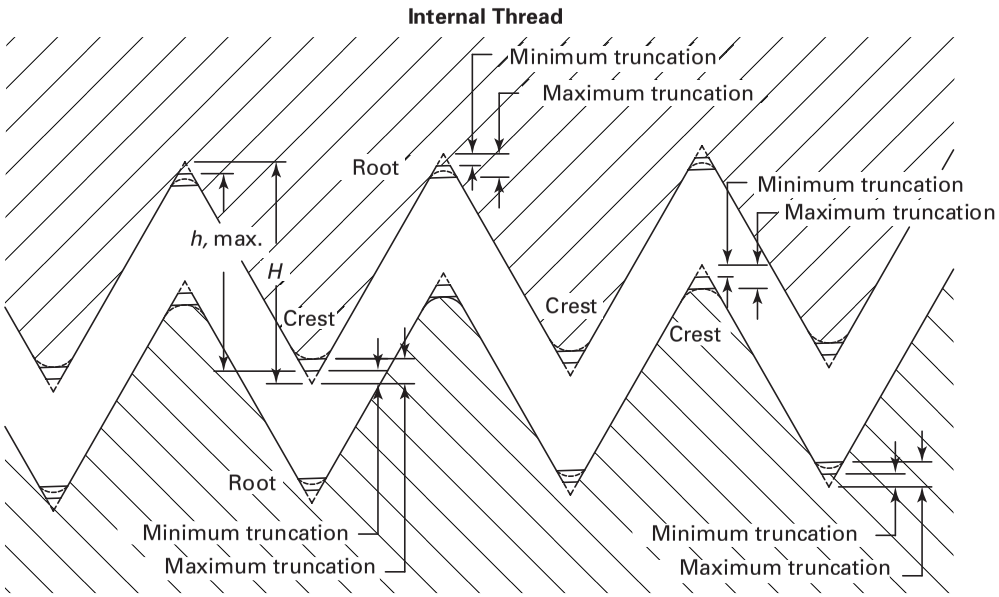
External Thread **Internal Thread**

where

F_c = width of flat at crest
F_r = width of flat at root
f_c = depth of truncation at crest
f_r = depth of truncation at root
H = 0,866025P = height of 60 deg sharp V thread
h = 0,800000P = height of thread on product
n = number of threads per 25,4 mm
P = 25,4/n = pitch (measured parallel to axis)
α = 30 deg = thread flank angle
β = 1° 47′ = thread taper per side

GENERAL NOTE: For a symmetrical parallel screw thread, H = 25,4 (cot α)/2n. For a symmetrical taper screw thread, the exact value for Standard taper pipe thread is H = 0,865743P. For a 3,175 mm pitch thread, which is the coarsest standard taper pipe thread pitch, the corresponding values of H are 2,74873 and 2,74963, the difference being 0,00090 mm. This difference being too small to be significant, the value of H = 0,866025P continues in use for threads of $\frac{1}{16}$ taper on the diameter.

Table 1 Limits on Crest and Root Truncation of Standard External and Internal Taper Pipe Threads



Number of Threads, *n*, per 25,4 mm	Height of Sharp V Thread, *H*, mm	Height of Thread, *h*, mm		Truncation, *f*					Equivalent Width of Flat, *F*				
				Minimum		Maximum		Tolerance	Minimum		Maximum		Tolerance
		Max.	Min.	Formula	mm	Formula	mm	mm	Formula	mm	Formula	mm	mm
1	2	3	4	5	6	7	8	9	10	11	12	13	14
27	0,81483	0,753	0,634	0,033*P*	0,030	0,096*P*	0,091	0,061	0,038*P*	0,036	0,111*P*	0,104	0,068
18	1,22199	1,129	0,974	0,033*P*	0,046	0,088*P*	0,124	0,079	0,038*P*	0,053	0,102*P*	0,145	0,092
14	1,57124	1,451	1,288	0,033*P*	0,061	0,078*P*	0,142	0,081	0,038*P*	0,069	0,090*P*	0,163	0,094
11,5	1,91287	1,767	1,590	0,033*P*	0,074	0,073*P*	0,160	0,086	0,038*P*	0,084	0,084*P*	0,185	0,101
8	2,74955	2,540	2,356	0,033*P*	0,104	0,062*P*	0,198	0,094	0,038*P*	0,122	0,072*P*	0,229	0,107

GENERAL NOTE: The basic dimensions of the Standard Taper Pipe Thread are given in millimeters to three, four, and five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are so expressed for the purpose of eliminating errors in computations.

Fig. 3 Standard Taper Pipe Threads for Pressure-Tight Joints

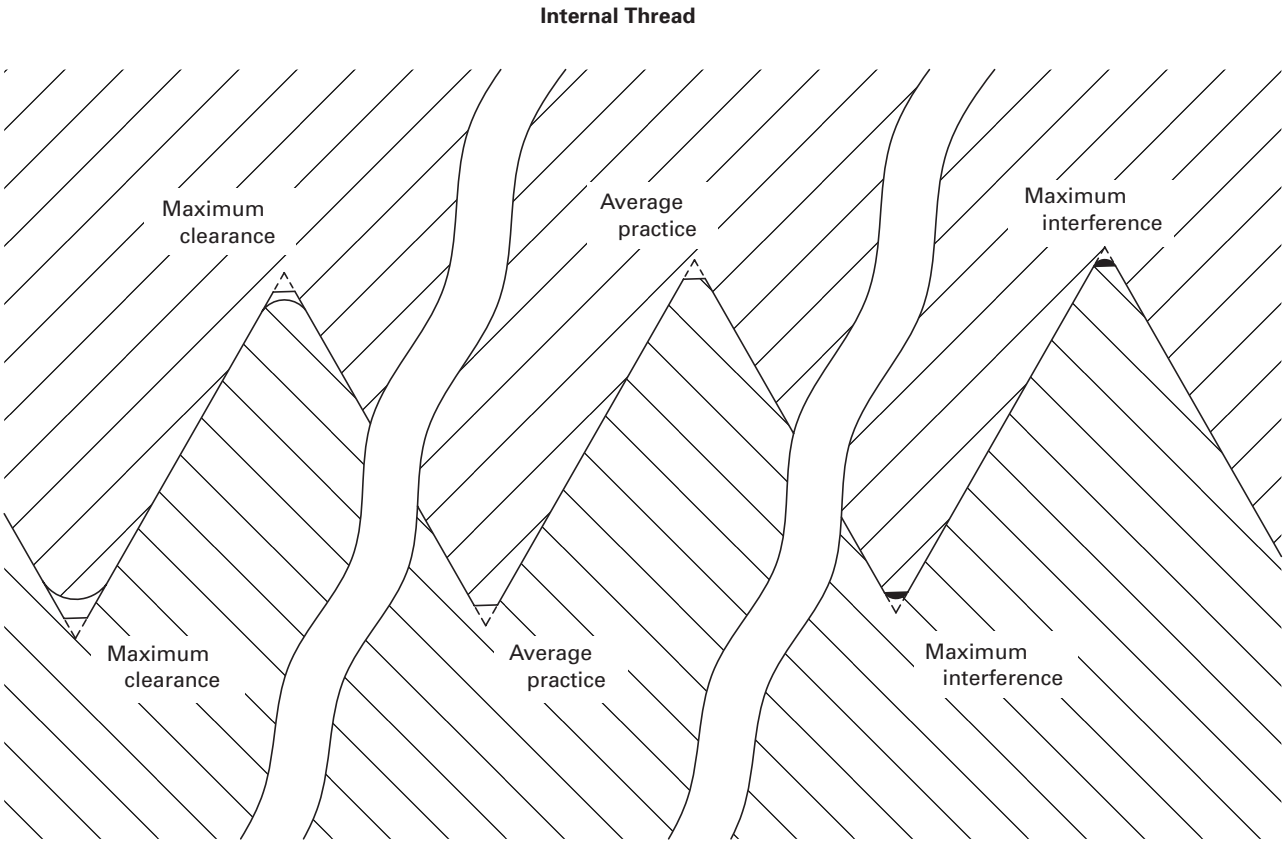


Table 2 Basic Thread Dimensions

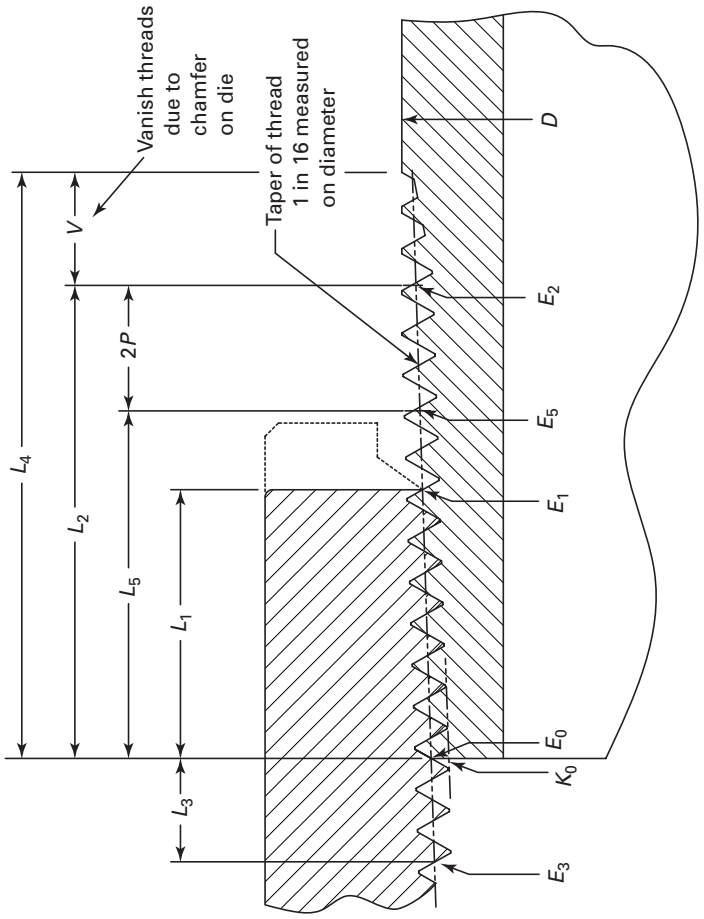


Table 2 Basic Thread Dimensions (Cont'd)

Nom. Pipe Size	Nom. O.D. of Pipe, D, mm	Number of Threads, n, per 25,4 mm	Pitch of Thread, P	Pitch Diam., at Beginning of External Thread, E_0	Hand-tight Engagement			Effective Thread, External			Length, L_1 Plane to L_2 Plane, External Thread ($L_2 - L_1$)		Wrench Makeup Length for Internal Thread			Varnish Thread, V		Overall Length of External Thread, L_4, mm [Note (4)]	Nom. Complete External Threads [Note (5)]		Height of Thread, h	Basic Minor Diam. at Small End of Pipe, K_0	Change in Diam./ Thread ($0{,}0625/n$)
					Length, L_1 [Note (1)]		Pitch Diam. [Note (2)] E_1	Length, L_2 [Note (3)]		Pitch Diam., E_2			Length L_3		Pitch Diam., E_3,				Length, L_5	Diam., E_5			
	mm	mm			mm	Threads		mm	Threads		mm	Threads	mm	Threads	mm	mm	Threads		mm	mm		mm	mm
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1/16	7,9	27	0,941	6,888	4,064	4,32	7,142	6,632	7,05	7,303	2,568	2,73	2,822	3	6,712	3,264	3,47	9,896	4,750	7,185	0,753	6,137	0,059
1/8	10,3	27	0,941	9,233	4,102	4,36	9,489	6,703	7,12	9,652	2,601	2,76	2,822	3	9,057	3,264	3,47	9,967	4,821	9,534	0,753	8,481	0,059
1/4	13,7	18	1,411	12,126	5,786	4,10	12,487	10,206	7,23	12,764	4,420	3,13	4,234	3	11,861	4,897	3,47	15,103	7,384	12,587	1,129	10,996	0,088
3/8	17,1	18	1,411	15,545	6,096	4,32	15,926	10,358	7,34	16,193	4,262	3,02	4,234	3	15,281	4,897	3,47	15,255	7,536	16,016	1,129	14,417	0,088
1/2	21,3	14	1,814	19,264	8,128	4,48	19,772	13,556	7,47	20,111	5,428	2,99	5,443	3	18,924	6,294	3,47	19,850	9,929	19,885	1,451	17,813	0,113
3/4	26,7	14	1,814	24,579	8,611	4,75	25,117	13,861	7,64	25,445	5,250	2,89	5,443	3	24,239	6,294	3,47	20,155	10,234	25,219	1,451	23,127	0,113
1	33,4	11,5	2,209	30,826	10,160	4,60	31,461	17,343	7,85	31,910	7,183	3,25	6,627	3	30,412	7,663	3,47	25,006	12,926	31,634	1,767	29,060	0,138
1 1/4	42,2	11,5	2,209	39,551	10,668	4,83	40,218	17,953	8,13	40,673	7,285	3,30	6,627	3	39,137	7,663	3,47	25,616	13,536	40,397	1,767	37,785	0,138
1 1/2	48,3	11,5	2,209	45,621	10,668	4,83	46,287	18,377	8,32	46,769	7,709	3,49	6,627	3	45,206	7,663	3,47	26,040	13,960	46,493	1,767	43,853	0,138
2	60,3	11,5	2,209	57,633	11,074	5,01	58,325	19,215	8,70	58,834	8,141	3,69	6,627	3	57,219	7,663	3,47	26,878	14,798	58,558	1,767	55,867	0,138
2 1/2	73,0	8	3,175	69,076	17,323	5,46	70,159	28,893	9,10	70,882	11,570	3,64	6,350	2	68,679	11,016	3,47	39,909	22,543	70,485	2,540	66,535	0,198
3	88,9	8	3,175	84,852	19,456	6,13	86,068	30,480	9,60	86,757	11,024	3,47	6,350	2	84,455	11,016	3,47	41,496	24,130	86,360	2,540	82,311	0,198
3 1/2	101,6	8	3,175	97,473	20,853	6,57	98,776	31,750	10,00	99,457	10,897	3,43	6,350	2	97,076	11,016	3,47	42,766	25,400	99,060	2,540	94,933	0,198
4	114,3	8	3,175	110,093	21,438	6,75	111,433	33,020	10,40	112,157	11,582	3,65	6,350	2	109,696	11,016	3,47	44,036	26,670	111,760	2,540	107,554	0,198
5	141,3	8	3,175	136,925	23,800	7,50	138,412	35,720	11,25	139,157	11,920	3,75	6,350	2	136,528	11,016	3,47	46,736	29,370	138,760	2,540	134,384	0,198
6	168,3	8	3,175	163,731	24,333	7,66	165,252	38,418	12,10	166,132	14,084	4,44	6,350	2	163,334	11,016	3,47	49,434	32,068	165,735	2,540	161,191	0,198
8	219,1	8	3,175	214,213	27,000	8,50	215,901	43,498	13,70	216,932	16,497	5,20	6,350	2	213,816	11,016	3,47	54,514	37,148	216,535	2,540	211,673	0,198
10	273,1	8	3,175	267,851	30,734	9,68	269,772	48,895	15,40	270,907	18,161	5,72	6,350	2	267,454	11,016	3,47	59,911	42,545	270,510	2,540	265,311	0,198
12	323,9	8	3,175	318,333	34,544	10,88	320,492	53,975	17,00	321,707	19,431	6,12	6,350	2	317,937	11,016	3,47	64,991	47,625	321,310	2,540	315,793	0,198
14	355,6	8	3,175	349,885	39,675	12,50	352,365	57,150	18,00	353,457	17,475	5,50	6,350	2	349,488	11,016	3,47	68,166	50,800	353,060	2,540	347,345	0,198
16	406	8	3,175	400,368	46,025	14,50	403,244	62,230	19,60	404,257	16,205	5,10	6,350	2	399,971	11,016	3,47	73,246	55,880	403,860	2,540	397,828	0,198
18	457	8	3,175	450,850	50,800	16,00	454,025	67,310	21,20	455,057	16,510	5,20	6,350	2	450,453	11,016	3,47	78,326	60,960	454,660	2,540	448,310	0,198
20	508	8	3,175	501,333	53,975	17,00	504,706	72,390	22,80	505,857	18,415	5,80	6,350	2	500,936	11,016	3,47	83,406	66,040	505,460	2,540	498,793	0,198
24	610	8	3,175	602,298	60,325	19,00	606,068	82,550	26,00	607,457	22,225	7,00	6,350	2	601,901	11,016	3,47	93,566	76,200	607,060	2,540	599,758	0,198

GENERAL NOTE: The basic dimensions of the NPT Standard Taper Pipe Thread are given in millimeters to three, four, and five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gauge dimensions and are so expressed for the purpose of eliminating errors in computations.

NOTES:

(1) Also length of thin ring gauge and length from gauging notch to small end of plug gauge.

(2) Also pitch diameter at gauging notch (hand-tight plane).

(3) Also length of plug gauge.

(4) The length, L_5, from the end of the pipe determines the plane beyond which the thread form is incomplete at the crest. At this plane the cone formed by the crest of the thread intersects the cylinder forming the external surface of the pipe. The next two threads are complete at the root $L_5 = L_2 - 2P$

(5) Reference dimension.

4 SPECIFICATIONS FOR GENERAL PURPOSE TAPER PIPE THREADS, NPT

4.1 Taper Pipe Threads, NPT

NPT threads made in accordance with these specifications consist of an external taper and an internal taper thread, to form the normal type of joint having general application on pipe and fittings. See Fig. 3.

NPT taper pipe threads are intended to be made up wrench-tight and with a sealant whenever a pressure-tight joint is required.

Sealing is affected by out-of-roundness, which is possible between the wrench-tight mated parts in final assembly. This will vary depending on the method for producing the thread in conjunction with the elasticity and/or ductility of the mating parts and the resultant conformance at final assembly.

4.1.1 Thread Designation. NPT taper pipe thread designation shall consist of the following sequence: nominal pipe size; dash; number of threads per 25,4 mm; and "NPT." If the thread is left-handed, add "-LH." Right-handed threads require no special designation.

EXAMPLE: ¼-18 NPT

¼-18 NPT-LH

NOTE: Each letter in the symbol, NPT, has a definite significance as follows: N = National (American) standard, P = Pipe, T = Taper.

4.1.2 Thread Dimensions. Basic dimensions are specified in Table 2. See para. 3.1 for profile.

4.1.3 Taper of Thread. The taper of the thread is 1 in 16 measured on the diameter and along the axis.

4.1.4 Engagement Between External and Internal Taper Threads. The normal length of engagement between external and internal taper threads when screwed together hand-tight is shown in Columns 6 and 7 of Table 2. This length is controlled by the construction and use of the gauges. It is recognized that in special applications, such as flanges for high-pressure work, longer thread engagement is used, in which case the pitch diameter (dimension E_1 in Table 2) is maintained and the pitch diameter, E_0, at the end of the pipe is proportionately smaller.

4.2 Tolerances

4.2.1 Manufacturing Tolerances on Product. The maximum allowable variation in the product is one turn, large or small, from gauges made to the basic dimensions. See paras. 7.1 and 7.2 for gauging.

4.2.2 Tolerances on Thread Elements. The permissible variations in thread elements are given in Table 3. This table is a guide for establishing limits of the thread elements of taps, dies, and thread chasers. Conformance to these limits may be required on product threads, in which case specifications shall require control and checking of thread elements.

On pipe fittings and valves (not steel or high-grade alloys used in critical services) for steam pressures 2,1 MPa and below, it is intended that plug and ring gauge practices as established in this Standard be used in conjunction with tooling control of thread elements, e.g., taps and dies, to provide satisfactory control of functional size. Therefore, no tolerances on thread elements have been established for this class.

For service conditions, where more exact checks are required, procedures have been developed by industry to supplement the standard plug and ring gauge method of gauging.

5 SPECIFICATIONS FOR INTERNAL PARALLEL THREADS IN PIPE COUPLINGS, NPSC

5.1 Parallel Pipe Threads in Pipe Couplings

Threads in pipe couplings made in accordance with these specifications are parallel threads of the same thread form as the Standard Taper Pipe Thread specified in para. 3.1. They are used to form pressure-tight joints when assembled with a NPT external taper pipe thread, and made up wrench-tight with lubricant or sealant.

5.1.1 Thread Designation. Standard parallel pipe thread designation shall consist of the following sequence: nominal pipe size; dash; number of threads per 25,4 mm; and "NPSC." If the thread is left-handed, add "-LH." Right-handed threads require no special designation.

EXAMPLE: ¼-18 NPSC

¼-18 NPSC-LH

NOTE: Each letter in the symbol, NPSC, has a definite significance as follows: N = National (American) standard, P = Pipe, S = Straight (parallel), C = Coupling.

5.1.2 Thread Dimensions. The thread dimensions are specified in Table 4. The pitch diameter limits of size correspond to one and one-half turns, large or small, of the Standard Taper Pipe Thread. The major and minor diameters vary with the pitch diameter, as the Standard Pipe Thread Form is maintained within the truncated tolerances shown in Table 1.

6 GAUGES AND GAUGE TOLERANCES FOR STANDARD PIPE THREAD, NPT

6.1 Design of Gauges

Gauges for Standard Pipe Threads in this Standard provide a functional check and are of the standard type as described below.

Table 3 Tolerances on Taper, Lead, and Angle of Pipe Threads, NPT

Nominal Pipe Size	Number of Threads, *n*, per 25,4 mm	Tolerance, Taper on Pitch Line (1/16 or 3°34′ on Diameter)		Tolerance, Lead in Length of Effective Threads, ±	Tolerance, 60 deg Angle of Threads, deg, ±
		Max.	Min.		
1	2	3	4	5	6
1/16, 1/8	27	+0,36′	−0,18′	0,076	2 1/2
1/4, 3/8	18	+0,36′	−0,18′	0,076	2
1/2, 3/4	14	+0,36′	−0,18′	0,076[1]	2
1, 1 1/4, 1 1/2, 2	11,5	+0,36′	−0,18′	0,076[1]	1 1/2
2 1/2 and larger	8	+0,36′	−0,18′	0,076[1]	1 1/2

GENERAL NOTE: For tolerances on height of thread, see Table 1; for tolerances on functional size, see para. 4.2.1.

NOTE:

(1) The tolerance on lead shall be ±0,003 mm/mm on any size threaded to an effective thread length greater than 25,4 mm.

Table 4 Dimensions, Internal Parallel Threads in Pipe Couplings, NPSC

Nominal Pipe Size	Nominal O.D. of Pipe, *D*	Number of Threads, *n*, per 25,4 mm	Minor Diameter, Minimum	Pitch Diameter [Note (1)]	
				Min.	Max.
1	2	3	4	5	6
1/8	10,3	27	8,636	9,401	9,578
1/4	13,7	18	11,227	12,355	12,619
3/8	17,1	18	14,656	15,794	16,058
1/2	21,3	14	18,161	19,601	19,942
3/4	26,7	14	23,495	24,948	25,288
1	33,4	11,5	29,489	31,255	31,669
1 1/4	42,2	11,5	38,252	40,010	40,424
1 1/2	48,3	11,5	44,323	46,081	46,495
2	60,3	11,5	56,363	58,118	58,532
2 1/2	73,0	8	67,310	69,860	70,457
3	88,9	8	83,236	85,771	86,365
3 1/2	101,6	8	95,936	98,478	99,073
4	114,3	8	108,585	111,135	111,730

NOTE:

(1) Attention is called to the fact that the actual pitch diameter of the parallel thread will be slightly smaller than the value given when gauged with a taper plug gauge as specified in para. 9.1.

6.1.1 Standard Type Gauges. A set of standard or basic type gauges consists of a taper-threaded plug gauge and a taper-threaded ring gauge. See Figs. 4 and 5. The plug gauges are made to dimensions given in Table 5 with a gauging notch located a distance L_1 from the small end. The L_1 ring gauge has a length equal to dimension L_1. The roots of the threads on these gauges shall clear 0,0381P width. A sharp V or undercut clearance is acceptable.

The crests are to be truncated an amount equal to 0,140P for 27 threads per 25,4 mm; 0,109P for 18 threads per 25,4 mm; 0,100P for 14 threads per 25,4 mm; $11\frac{1}{2}$ threads per 25,4 mm; and 8 threads per 25,4 mm threads (see Fig. 5).

It is noted that these gauges are truncated at the crests and cleared at the roots, so that they bear only on the flanks of the thread. Thus, they do not check the root truncations or crest truncations specified in Table 1. When it is deemed necessary to determine whether or not such truncations are within the specified limits, it is necessary to make further inspection. For this purpose, inspection by optical projection is suggested.

Partial end threads shall be removed on both ends of the ring gauge and on the small end of the plug gauge to full form profile in order to avoid possible seating error from bent or malformed feathered edges.

6.1.2 Marking of Gauges. Each gauge shall be marked so as to indicate clearly the nominal size of pipe; threads per 25,4 mm; and series designation "NPT."

6.2 Classes of Gauges

Gauges of the following types may be used to completely cover gauge requirements:

(a) master gauges used to check working gauges

(b) working gauges used to check threads during manufacture and for conformance inspection

6.2.1 Master Gauges. The set of master gauges consists of an L_1 taper-threaded plug gauge and an L_1 taper-threaded ring gauge (see Figs. 4 and 5). The plug gauge is made to dimensions specified in Table 5. It is constructed of hardened steel with a gauging notch located a distance L_1 (see Table 2) from the small end. The ring gauge has a length equal to dimension L_1 specified in Table 5. This ring is fitted to its mating plug, seating flush at the notch within ±0,051 mm for sizes $\frac{1}{16}$ to 2 inclusive; ±0,076 mm for sizes $2\frac{1}{2}$ to 12 inclusive; and within ±0,127 mm for size 14 and larger. The roots of the threads on these ring gauges shall clear a 0,0381P flat or may be undercut beyond a sharp V. The crests of the plug and ring gauge are truncated 0,100P. The set of master gauges is used for checking working gauges (see para. 6.3.2). A supplementary check by optical means should be made of flank angle and form.

CAUTION: It should be understood that only a specifically matched set of master gauges (L_1 plug and L_1 ring) can be expected to mate with each other within the tolerance specified. There are many characteristics or variations in gauge elements that may combine to cause a significant standoff difference between master gauges which are not specifically matched.

6.2.2 Working Gauges. Each set of working gauges consists of an L_1 taper-threaded ring gauge and an L_1 taper-threaded plug gauge and is used for checking the product. These gauges are made of hardened steel or equivalent material to dimensions given in Table 5 (see para. 6.3.2 for tolerance). In locating the basic notch of the plug gauge, the plane of the notch should intersect the crest of the thread.

6.3 Gauge Tolerances

In the manufacture of gauges, variations from basic dimensions are unavoidable. Furthermore, gauges will wear in use. In order to fix the maximum allowable variations of gauges, tolerances have been established. See Table 6 and para. 6.3.2.

6.3.1 Master Gauge Tolerances. The set of master gauges should be made to the basic dimensions as accurately as possible, but in no case shall the cumulative variation exceed one-half of the total cumulative tolerance in Columns 13 and 14 of Table 6. Each master gauge should be accompanied by a record of the measurement of all elements of the thread and the standoff of master plug to master ring (large end of ring gauge to basic notch of plug gauge).

6.3.2 Working Gauge Tolerance. All gauges applied to the product thread, whether in manufacture or inspection, are designated as working gauges. All working gauges should be made to the basic dimensions specified in Table 7 and within tolerances specified in Table 6. The maximum wear on a working gauge shall not be more than the equivalent of one-quarter turn from its original dimensions, as determined by its master gauge.

6.4 Relation of Lead and Angle Variations to Pitch Diameter Tolerance of Gauges

When it is necessary to compute from measurements the decimal part of a turn that a gauge varies from the basic dimensions, Tables 7 and 8 should be used. Table 7 gives the correction in diameter for lead variations and Table 8 gives the correction in diameter for angle variations. These corrections are always added to the pitch diameter in the case of external threads and subtracted in the case of internal threads regardless of whether the lead or angle variations are plus or minus.

The diameter equivalent for lead and angle variations plus the pitch diameter variation multiplied by 16 gives the longitudinal variation from basic at the gauging notch. This longitudinal variation divided by the pitch equals the decimal part of a turn that the gauge varies from basic at the gauging notch.

7 GAUGING OF TAPER PIPE THREAD, NPT

7.1 Gauging External Taper Threads

In gauging external taper threads the L_1 ring gauge, Fig. 6, is screwed hand-tight on the pipe or external thread. The thread is within the permissible tolerance when the gauging face of the working ring gauge is not more than one turn, large or small, from being flush with the end of the thread, as indicated in Fig. 6.

7.2 Gauging Internal Taper Threads

In gauging internal taper threads the L_1 plug gauge, Fig. 4, is screwed hand-tight into the fitting or coupling. The thread is within the permissible tolerance when the gauging notch of the working plug gauge is not more than one turn, large or small, from being flush with the end of the thread, as indicated in Fig. 7.

7.3 Gauging Practice

7.3.1 Seating of Gauge. In gauging pipe threads it is common practice to tap or rap the part to assure proper seating of the gauge in or on the product thread. However, it is first necessary to clean both the gauge and the product threads so that they are free of chips, burrs, abrasives, or other foreign materials.

7.3.2 Supplemental Gauging. Gauging of both internal and external threads by use of the L_1 plug and ring gauges, illustrated by Figs. 6 and 7, serves as functional verification of hand-tight L_1 engagement threads. However, conformance to this Standard requires that all basic design dimensions be met within applicable tolerances including extension of the thread elements to provide for wrench-tight makeup. Therefore, in controlling manufacturing practices or as otherwise required, additional methods of measuring or gauging may be employed to supplement L_1 gauging. If additional methods of gauging must be employed to evaluate conformance to the design dimensions, they shall be agreed upon by the supplier and the purchaser. See sections 6, 7, and 8 for gauges and gauging requirements.

NOTE: Nonmandatory Appendix A provides information on inspection of pipe threads using the Turns of Engagement method of gauging.

7.4 Treatment of Chamfers, Recesses, Counterbores, and Thread Extensions

The reference point for gauging product thread depends on the chamfer diameter.

(a) For an internal thread with a chamfer diameter not exceeding the major diameter, the reference point is the end of the fitting. See Fig. 8.

(b) For an internal thread with a chamfer diameter larger than the major diameter, the reference point is the last scratch of the chamfer cone. See Fig. 8.

(c) The reference point for gauging or measuring external product threads is the end of the pipe or fitting. See Fig. 8.

(d) Recesses and counterbores must be accounted for when gauging internal threads. Extensions to external threads must be accounted for when gauging external threads.

7.5 Acceptability

A product thread meets the gauging requirements of this Standard when it is accepted by any one gauge that conforms to this Standard.

8 GAUGING OF NPSC PARALLEL PIPE THREADS

Taper L_1 thread gauges shall be used to gauge parallel internal pipe threads forming part of pressure-tight joints where the external thread is NPT.

The plane of the gauging notch on the Standard Taper Pipe Thread plug gauge shall come flush with the end of the Standard Coupling Straight Pipe Thread (NPSC) (see Table 4) or flush with the last thread scratch on the chamfer cone if chamfered with an internal chamfer diameter in excess of the major diameter of the internal thread [see Fig. 8, illustration (b)]. A tolerance of one and one-half turns, large or small, to gauge shall be allowed.

CAUTION: When using a tapered thread plug gauge in a parallel internal thread, nonuniformity of gauge wear is a particular problem; therefore, taper plug gauges used for this application should be checked by direct measurement of thread form and size in addition to checking against a master.

Fig. 4 NPT Standard Taper Pipe Thread Plug and Ring Gauges

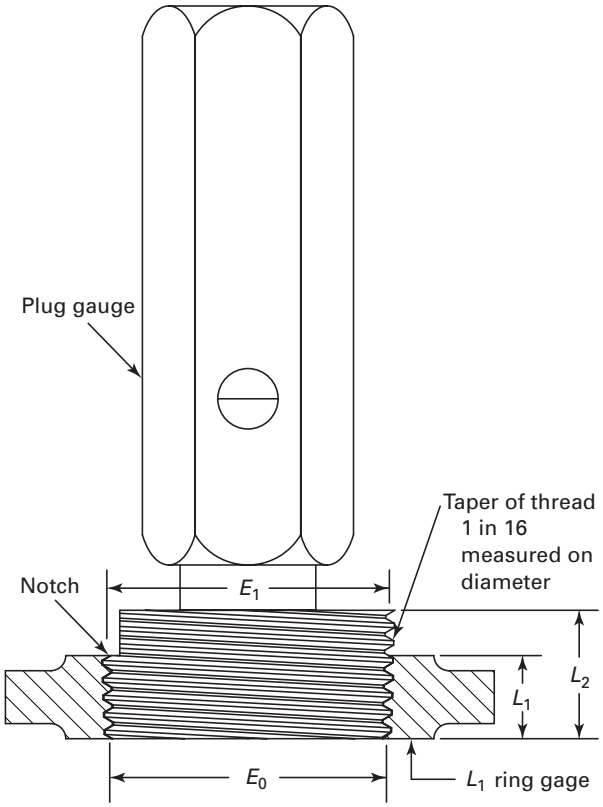
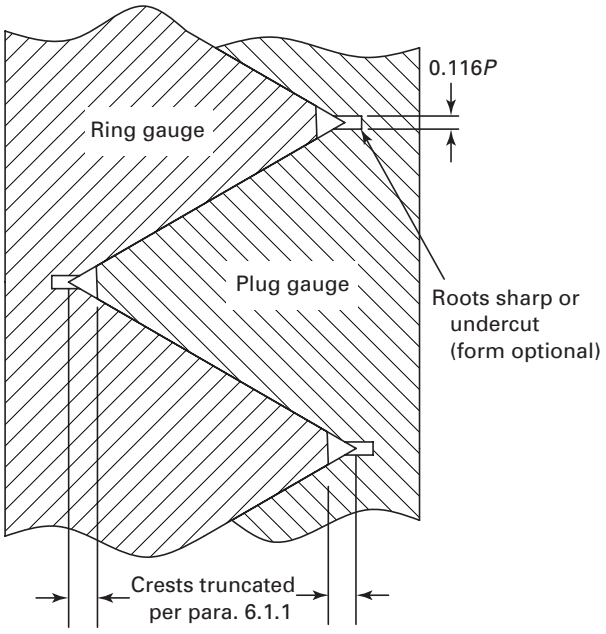


Fig. 5 Suggested Form of Gauge Thread



GENERAL NOTE: Root must clear 0,038100P width.

Fig. 6 Gauging External Taper Threads With Ring Gauge

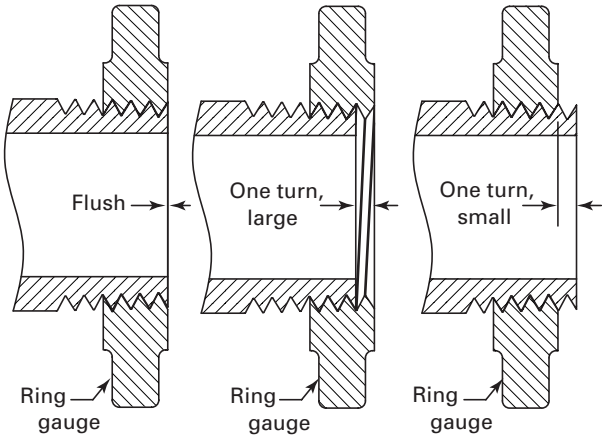


Fig. 7 Gauging Internal Taper Threads With Plug Gauge

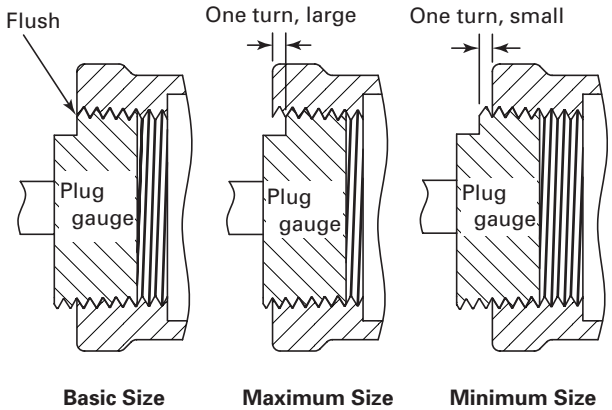


Table 5 Basic Dimensions of Plug and Ring Gauges for NPT Threads

Nominal Pipe Size	Nominal O.D. of Pipe, D	Number of Threads, n, per 25,4 mm	Pitch, P	Major Diameters of Plug Gauges			Pitch Diameters of Plug and Ring Gauges			Minor Diameters of Ring Gauges		Increase in Diam./Thread, 0,0625/n	Thickness of Ring, L_1
				At Small End Plane, E_0	At Gauging Notch Plane, E_1	At Large End Plane, E_2	At Small End, E_0	At Gauging Notch, E_1	At End Plug Gauge, E_2	At Small End, E_0	At Gauging Notch Plane, E_1		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1/16	7,9	27	0,94082	7,439	7,693	7,854	6,888	7,142	7,302	6,337	6,591	0,059	4,064
1/8	10,3	27	0,94082	9,785	10,041	10,203	9,233	9,489	9,652	8,682	8,938	0,059	4,102
1/4	13,7	18	1,41122	13,040	13,402	13,678	12,126	12,487	12,764	11,211	11,573	0,088	5,786
3/8	17,1	18	1,41122	16,459	16,840	17,107	15,545	15,926	16,193	14,631	15,012	0,088	6,096
1/2	21,3	14	1,81432	20,472	20,980	21,320	19,264	19,772	20,111	18,056	18,564	0,113	8,128
3/4	26,7	14	1,81432	25,787	26,326	26,654	24,579	25,117	25,445	23,371	23,909	0,113	8,611
1	33,4	11,5	2,20878	32,297	32,932	33,381	30,826	31,461	31,910	29,355	29,990	0,138	10,160
1 1/4	42,2	11,5	2,20878	41,022	41,689	42,144	39,551	40,218	40,673	38,080	38,747	0,138	10,668
1 1/2	48,3	11,5	2,20878	47,092	47,758	48,240	45,621	46,287	46,769	44,150	44,816	0,138	10,668
2	60,3	11,5	2,20878	59,104	59,796	60,305	57,633	58,325	58,834	56,162	56,854	0,138	11,074
2 1/2	73,0	8	3,17500	71,191	72,273	72,997	69,076	70,159	70,882	66,962	68,044	0,198	17,323
3	88,9	8	3,17500	86,967	88,182	88,872	84,852	86,068	86,757	82,737	83,953	0,198	19,456
3 1/2	101,6	8	3,17500	99,587	100,891	101,572	97,473	98,776	99,457	95,358	96,661	0,198	20,853
4	114,3	8	3,17500	112,208	113,548	114,272	110,093	111,433	112,157	107,978	109,318	0,198	21,438
5	141,3	8	3,17500	139,039	140,527	141,272	136,925	138,412	139,157	134,810	136,297	0,198	23,800
6	168,3	8	3,17500	165,845	167,366	168,247	163,731	165,252	166,132	161,616	163,137	0,198	24,333
8	219,1	8	3,17500	216,328	218,015	219,047	214,213	215,901	216,932	212,099	213,786	0,198	27,000
10	273,1	8	3,17500	269,966	271,886	273,022	267,851	269,772	270,907	265,736	267,657	0,198	30,734
12	323,9	8	3,17500	320,448	322,607	323,822	318,333	320,492	321,707	316,219	318,378	0,198	34,544
14	355,6	8	3,17500	352,000	354,479	355,572	349,885	352,365	353,457	347,770	350,250	0,198	39,675
16	406	8	3,17500	402,482	405,359	406,372	400,368	403,244	404,257	398,253	401,130	0,198	46,025
18	457	8	3,17500	452,965	456,140	457,172	450,850	454,025	455,057	448,735	451,910	0,198	50,800
20	508	8	3,17500	503,447	506,821	507,972	501,333	504,706	505,857	499,218	502,591	0,198	53,975
24	610	8	3,17500	604,412	608,182	609,572	602,298	606,068	607,457	600,183	603,953	0,198	60,325

GENERAL NOTE: The major diameters of the plug gauges and the minor diameters of the ring gauges are based upon the truncation specified in para. 6.1.1.

Table 6 Tolerances for NPT Working Plug and Ring Gauges

Nominal Pipe Size	O.D. of Pipe, *D*, mm	Number of Threads, *n*, per 25,4 mm	Tolerance on Pitch Diameter [Note (1)], ±, mm	Tolerance on Lead, [Notes (2), (3)]		Tolerance on Half Angle, [Note (4)]		Tolerance on Taper [Notes (3), (5)]		Tolerance on Major Diameter	Tolerance on Minor Diameter	Total Cumulative Tolerances on Pitch Diameter		Standoff Between Plug and Ring Gauges at Gauging Notch for Dimensions at Opposite Extreme Tolerance Limits, [Note (6)], mm
				Plugs, mm	Rings, mm	Plugs (±), minutes	Rings (±), minutes	Plugs (±), mm	Rings (–), mm	Plugs (–), mm	Rings (+), mm	Plugs, mm	Rings, mm	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1/16	7,9	27	0,005	0,005	0,008	15	20	0,008	0,015	0,010	0,010	0,020	0,030	0,813
1/8	10,3	27	0,005	0,005	0,008	15	20	0,008	0,015	0,010	0,010	0,020	0,030	0,813
1/4	13,7	18	0,005	0,005	0,008	15	20	0,010	0,018	0,015	0,015	0,023	0,034	0,914
3/8	17,1	18	0,005	0,005	0,008	15	20	0,010	0,018	0,015	0,015	0,023	0,034	0,914
1/2	21,3	14	0,008	0,005	0,008	10	15	0,015	0,023	0,025	0,025	0,025	0,036	0,965
3/4	26,7	14	0,008	0,005	0,008	10	15	0,015	0,023	0,025	0,025	0,025	0,036	0,965
1	33,4	11,5	0,008	0,008	0,010	10	15	0,020	0,030	0,025	0,025	0,031	0,043	1,194
1 1/4	42,2	11,5	0,008	0,008	0,010	10	15	0,020	0,030	0,025	0,025	0,031	0,043	1,194
1 1/2	48,3	11,5	0,008	0,008	0,010	10	15	0,020	0,030	0,025	0,025	0,031	0,043	1,194
2	60,3	11,5	0,008	0,008	0,010	10	15	0,020	0,030	0,025	0,025	0,031	0,043	1,194
2 1/2	73,0	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
3	88,9	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
3 1/2	101,6	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
4	114,3	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
5	141,3	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
6	168,3	8	0,013	0,010	0,013	7	10	0,025	0,036	0,041	0,041	0,040	0,054	1,499
8	219,1	8	0,013	0,010	0,013	7	10	0,025	0,036	0,051	0,051	0,040	0,054	1,499
10	273,1	8	0,013	0,010	0,013	7	10	0,025	0,036	0,051	0,051	0,040	0,054	1,499
12	323,9	8	0,013	0,010	0,013	7	10	0,025	0,036	0,051	0,051	0,040	0,054	1,499
14	355,6	8	0,020	0,013	0,015	7	10	0,025	0,036	0,076	0,076	0,052	0,069	1,930
16	406	8	0,020	0,013	0,015	7	10	0,025	0,036	0,076	0,076	0,052	0,069	1,930
18	457	8	0,020	0,013	0,015	7	10	0,025	0,036	0,076	0,076	0,052	0,069	1,930
20	508	8	0,020	0,013	0,015	7	10	0,025	0,036	0,076	0,076	0,052	0,069	1,930
24	610	8	0,020	0,013	0,015	7	10	0,025	0,036	0,076	0,076	0,052	0,069	1,930

Table 6 Tolerances for NPT Working Plug and Ring Gauges (Cont'd)

GENERAL NOTES:

(a) The large end of the master ring gauge shall be flush with the gauging notch of its master plug when assembled hand-tight within ±0,051 for sizes $\frac{1}{16}$ to 2 inclusive, within ±0,076 for sizes $2\frac{1}{2}$ to 12 inclusive, and within ±0,127 for sizes 14 and larger.

(b) The tolerances for the length L_1 from small end to gauging notch of the plug gauge (see Fig. 4) shall be +0,000/−0,025 for sizes $\frac{1}{16}$ to 2 inclusive, and +0,000/−0,025 for sizes $2\frac{1}{2}$ and larger.

(c) The tolerance for the overall length L_2 of the plug gauge (see Fig. 4) shall be +1,270/−0,000 for all sizes.

(d) The tolerances for the thickness L_1 of the ring gauge (see Fig. 4) shall be −0,000/+0,025 for sizes $\frac{1}{16}$ to 2 inclusive, and −0,000/+0,051 for sizes $2\frac{1}{2}$ and larger.

NOTES:

(1) To be measured at the gauging notch of plug gauge.

(2) Allowable variation in lead between any two threads in L_1 length of gauge (see Fig. 4).

(3) The lead and taper on plug and ring gauges shall be measured along the pitch line, omitting incomplete threads at each end.

(4) In solving for the correction in diameter for angle variations, the average variation in half-angle for the two sides of thread regardless of their signs should be taken.

(5) Allowable variation in taper in L_1 length of gauge (see Fig. 4).

(6) Maximum possible interchange standoff, any ring against any plug other than its master plug, may occur when taper variations are zero and all other dimensions are at opposite extreme tolerance limits. Average standoff should be well within these maximum limits.

Table 7 Diameter Equivalent of Variation in Lead for Tools and Gauges

Variation, ΔP_h [Note (1)]	0,0000	0,0001	0,0002	0,0003	0,0004	0,0005	0,0006	0,0007	0,0008	0,0009
1	2	3	4	5	6	7	8	9	10	11
0,000	0,0000	0,0002	0,0003	0,0005	0,0007	0,0009	0,0010	0,0012	0,0014	0,0016
0,001	0,0017	0,0019	0,0021	0,0023	0,0024	0,0026	0,0028	0,0029	0,0031	0,0033
0,002	0,0035	0,0036	0,0038	0,0040	0,0042	0,0043	0,0045	0,0047	0,0048	0,0050
0,003	0,0052	0,0054	0,0055	0,0057	0,0059	0,0061	0,0062	0,0064	0,0066	0,0068
0,004	0,0069	0,0071	0,0073	0,0074	0,0076	0,0078	0,0080	0,0081	0,0083	0,0085
0,005	0,0087	0,0088	0,0090	0,0092	0,0094	0,0095	0,0097	0,0099	0,0100	0,0102
0,006	0,0104	0,0106	0,0107	0,0109	0,0111	0,0113	0,0114	0,0116	0,0118	0,0120
0,007	0,0121	0,0123	0,0125	0,0126	0,0128	0,0130	0,0132	0,0133	0,0135	0,0137
0,008	0,0139	0,0140	0,0142	0,0144	0,0145	0,0147	0,0149	0,0151	0,0152	0,0154
0,009	0,0156	0,0158	0,0159	0,0161	0,0163	0,0165	0,0166	0,0168	0,0170	0,0171
0,010	0,0173	0,0175	0,0177	0,0178	0,0180	0,0182	0,0184	0,0185	0,0187	0,0189
0,011	0,0191	0,0192	0,0194	0,0196	0,0197	0,0199	0,0201	0,0203	0,0204	0,0206
0,012	0,0208	0,0210	0,0211	0,0213	0,0215	0,0217	0,0218	0,0220	0,0222	0,0223
0,013	0,0225	0,0227	0,0229	0,0230	0,0232	0,0234	0,0236	0,0237	0,0239	0,0241
0,014	0,0242	0,0244	0,0246	0,0248	0,0249	0,0251	0,0253	0,0255	0,0256	0,0258
0,015	0,0260	0,0262	0,0263	0,0265	0,0267	0,0268	0,0270	0,0272	0,0274	0,0275
0,016	0,0277	0,0279	0,0281	0,0282	0,0284	0,0286	0,0288	0,0289	0,0291	0,0293
0,017	0,0294	0,0296	0,0298	0,0300	0,0301	0,0303	0,0305	0,0307	0,0308	0,0310
0,018	0,0312	0,0314	0,0315	0,0317	0,0319	0,0320	0,0322	0,0324	0,0326	0,0327
0,019	0,0329	0,0331	0,0333	0,0334	0,0336	0,0338	0,0339	0,0341	0,0343	0,0345
0,020	0,0346	0,0348	0,0350	0,0352	0,0353	0,0355	0,0357	0,0359	0,0360	0,0362
0,021	0,0364	0,0365	0,0367	0,0369	0,0371	0,0372	0,0374	0,0376	0,0378	0,0379
0,022	0,0381	0,0383	0,0385	0,0386	0,0388	0,0390	0,0391	0,0393	0,0395	0,0397
0,023	0,0398	0,0400	0,0402	0,0404	0,0405	0,0407	0,0409	0,0410	0,0412	0,0414
0,024	0,0416	0,0417	0,0419	0,0421	0,0423	0,0424	0,0426	0,0428	0,0430	0,0431
0,025	0,0433	0,0435	0,0436	0,0438	0,0440	0,0442	0,0443	0,0445	0,0447	0,0449

GENERAL NOTES:

(a) Diameter equivalent = $1{,}732050\Delta P_h$ where ΔP_h = variation in lead between any two threads.

(b) Values are given in millimeters at 20°C.

NOTE:

(1) Find diameter equivalent of variation by locating the first three decimal places of variation in Column 1 and coordinating with the fourth decimal place of variation found in Columns 2 through 11.

Table 8 Diameter Equivalent of Variation in Half Included Angle of Thread for Tools and Gauges

Variation, $\Delta\alpha$, Minutes [Note (1)]	8 Threads per 25,4 mm	11,5 Threads per 25,4 mm	14 Threads per 25,4 mm	18 Threads per 25,4 mm	27 Threads per 25,4 mm
1	2	3	4	5	6
1	0,0015	0,0010	0,0008	0,0005	0,0005
2	0,0028	0,0020	0,0015	0,0013	0,0008
3	0,0043	0,0030	0,0025	0,0018	0,0013
4	0,0056	0,0041	0,0033	0,0025	0,0018
5	0,0071	0,0048	0,0041	0,0030	0,0020
6	0,0086	0,0058	0,0048	0,0038	0,0025
7	0,0099	0,0069	0,0056	0,0043	0,0030
8	0,0114	0,0079	0,0066	0,0051	0,0033
9	0,0127	0,0089	0,0074	0,0056	0,0038
10	0,0142	0,0099	0,0081	0,0064	0,0043
11	0,0157	0,0109	0,0089	0,0069	0,0046
12	0,0170	0,0119	0,0097	0,0076	0,0051
13	0,0185	0,0130	0,0107	0,0081	0,0056
14	0,0198	0,0137	0,0114	0,0089	0,0058
15	0,0213	0,0147	0,0122	0,0094	0,0064
16	0,0226	0,0157	0,0130	0,0102	0,0069
17	0,0241	0,0168	0,0137	0,0107	0,0071
18	0,0257	0,0178	0,0147	0,0114	0,0076
19	0,0269	0,0188	0,0155	0,0119	0,0079
20	0,0284	0,0198	0,0163	0,0127	0,0084
21	0,0297	0,0208	0,0170	0,0132	0,0089
22	0,0312	0,0218	0,0178	0,0140	0,0091
23	0,0328	0,0226	0,0188	0,0145	0,0097
24	0,0340	0,0236	0,0196	0,0152	0,0102
25	0,0356	0,0246	0,0203	0,0157	0,0104
26	0,0368	0,0257	0,0211	0,0165	0,0109
27	0,0384	0,0267	0,0218	0,0170	0,0114
28	0,0399	0,0277	0,0226	0,0178	0,0117
29	0,0411	0,0287	0,0236	0,0183	0,0122
30	0,0427	0,0297	0,0244	0,0191	0,0127
45	0,0640	0,0445	0,0366	0,0284	0,0191
50	0,0853	0,0592	0,0488	0,0378	0,0251

GENERAL NOTES:

(a) In solving for the diameter equivalent of angle variations, the average variation in half included angle for the two sides of the thread should be taken regardless of their signs.

(b) Table is based on a NPT gauge with 0,1P root/crest truncation with half-angle variations. For other gauges with equal truncations, multiply by

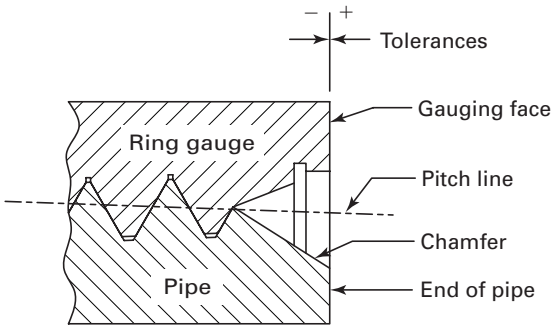
$$\frac{0{,}866P - 2\ (\text{truncation})}{0{,}6667P}$$

(c) Values are given in millimeters at 20°C.

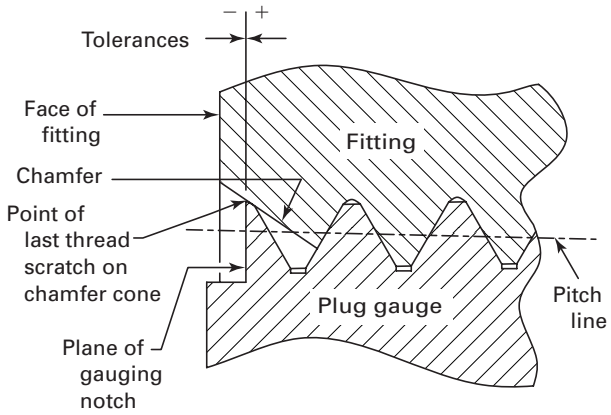
NOTE:

(1) Diameter equivalent = (0.1538120P) tan $\Delta\alpha$ = variation in half included angle of thread expressed in minutes.

Fig. 8 Gauging of Chamfered Threads



(a) Enlarged View Showing Chamfered External Thread of Basic Size



(b) Enlarged View Showing Chamfered Internal Thread of Basic Size With Chamfer Exceeding the Major Diameter

GENERAL NOTES:

(a) The plane of the gauging notch should intersect the crest of thread on the gauge.

(b) The chamfer illustrated is at a 45 deg angle and is approximately $\frac{1}{2}$ pitch in depth. However, these details are given only for information on the illustration shown.

(c) The reference point for the internal thread is the starting end of the fitting, providing the chamfer does not exceed the major diameter of the internal thread. When the chamfer exceeds the major diameter, the reference point becomes the last thread scratch on the chamfer cone as illustrated. Allowance must be made for depth of counterbore on counterbored fittings.

(d) The reference point of the external thread is the end of the pipe or fitting.

NONMANDATORY APPENDIX A
THE TURNS OF ENGAGEMENT METHOD OF VERIFYING PRODUCT THREADS

A-1 GENERAL

The Turns of Engagement method of verification of taper threads determines that there is an adequate number of threads available at hand-tight engagement.

The L_1 gauge (plug or ring) and product are screwed together, hand-tight. The turns to remove the L_1 gauge from the product thread are counted and must be within the tolerance of "basic number of turns," plus or minus one turn.

The basic turns of engagement (in the absence of chamfers) are found in Column 7 of Table 2. Since this table is theoretical, actual basic turns of engagement should be agreed upon by the supplier and the user. Gauges made with convoluted starting and ending threads will yield less turns of engagement than chamfered gauges.

NONMANDATORY APPENDIX B
TAP DRILL SIZES

B-1 GENERAL

Holes prepared for tapping can be either straight or tapered. Both are acceptable as long as the product standards for thread dimensions are met after tapping. The minor diameter of the product threads should be cut by the tap minor diameter to ensure concentricity with the pitch diameter, as well as to generate the proper thread height and truncations. The actual hole size prior to tapping is dependent on many variables and should approximate the diameter K_0, Column 23 of Table 2 (Basic Minor Diameter at Small End of Pipe). Hole sizes may vary from K_0, so the tap can cut an acceptable pipe thread with the required thread height in the L_1 length.

B1 OTHER STANDARDS FOR SCREW THREADS

Unified Inch Screw Threads (UN and UNR Thread Form) B1.1-2003
Gages and Gaging for Unified Inch Screw Threads B1.2-1983 (R2001)
Screw Thread Gaging Systems for Dimensional Acceptability —
Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ) B1.3M-1992 (R2001)
Acme Screw Threads B1.5-1997 (R2004)
Screw Threads: Nomenclature, Definitions, and Letter Symbols B1.7-2006
Stub Acme Screw Threads B1.8-1988 (R2001)
Buttress Inch Screw Threads 7°/45° Form With 0.6 Pitch Basic Height of Thread Engagement B1.9-1973 (R2001)
Unified Miniature Screw Threads B1.10M-2004
Microscope Objective Thread B1.11-1958 (R2001)
Class 5 Interference-Fit Thread B1.12-1987 (R2003)
Metric Screw Threads: M Profile B1.13M-2005
Unified Inch Screw Threads (UNJ Thread Form) B1.15-1995
Gages and Gaging for Metric M Screw Threads B1.16M-1984 (R2001)
Pipe Threads, General Purpose (Inch) B1.20.1-1983 (R2001)
Pipe Threads, 60 deg, General Purpose B1.20.2M-2006
Dryseal Pipe Threads (Inch) B1.20.3-1976 (R2003)
Gaging for Dryseal Pipe Threads (Inch) B1.20.5-1991 (R2004)
Hose Coupling Screw Threads (Inch) B1.20.7-1991 (R2003)
Metric Screw Threads: MJ Profile B1.21M-1997 (R2003)
Gages and Gaging for MJ Series Metric Screw Threads B1.22M-1985 (R2001)
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