Designation: F1498 – 08 (Reapproved 2012)ε1

Standard Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings[1]

This standard is issued under the fixed designation F1498; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Section 4.8 and Note 3 were editorially corrected in November 2012.

1. Scope*

1.1 This specification establishes requirements for dimensions and gaging of taper pipe threads used on threaded plastic pipe and fittings.

1.2 Threads meeting this specification shall only be used on those plastic materials deemed suitable by the manufacturer.

1.3 Specialty threads or threads not requiring a leak-tight joint are not covered in this specification.

NOTE 1—The terms "wrench makeup" and "wrench tight" are standard terminology for tightness and do not imply using a pipe wrench or other tools which would damage plastic pipe and fittings. The terms "hand-tight" and "hand-tight engagement" refer only to thread gaging (not pipe and fitting connections) and is the definition of the L_1 gage length.

1.4 *Thread Designations*—The type of pipe threads included in this specification are designated by specifying in sequence the nominal pipe size, number of threads per inch, and the thread series symbols as follows in accordance with ANSI/ASME B 1.20.1: ⅜-18 NPT. For left-hand threads add LH to the end of the designation, otherwise right-hand threads will be understood. For example: ⅜-18 NPT-LH.

1.4.1 Each of these letters in the symbol has a definite significance as follows:

N = National (American Standard)
P = Pipe
T = Taper

1.5 The values stated in inch-pound units are to be regarded as the standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see 7.2.1 and 8.3.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1600 Terminology for Abbreviated Terms Relating to Plastics

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

F412 Terminology Relating to Plastic Piping Systems

2.2 *ASME Standards:*[3]

B 1.20.1 Pipe Threads, General Purpose (inch)

B 1.7 Nomenclature, Definitions and Letter Symbols for Screw Threads[3]

B 47.1 Gage Blanks

3. Terminology

3.1 Terminology is in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

3.2 Nomenclature, definitions, and letter symbols for screw threads are in accordance with ASME/ANSI B 1.7.

4. American National Standard Taper Pipe Thread Form

4.1 *Thread Form*—The form of thread profile specified in this specification shall be known as the American National Standard Taper Pipe Thread Form. The relations as specified herein, for form of thread and general notations are shown in Fig. 1.

4.2 *Angle of Thread*—The angle between the sides of the thread is 60° when measured in an axial plane. The line bisecting this angle is perpendicular to the axis.

4.3 *Truncation and Thread Height*—The height of the sharp V thread, H, is as follows:

$$H = 0.866025p = 0.866025/n \quad (1)$$

where:

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.10 on Fittings.

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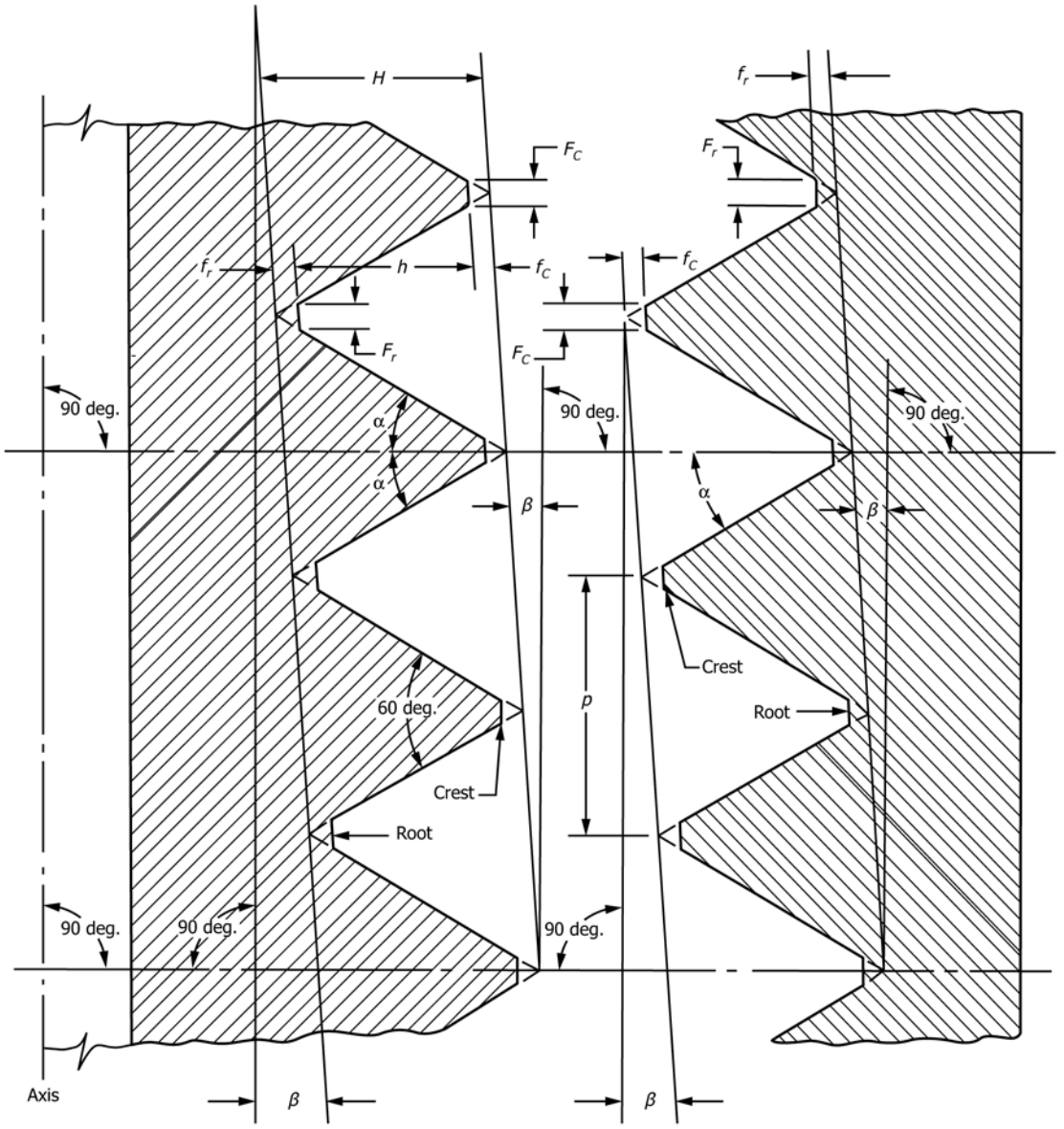
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

***A Summary of Changes section appears at the end of this standard**



H = 0.866025p = height of 60° sharp V thread
h = 0.800000p = height of thread on product
p = 1/n = pitch (measured parallel to axis)
n = number of threads per inch
α = 30° = thread flank angle
β = 1° 47 min. = thread taper angle for 1⁄16 taper
f_c = depth of truncation at crest
f_r = depth of truncation at root
F_c = width of flat at crest
F_r = width of flat at root

NOTE 1—For a symmetrical straight screw thread, $H = \cot \alpha/2n$. For a symmetrical taper screw thread, $H = (\cot \alpha - \tan^2 \beta \tan \alpha)/2n$, so that the exact value for an American National Standard Taper Pipe Thread is $H = 0.865743p$ as against $H = 0.866025p$, the value given above. For an 8-pitch thread, which is the coarsest standard taper pipe thread pitch, the corresponding values of H are 0.108218 and 0.108253 respectively, the difference being 0.000035 in. This difference being too small to be significant, the value of $H = 0.866025p$ continues in use for threads of 0.750 in., or less, taper/ft on the diameter.

FIG. 1 Basic Form of American National Standard Taper Pipe Thread

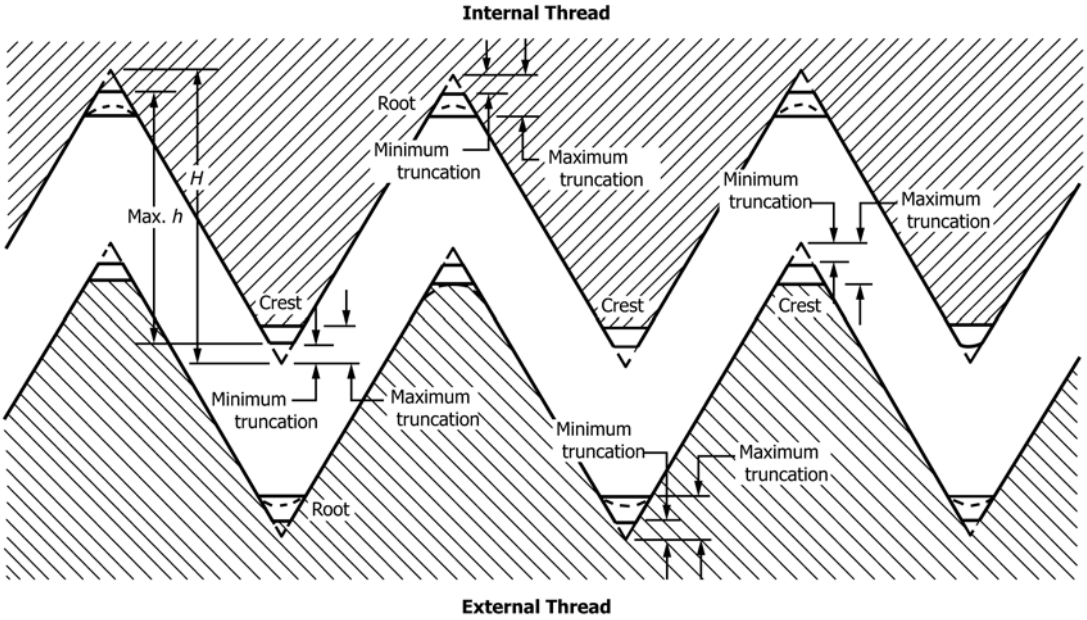
p = pitch of thread, and
n = threads per inch.

4.3.1 The basic maximum height of the truncated thread, h (see Fig. 1) is based on factors entering into the manufacture of cutting tools and the making of tight joints.

$$h = 0.800p = 0.800/n \quad (2)$$

The crest and root of pipe threads are truncated a minimum of 0.033p. Maximum truncation for the crest and root of these pipe threads is in Table 1. The crests and roots of the external and internal threads may be truncated either parallel to the pitch line or parallel to the axis. The sketches in Tables 2-6 give a sectional view of this standard thread form, which represents

TABLE 1 Limits on Crest and Root Truncation of American National Standard External and Internal Taper Pipe Threads, NPT[A]



Threads/ in. (*n*)	Height of Sharp *V* Thread (*H*)	Height of Thread (*h*)		Truncation (*f*)					Equivalent Width of Flat (*F*)				
				Min		Max		Tolerance	Min		Max		Tolerance
		Max	Min	Formula	Inch	Formula	Inch		Formula	Inch	Formula	Inch	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
27	0.03208	0.02963	0.02496	0.033*p*	0.0012	0.096*p*	0.0036	0.0024	0.038*p*	0.0014	0.111*p*	0.0041	0.0027
18	0.04811	0.04444	0.03833	0.033*p*	0.0018	0.088*p*	0.0049	0.0031	0.038*p*	0.0021	0.102*p*	0.0057	0.0036
14	0.06186	0.05714	0.05071	0.033*p*	0.0024	0.078*p*	0.0056	0.0032	0.038*p*	0.0027	0.090*p*	0.0064	0.0037
11.5	0.07531	0.06957	0.06261	0.033*p*	0.0029	0.073*p*	0.0063	0.0034	0.038*p*	0.0033	0.084*p*	0.0073	0.0040
8	0.10825	0.10000	0.09275	0.033*p*	0.0041	0.062*p*	0.0078	0.0037	0.038*p*	0.0048	0.072*p*	0.0090	0.0042

[A] The basic dimensions of the American National Standard Taper Pipe Thread are given in inches to 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.

TABLE 2 ABS, CPVC, and PVC Reference Information

Nominal Pipe Size, in.	Minimum Wall-Thickness, in.		Minimum Hub-Diameter, in.	
	Schedule 80 Pipe	DWV	Schedule 40 and DWV	Schedule 80
⅛	0.095	. . .	0.526	0.645
¼	0.119	. . .	0.672	0.840
⅜	0.126	. . .	0.821	1.000
½	0.147	. . .	0.998	1.280
¾	0.154	. . .	1.221	1.450
1	0.179	. . .	1.504	1.810
1¼	0.191	0.100	1.871	2.200
1½	0.200	0.088	2.127	2.450
2	0.218	0.066	2.634	3.000
2½	0.276	. . .	3.170	3.560
3	0.300	0.086	3.841	4.250
3½	0.318	. . .	4.374	. . .
4	0.337	0.104	4.907	5.350
5	0.375	. . .	6.039	. . .
6	0.432	. . .	7.203	7.625
8	0.500	. . .	9.320	. . .
10	0.593	. . .	11.614	. . .
12	0.687	. . .	13.786	. . .

the truncated thread form by a straight line. However, when closely examined, the crests and roots of molded pipe threads appear slightly rounded.

4.4 *Thread Starts—Machined*—Feathered starts are produced by a 45° chamfer on the first thread when the thread is cut with a tap or die. The depth of chamfer shall be from ¾ to 1¼ thread deep (see Fig. 2(*a*)). Feathered starts are prone to crossing and mutilation and shall not be molded.

4.5 *Thread Starts—Molded*—Internal and external molded threads shall begin with a taper or blunt start. A pilot shall be provided from the face of the fitting and at the entering end of the external threads; it shall have a length to the start (flank) of the first thread, equal to ½ to ¾ the width of the thread pitch, 1 to 1¼ thread pitch to the centerline. (Thread pitch equals one turn; see Fig. 2(*b*) and Fig. 2(*c*).) The pilot shall be included in the measurement of the thread length.

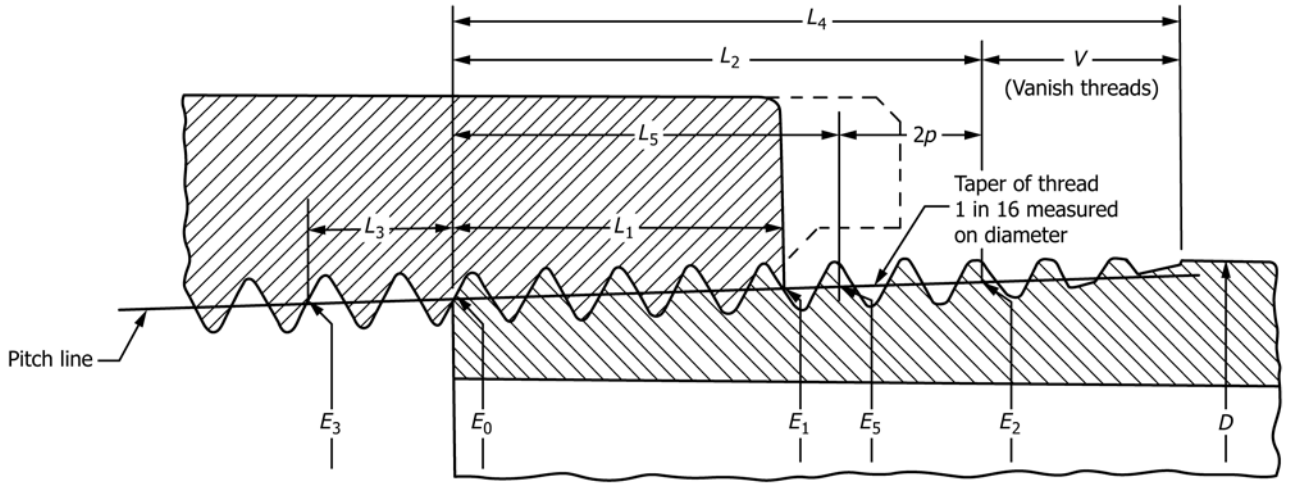
4.5.1 Taper starts on the first thread are formed by the thread rising from the minimum to maximum diameter while maintaining the 60° thread profile (see Fig. 2(*b*)). The length of rise shall not exceed ⅛ turn (45°).

4.5.2 Blunt starts on the first thread are formed by the thread rising from the minimum to maximum diameter while maintaining the 60° thread profile (see Fig. 2(*c*)). The length of rise shall not be greater than twice the thread height. The blunt start is the preferred thread start.

4.6 *Plastic Threads—General*—The minimum wall thickness (see Table 2) for the threaded portion of a plastic pipe or fitting depends upon the material and the application. For pressure rated pipe, reduce the pressure rating for threaded pipe

TABLE 3 Basic Dimensions of American National Standard Taper Thread, NPT[A]

NOTE 1—Wrench makeup modified for plastic.



Nominal Pipe Size, in.	Outside Diameter of Pipe (D)	Threads/in. (n)	Pitch of Thread (P)	Pitch Diameter at Beginning of External Thread (E_0)	Hand-tight Gage Engagement			Effective Thread, External		
					Length[B] (L_1)		Diameter[C] (E_1)	Length[D] (L_2)		Diameter (E_2)
					Inch	Threads		Inch	Threads	
1	2	3	4	5	6	7	8	9	10	11
1/16	0.3125	27	0.03704	0.27118	0.160	4.32	0.28118	0.2611	7.05	0.28750
1/8	0.405	27	0.03704	0.36351	0.1615	4.36	0.37360	0.2639	7.12	0.38000
1/4	0.540	18	0.05556	0.47739	0.2278	4.10	0.49163	0.4018	7.23	0.50250
3/8	0.675	18	0.05556	0.61201	0.240	4.32	0.62701	0.4078	7.34	0.63750
1/2	0.840	14	0.07143	0.75843	0.320	4.48	0.77843	0.5337	7.47	0.79179
3/4	1.050	14	0.07143	0.96768	0.339	4.75	0.98887	0.5457	7.64	1.00179
1	1.315	11.5	0.08696	1.21363	0.400	4.60	1.23863	0.6828	7.85	1.25630
1 1/4	1.660	11.5	0.08696	1.55713	0.420	4.83	1.58338	0.7068	8.13	1.60130
1 1/2	1.900	11.5	0.08696	1.79609	0.420	4.83	1.82234	0.7235	8.32	1.84130
2	2.375	11.5	0.08696	2.26902	0.436	5.01	2.29627	0.7565	8.70	2.31630
2 1/2	2.875	8	0.12500	2.71953	0.682	5.46	2.76216	1.1375	9.10	2.79062
3	3.500	8	0.12500	3.34062	0.766	6.13	3.38850	1.2000	9.60	3.41562
3 1/2	4.000	8	0.12500	3.83750	0.821	6.57	3.88881	1.2500	10.00	3.91562
4	4.500	8	0.12500	4.33438	0.844	6.75	4.38712	1.3000	10.40	4.41562
5	5.563	8	0.12500	5.39073	0.937	7.50	5.44929	1.4063	11.25	5.47862
6	6.625	8	0.12500	6.44609	0.958	7.66	6.50597	1.5125	12.10	6.54062
8	8.625	8	0.12500	8.43359	1.063	8.50	8.50003	1.7125	13.70	8.54062
10	10.750	8	0.12500	10.54531	1.210	9.68	10.62094	1.9250	15.40	10.66562
12	12.750	8	0.12500	12.53281	1.360	10.88	12.61781	2.1250	17.00	12.66562

[A] The basic dimensions of the American National Standard Taper Pipe Thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations.
[B] Also length of thin ring gage and length from gaging notch to small end of plug gage.
[C] Also pitch diameter at gaging notch (hand-tight plane).
[D] Also length of plug gage.

by one-half (50 %) that of unthreaded pipe. Some pressure rated pipe materials (for example, PP and PE) are not recommended for threaded applications. If the wall thickness is not specified in a pipe or fitting standard, the manufacturer must determine the appropriate wall thickness.

4.7 *Sealing*—Where pressure-tight or leak-tight non-pressure joints are required, it is intended that taper pipe threads conforming to this specification be made up with PTFE (polytetrafluoroethylene or equivalent) tape or a chemically compatible a sealant-lubricant. Conventional pipe-thread compounds, putty, linseed oil-base products, and unknown mixtures shall not be used.

NOTE 2—Some TFE-fluorocarbon-paste compounds, even though they are recommended by the manufacturer, may not be compatible with some plastics.

4.8 *Thread Tightness—Wrench Makeup*—Some lubricants (PTFE pastes, silicones, etc.) will provide added lubricity, which can result in more finger-tight engagement than with sealants. The maximum recommended tightness is two turns past finger tight for both internal and external threads. Over tightening of internal threads will produce hoop stresses greater than plastic can withstand, resulting in split fittings.

NOTE 3—When assembling metal and plastic threads, the preferred method is plastic external (male) threads to metal internal (female) threads. Cyclic heating and cooling may result in dripping leaks.

NOTE 4—When PTFE tape is used to seal the threads, wrap the external threads with 2 to 3 layers.

TABLE 3 Basic Dimensions of American National Standard Taper Thread, NPT *(continued)*

Nominal Pipe Size, in.	Length, L_1 Plane to L_2 Plane External Thread ($L_2 - L_1$)		Wrench Makeup Length for Internal Thread[A]			Vanish Thread (V)		Overall[B] Length External Thread (L_4)	Nominal Complete External Thread[C]		Height of Thread (h)	Increase in Diameter per Thread ($0.0625/n$)	Basic Minor Diameter at Small End of Pipe (K_0)
			Length (L_3)		Diameter (E_3)				Length (L_5)	Diameter (E_5)			
	Inch	Thread	Inch	Thread		Inch	Thread						
1	12	13	14	15	16	17	18	19	20	21	22	23	24
1/16	0.1011	2.73	0.0741	2	0.26656	0.1285	3.47	0.3896	0.1870	0.28287	0.02963	0.00231	0.2416
1/8	0.1024	2.76	0.0741	2	0.35889	0.1285	3.47	0.3924	0.1898	0.37537	0.02963	0.00231	0.3339
1/4	0.1740	3.13	0.1111	2	0.47045	0.1928	3.47	0.5946	0.2907	0.49556	0.04444	0.00347	0.4329
3/8	0.1678	3.02	0.1111	2	0.60507	0.1928	3.47	0.6006	0.2967	0.63056	0.04444	0.00347	0.5676
1/2	0.2137	2.99	0.1429	2	0.74951	0.2478	3.47	0.7815	0.3909	0.78286	0.05714	0.00446	0.7013
3/4	0.2067	2.89	0.1429	2	0.95876	0.2478	3.47	0.7935	0.4029	0.99286	0.05714	0.00446	0.9105
1	0.2828	3.25	0.1739	2	1.20277	0.3017	3.47	0.9845	0.5089	1.24543	0.06957	0.00543	1.1441
1 1/4	0.2868	3.30	0.1739	2	1.54627	0.3017	3.47	1.0085	0.5329	1.59043	0.06957	0.00543	1.4876
1 1/2	0.3035	3.49	0.1739	2	1.78523	0.3017	3.47	1.0252	0.5496	1.83043	0.06957	0.00543	1.7265
2	0.3205	3.69	0.1739	2	2.25816	0.3017	3.47	1.0582	0.5826	2.30543	0.06957	0.00543	2.1995
2 1/2	0.4555	3.64	0.2500	2	2.70391	0.4337	3.47	1.5712	0.8875	2.77500	0.100000	0.00781	2.6195
3	0.4340	3.47	0.2500	2	3.32500	0.4337	3.47	1.6337	0.9500	3.40000	0.100000	0.00781	3.2406
3 1/2	0.4290	3.43	0.2500	2	3.82188	0.4337	3.47	1.6837	1.0000	3.90000	0.100000	0.00781	3.7375
4	0.4560	3.65	0.2500	2	4.31875	0.4337	3.47	1.7337	1.0500	4.40000	0.100000	0.00781	4.2344
5	0.4693	3.75	0.2500	2	5.37511	0.4337	3.47	1.8400	1.1563	5.46300	0.100000	0.00781	5.2907
6	0.5545	4.44	0.2500	2	6.43047	0.4337	3.47	1.9462	1.2625	6.52500	0.100000	0.00781	6.3461
8	0.6495	5.20	0.2500	2	8.41797	0.4337	3.47	2.1462	1.4625	8.52500	0.100000	0.00781	8.3336
10	0.7150	5.72	0.2500	2	10.52969	0.4337	3.47	2.3587	1.6750	10.65000	0.100000	0.00781	10.4453
12	0.7650	6.12	0.2500	2	12.51719	0.4337	3.47	2.5587	1.8750	12.65000	0.100000	0.00781	12.4328

[A] Maximum wrench-tightness is two turns past finger-tight. Over tightening may result in split fittings.
[B] Reference dimension.
[C] The length L_5 from the end of the pipe determines the plane beyond which the thread form is incomplete at the crest. The next two threads are complete at the root. At this plane the cone formed by the crests of the thread intersects the cylinder forming the external surface of the pipe, $L_5 = L_2 - 2p$.

4.9 *Inspection*—A gaging method of tolerances is prescribed in this specification to effect a functional inspection of the hand-tight L_1 engagement threads. However, conformance to this specification requires that all basic design dimensions be met (within applicable tolerances) including extension of the thread elements ($L_2 - L_1$) to provide for wrench-tight makeup. Therefore, additional methods of gaging may be employed to evaluate conformance to the basic design dimensions. When additional methods of gaging are employed, they shall be agreed upon between the supplier and the purchaser. Because it is known that injection molded threads that are removed from the mold before they are completely cooled will distort in form so that they will not gage properly, threads suspected of being so distorted should be inspected with an optical comparator to determine their true quality.

5. Specification for General Purpose Taper Pipe Threads, NPT

5.1 *Taper Pipe Threads*—Threads made in accordance with these specifications consist of an external taper and an internal taper thread, to form a normal type of joint having general application on pipe and fittings (see Fig. 3). The NPT taper pipe threads are intended to be made up wrench-tight (maximum two turns past finger-tight), and with a lubricant or sealant whenever a pressure-tight or leak-tight non-pressure joint is required (see 4.7 and 4.8). 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 or ductility, or both, of the mating parts and the resultant conformance at final assembly.

5.1.1 *Thread Designation and Notation*—American National Standard Taper Pipe Threads are designated in accordance with 3.2 as follows: 3/8-18 NPT.

5.1.1.1 Standard notation applicable to American National Standard Taper Pipe Threads is shown in Fig. 4.

5.1.2 *Form of Thread:*

5.1.2.1 The basic dimensions of American National Standard Pipe Threads, NPT, are given in Table 3 (wrench makeup has been changed from three turns to two turns for sizes 2 in. and smaller), which is for machined threads. (See 4.1.)

5.1.2.2 The basic dimensions of molded taper pipe threads for pressure fittings are given in Table 4. The overall length (L_4) is slightly less than that of American National Standard Taper Pipe Threads, NPT, because there are no vanish threads.

5.1.2.3 The basic dimensions of molded taper pipe threads for DWV fittings are given in Table 5. The overall length (L_4) is shorter than that of American National Standard Taper Pipe Threads, NPT, and molded pressure fitting threads.

5.1.2.4 The basic dimension of molded taper pipe threads for DWV plugs and cleanout fittings are given in Table 6. These threads are shorter than DWV threads.

5.1.3 *Taper of Thread*—The taper of the thread is 1 in 16 or 0.75 in./ft measured on the diameter and along the axis.

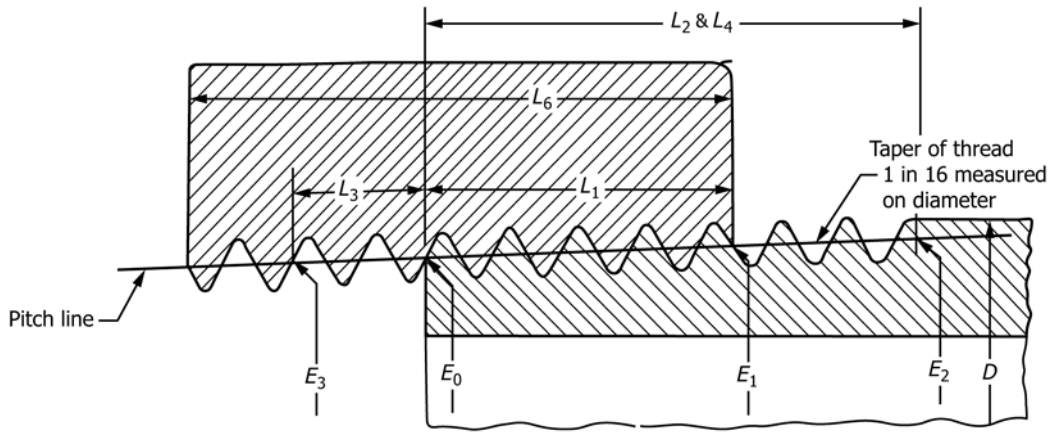
5.1.4 *Diameter of Thread*—The basic pitch diameter of the taper thread is determined by the following formulas based on the outside diameter of the pipe and the pitch of the thread:

$$E_o = D - (0.05D + 1.1)1/n \quad (3)$$

$$= D - (0.05D + 1.1)p$$

$$E_1 = E_o + 0.0625L_1$$

TABLE 4 Basic Dimensions of Molded Taper Pipe Threads for Pressure Fittings[A]



Nominal Pipe Size, in.	Outside Diameter of Pipe (D)	Threads/ in. (n)	Pitch of Thread (P)	Pitch Diameter at Beginning of External Thread (E_0)	Hand-tight Gage Engagement			Overall Thread Length (L_4) and Effective Thread, External (L_2)			Length, L_1 Plane to L_2 Plane External Thread ($L_2 - L_1$)		Wrench Makeup Length for Internal Thread[B]			Overall Thread Length, Internal (L_6)	
					Length (L_1)		Diameter[C] (E_1)	Length, min		Diameter (E_2)			Length (L_3)		Diameter (E_3)	Length, min	
					Inch	Threads		Inch	Threads		Inch	Thread	Inch	Thread		Inch	Threads
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
⅛	0.405	27	0.03704	0.36351	0.1615	4.36	0.37360	0.3100	8.37	0.38284	0.1485	3.01	0.0741	2	0.35889	0.3800	10.30
¼	0.540	18	0.05556	0.47739	0.2278	4.10	0.49163	0.4400	7.92	0.50487	0.2122	3.82	0.1111	2	0.47045	0.5000	9.00
⅜	0.675	18	0.05556	0.61201	0.240	4.32	0.62701	0.4400	7.92	0.63949	0.2000	3.60	0.1111	2	0.60507	0.5000	9.00
½	0.840	14	0.07143	0.75843	0.320	4.48	0.77843	0.5300	7.42	0.79152	0.2100	2.94	0.1429	2	0.74951	0.6400	8.96
¾	1.050	14	0.07143	0.96768	0.339	4.75	0.98887	0.5500	7.70	1.00202	0.2110	2.95	0.1429	2	0.95876	0.6500	9.10
1	1.315	11.5	0.08696	1.21363	0.400	4.60	1.23863	0.6800	7.82	1.25609	0.2800	3.22	0.1739	2	1.20277	0.8100	9.32
1¼	1.660	11.5	0.08696	1.55713	0.420	4.83	1.58338	0.7100	8.16	1.60144	0.2900	3.33	0.1739	2	1.54627	0.8500	9.78
1½	1.900	11.5	0.08696	1.79609	0.420	4.83	1.82234	0.7200	8.28	1.84105	0.3000	3.45	0.1739	2	1.78523	0.8500	9.78
2	2.375	11.5	0.08696	2.26902	0.436	5.01	2.29627	0.7600	8.74	2.31648	0.3240	3.73	0.1739	2	2.25816	0.9000	10.35
2½	2.875	8	0.12500	2.71953	0.682	5.46	2.76216	1.1400	9.12	2.79076	0.4580	3.66	0.2500	2	2.70391	1.2100	9.68
3	3.500	8	0.12500	3.34062	0.766	6.13	3.38850	1.2000	9.60	3.41560	0.4340	3.47	0.2500	2	3.32500	1.3000	10.40
4	4.500	8	0.12500	4.33438	0.844	6.75	4.38712	1.3000	10.40	4.41560	0.4560	3.65	0.2500	2	4.31875	1.3800	11.04
6	6.625	8	0.12500	6.44609	0.958	7.66	6.50597	1.4400	11.52	6.53606	0.4820	3.86	0.2500	2	6.43047	1.6000	12.80
8	8.625	8	0.12500	8.43359	1.063	8.50	8.50003	1.6300	13.04	8.53543	0.5670	4.54	0.2500	2	8.41797	1.7800	14.24

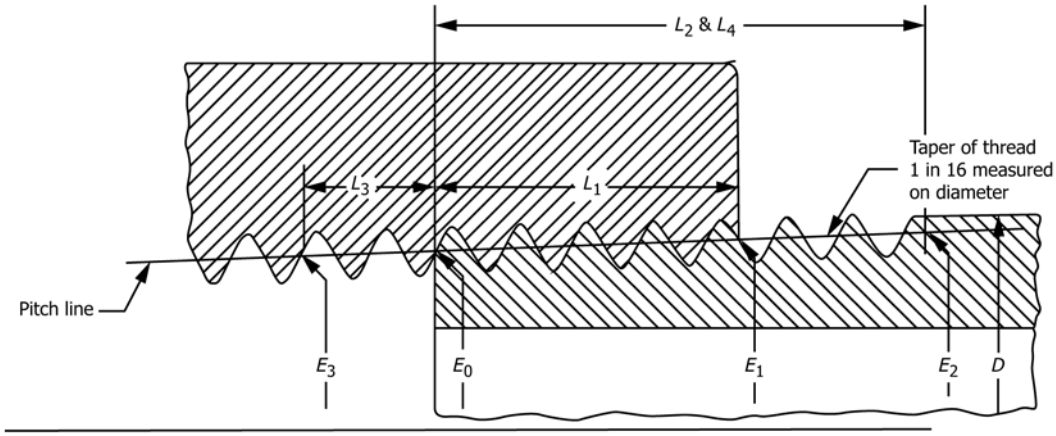
[A] The basic dimensions of taper pipe threads for pressure fittings are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations. Molded pressure fitting threads are shorter than American National Standard Taper Pipe Thread, NPT, because there are no vanish threads.

[B] Maximum wrench tightness is two turns past finger tight. Overtightening may result in split fittings.

[C] Also pitch diameter at gaging notch (hand-tight plane).

TABLE 5 Basic Dimensions of Molded Taper Pipe Threads for DWV Fittings[A]

(See Table 6 for threaded DWV plugs and cleanout fillings.)



Nominal Pipe Size, in.	Outside Diameter of Pipe (*D*)	Threads/ in. (*n*)	Pitch of Thread (*P*)	Pitch Diameter at Beginning of External Thread (E_0)	Hand-tight Gage Engagement			Overall Thread Length (L_4) and Effective Thread, External (L_2)			Length, L_1 Plane to L_2 Plane External Thread ($L_2 - L_1$)		Wrench Makeup Length for Internal Thread[B]		
					Length (L_1)		Diameter[C] (E_1)	Length, min		Diameter (E_2)			Length (L_3)		Diameter (E_3)
					Inch	Threads		Inch	Threads		Inch	Thread	Inch	Thread	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1¼	1.660	11.5	0.08696	1.55713	0.420	4.83	1.58338	0.687	7.91	1.60008	0.277	3.08	0.174	2	1.54627
1½	1.900	11.5	0.08696	1.79609	0.420	4.83	1.82234	0.687	7.91	1.83904	0.277	3.08	0.174	2	1.78523
2	2.375	11.5	0.08696	2.26902	0.436	5.01	2.29627	0.750	8.63	2.31588	0.314	3.61	0.174	2	2.25816
3	3.500	8	0.12500	3.34062	0.766	6.13	3.38850	1.187	9.50	3.41484	0.422	3.37	0.250	2	3.32500
4	4.500	8	0.12500	4.33438	0.844	6.75	4.38712	1.281	10.25	4.41444	0.437	3.50	0.250	2	4.31875
6	6.625	8	0.12500	6.44609	0.958	7.66	6.50597	1.500	12.00	6.53983	0.542	4.34	0.250	2	6.43047
8	8.625	8	0.12500	8.43359	1.063	8.50	8.50003	1.687	13.50	8.53905	0.625	5.00	0.250	2	8.41797

[A] The basic dimensions of the DWV taper pipe thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations. DWV threads are shorter than American National Standard Taper Pipe Thread, NPT.

[B] Maximum wrench-tightness is two turns past finger-tight. Over tightening may result in split fittings.

[C] Also pitch diameter at gaging notch (hand-tight plane).

where:

D = outside diameter of pipe, and

E_o = pitch diameter of thread at end of pipe or small end of external thread.

NOTE 5—Formulas for the ⅛-27 and ¼-18 sizes,

$$E_0 \text{ approximately} = D - (0.05D + 0.827)p \quad (4)$$

where:

E_1 = pitch diameter of thread at the gaging notch or large end of internal thread,

L_1 = normal engagement by hand between external and internal threads (see Fig. 5), and

n = threads per inch.

5.1.5 *Length of Thread*—The basic length of the effective external taper thread L_2 is determined by the following formula based on the outside diameter of the pipe and the pitch of the thread:

$$L_2 = (0.80D + 6.8)1/n \quad (5)$$
$$= (0.80D + 6.8)p$$

where:

D = outside diameter of pipe, and

n = threads per inch.

This formula determines directly the length of effective thread which includes the usable threads slightly incomplete at the crest.

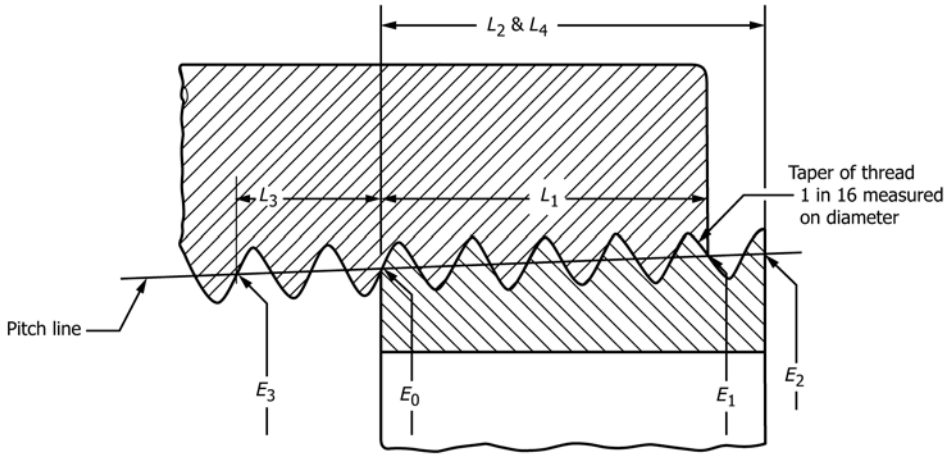
5.1.6 *Engagement Between External and Internal Taper Threads*—The normal length of engagement between external and internal taper threads when screwed together hand-tight is shown in Column 6 of Table 3, Table 4, Table 5, and Table 6. This length is controlled by the construction and use of the gages.

5.1.7 *Basic Dimensions*—The basic dimensions of taper pipe threads, derived from the above specifications, are given in Table 3, Table 4, Table 5, and Table 6. All dimensions are given in inches unless otherwise specified.

5.2 *Tolerances:*

TABLE 6 Basic Dimensions of Taper Pipe Threads for DWV Plugs and Cleanout Fittings[A]

(See Table 5 for other threaded DWV fittings.)



Nominal Pipe Size, in.	Outside Diameter of Pipe (D)	Threads/ in. (n)	Pitch of Thread (P)	Pitch Diameter at Beginning of External Thread (E_o)	Hand-tight Gage Engagement			Overall Thread Length (L_4) and Effective Thread, External (L_2)			Length, L_1 Plane to L_2 Plane External Thread ($L_2 - L_1$)		Wrench Makeup Length for Internal Thread[B]		
					Length (L_1)		Diameter[C] (E_1)	Length, min		Diameter (E_2)			Length (L_3)		Diameter E_3)
					Inch	Threads		Inch	Threads		Inch	Thread	Inch	Thread	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1¼	1.660	11.5	0.08696	1.56777	0.250	2.88	1.58338	0.500	5.80	1.59312	0.250	2.88	0.174	2.00	1.55691
1½	1.900	11.5	0.08696	1.79961	0.364	4.19	1.82234	0.625	7.20	1.83405	0.261	3.00	0.174	2.00	1.78875
2	2.375	11.5	0.08696	2.27354	0.364	4.19	2.29627	0.625	7.20	2.30798	0.261	3.00	0.174	2.00	2.26268
2½	2.875	8	0.12500	2.73873	0.375	3.00	2.76216	0.750	6.00	2.77778	0.375	3.00	0.250	2.00	2.72311
3	3.500	8	0.12500	3.36507	0.375	3.00	3.38850	0.750	6.00	3.40412	0.375	3.00	0.250	2.00	3.34945
3½	4.000	8	0.12500	3.86538	0.375	3.00	3.88881	0.750	6.00	3.90443	0.375	3.00	0.250	2.00	3.84976
4	4.500	8	0.12500	4.35588	0.500	4.00	4.38712	0.875	7.00	4.40665	0.375	3.00	0.250	2.00	4.34026
6	6.625	8	0.12500	6.46692	0.625	5.00	6.50597	1.000	8.00	6.52940	0.375	3.00	0.250	2.00	6.45130

[A] The basic dimensions of the cleanout pipe thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations. Cleanout threads are shorter than DWV and American National Standard Taper Pipe Thread, NPT. If internal and external threads are at the tolerance extremes (1½ turns large or small), they may not start or may not tighten.

[B] Maximum wrench tightness is two turns past finger tight. Over tightening may result in split fittings.

[C] Pitch diameter at hand-tight plane.

5.2.1 *Manufacturing Tolerance on Product*—The maximum- allowable deviation in the commercial product is 1½ turns large or small from gages made to the basic dimensions.

5.2.2 *Tolerances on Thread Elements*—The permissible deviations in thread elements are given in Table 7. Conformance of these limits may be required on product threads, in which case specifications shall require control and checking of thread elements.

5.2.3 Excessive flash or parting line mismatch (either axial or radial) will result in external pipe threads gaging large.

6. Precision of Measurement

6.1 The measurement experience of an individual manufacturer of threads in accordance with this specification has shown the following indexes of precision.

6.1.1 *Micrometer Caliper*—The multi-micrometer-operator-specimen-day precision is ±0.001 in. (2S) as defined in Practice E177.

6.1.2 *Optical Comparator with Micrometer Head Readout*—The single-optical comparator and multi-micrometer-operator-specimen-day precision is ±0.001 in. (2S) as defined in Practice E177.

7. Gages and Gage Tolerances for American National Standard Pipe Threads

7.1 *Design of Gages*—Gages for American National Standard Pipe Threads provide a functional check and are of the standard type as described as follows. Gages should conform to the designs recommended in ASME/ANSI B47.1.

7.1.1 *Standard Type Gages*—A set of standard- or basic-type gages consists of a taper-threaded plug gage and a taper-threaded ring gage. (See Fig. 5 and Fig. 6.) The plug gages have a gaging notch located a distance L_1 from the small end. The L_1 ring gage has a length equal to dimensions L_1. The roots of the threads on these gages shall clear 0.0381p width. A sharp V or undercut clearance is acceptable. The crests are to be truncated an amount equal to 0.14p for 27 threads per inch

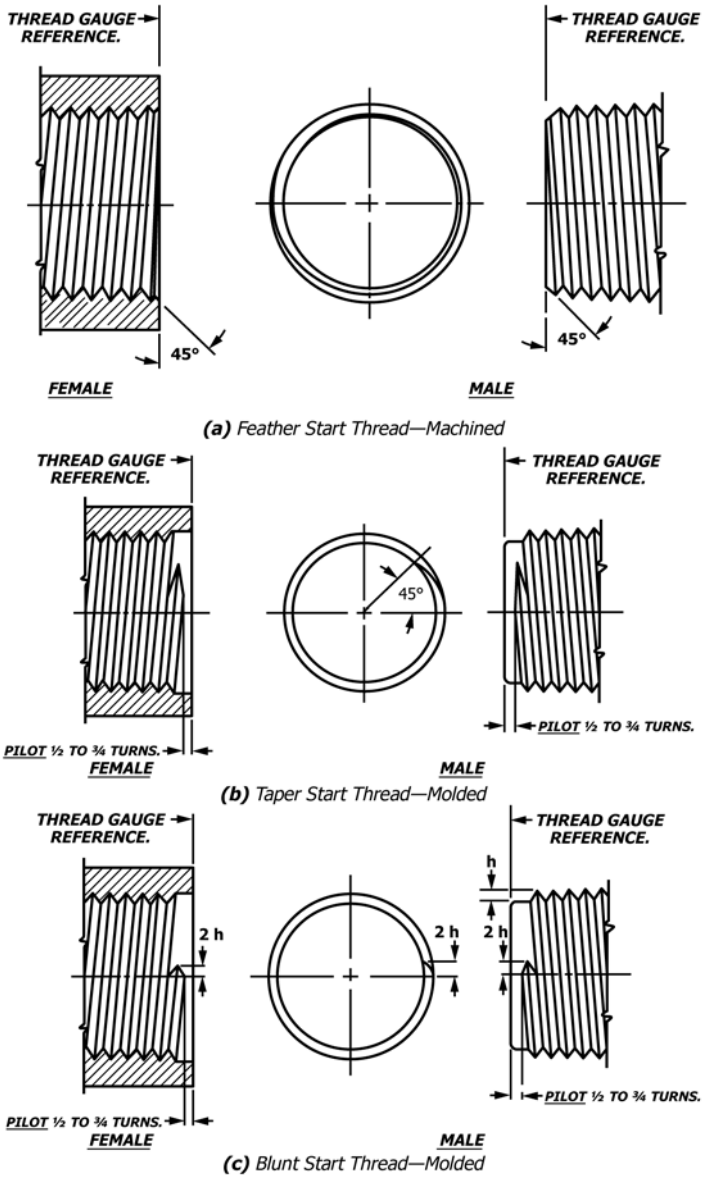
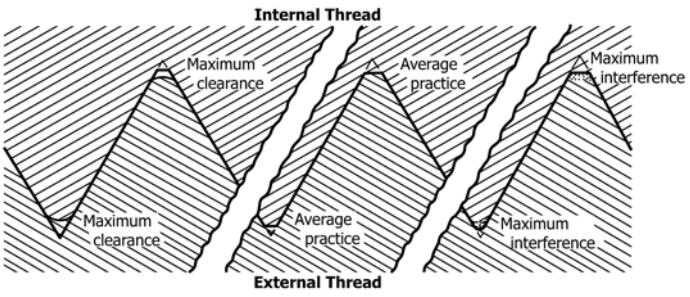


FIG. 2 Start Threads



NOTE 1—When threaded joints are made up wrench-tight with lubricant or sealer, it is intended that the flanks shall be in contact.

FIG. 3 American National Standard Taper Pipe Threads for Pressure-Tight Joints, NPT

(tpi), 0.109*p* for 18 tpi, and 0.10*p* for 14 tpi, 11½ tpi and 8 tpi threads (see Fig. 7). In locating the basic gaging notch, the plane of the notch should intersect the crest of the gage thread.

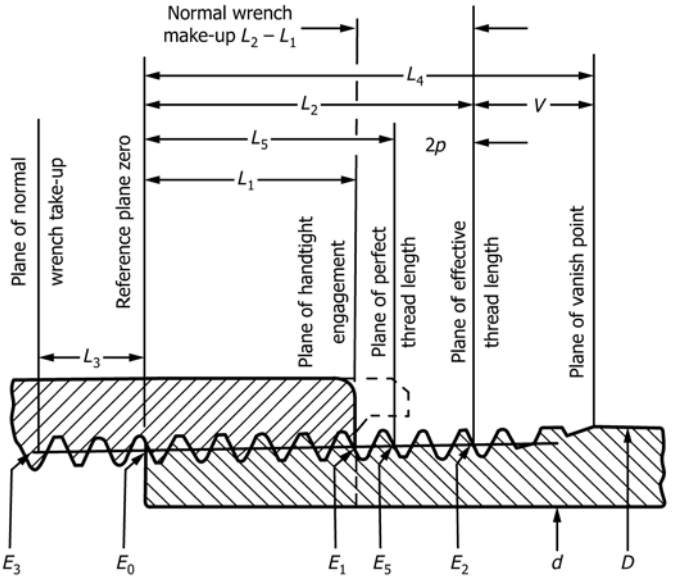


FIG. 4 American National Standard Taper Pipe Thread Notation

7.1.1.1 The ring gage shall be fitted to the plug so that when assembled hand-tight, the gaging notch of the plug gage will be flush with the large-end face of the ring gage within tolerances (see Fig. 5).

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

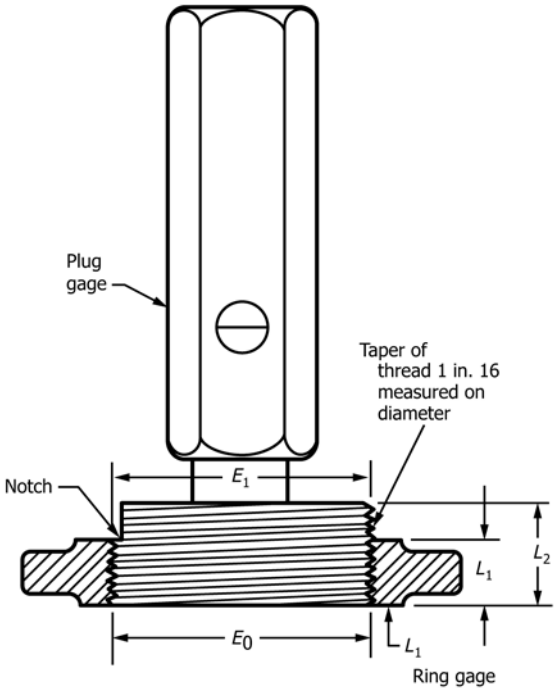
7.1.2 *Marking of Gages*—Each gage shall be marked so as to indicate clearly the nominal size of pipe, threads per inch, and the proper thread series designation as given in the respective section of this specification.

7.2 *Classes of Gages*—Gages of the following types may be used to completely cover gage requirements: (*1*) master gages used to check working gages; and (*2*) working gages used to check threads during manufacture and for conformance inspection.

7.2.1 *Master Gages*—The set of master gages consists of an L_1 taper threaded plug gage and an L_1 taper threaded ring gage (see Fig. 5 and Fig. 6). The set of master gages is used for checking working gages (see Note 1). A supplementary check by optical means should be made of flank angle and form.

NOTE 6—**Caution:** It should be understood that only a specifically matched set of masters (L_1 plug and L_1 ring) can be expected to mate with each other within the tolerance specified.

7.2.2 *Working Gages*—Each set of working gages consists of an L_1 taper threaded ring gage and is used for checking the product. These gages are made of hardened steel or equivalent material. In locating the basic notch of the plug gage the plane of the notch should intersect the rest of the thread. It is to be noted that these gages are truncated at the crest so that they bear only on the flanks of the thread. Thus, although they do not check the crest or root truncations specified in Table 1, they are a satisfactory functional check for the general run of product. When it is deemed necessary to determine whether or



NOTE 1—The illustration shows standard design for sizes 2 in. and smaller. Larger sizes are of slightly different designs.

FIG. 5 NPT Standard Taper Pipe Thread Plug and Ring Gages

TABLE 7 Tolerances on Taper, Lead, and Angle of Pipe Threads, NPT[A]

For tolerances on depth of thread see Table 1, and for tolerances on functional size, see 5.2.1.

Nominal Pipe Size, in.	Threads/ in. (*n*)	Tolerances			
		Taper on Pitch Line (¾ in./ft)		Lead in Length of Effective Threads (±)	60° Angle of Threads, degrees (±)
		Max	Min		
1	2	3	4	5	6
1/16 , 1/8	27	+1/8	−1/16	0.003	2½
¼ , ⅜	18	+1/8	−1/16	0.003	2
½ , ¾	14	+1/8	−1/16	0.003[A]	2
1, 1¼ , 1½, 2	11.5	+1/8	−1/16	0.003[A]	1½
2½ and larger	8	+1/8	−1/16	0.003[A]	1½

[A] The tolerance on lead shall be ±0.003 in./in. on any size threaded to an effective thread length greater than 1 in.

not such truncations are within the limits specified, or particularly to see that maximum truncation is not exceeded, it is necessary to make further inspection. For this inspection, optics or optical projection is suggested.

NOTE 7—The maximum wear on a working gage shall not be more than the equivalent of one-quarter turn from its original dimensions.

8. Gaging Taper Threads

8.1 *Gaging External Taper Threads*—In gaging external taper threads, the L_1 ring gage (see Fig. 7) is assembled hand tight on the pipe or external thread. The thread is within the permissible tolerance when the gaging face of the working ring gage is not more than 1½ turns, large or small, from being flush with the face of the fitting, as indicated in Fig. 7.

8.2 *Gaging Internal Taper Threads*—In gaging internal taper threads, the L_1 plug gage (see Fig. 8) is assembled hand-tight into the fitting or coupling. The thread is within the permissible tolerance when the gaging notch of the working plug gage is not more than 1½ turns, large or small, from being flush with the face of the fitting, as indicated in Fig. 8.

8.3 *Gaging Practice*—See Note 8.

NOTE 8—**Caution:** When gaging pipe threads it is first necessary to clean both the gage and the product threads so that they are free of chips, burrs, abrasives, or other foreign materials.

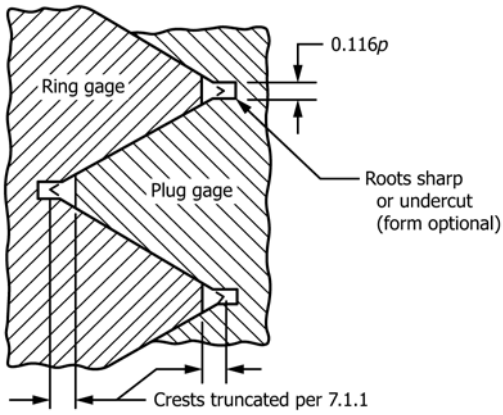
8.3.1 *Supplemental Gaging*—Gaging of both internal and external threads by use of the L_1 plug and ring gages, illustrated by Fig. 7 and Fig. 8, serves to assure conformance to the L_1 elements of the design dimensions. However, conformance to this specification requires that all basic design dimensions be met within applicable tolerances including extension of the thread elements ($L_2 - L_1$) to provide for wrench-tight makeup. Therefore, in designing threads and controlling manufacturing practices or as otherwise required, additional methods of measuring or gaging may be employed to supplement L_1 gaging.

8.4 *Gaging Chamfered, or Blunt Start Threads*—The reference point for gaging or measuring the length of external or internal product threads is the end of the pipe or fitting (see Fig. 9).

8.4.1 *Turns-Engagement Method of Gaging*—The turns-engagement method shall not be used as results differ depending on type of start (blunt to feather start).

9. Keywords

9.1 fitting threads; pipe threads; plastic pipe threads; taper pipe threads; threads



NOTE 1—Roots must clear 0.0381p flat.

FIG. 6 Suggested Form of Gage Thread

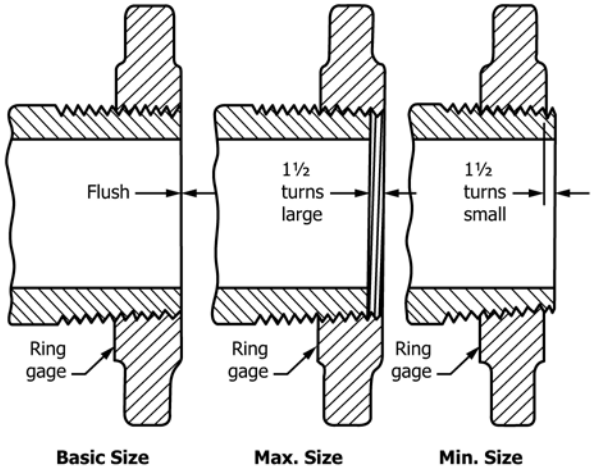


FIG. 7 Gaging External Taper Threads with Ring Gage

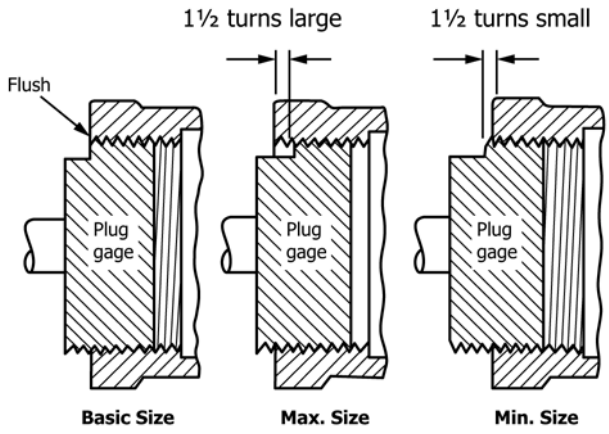
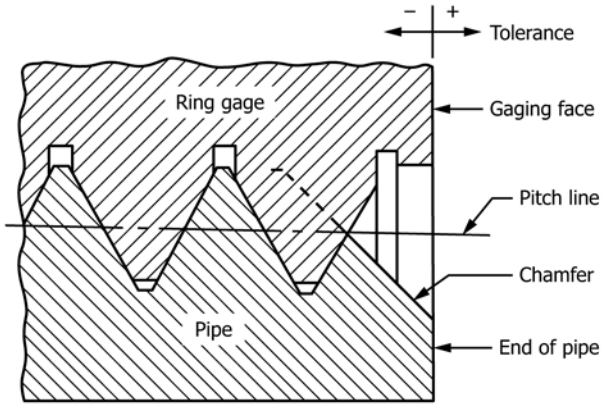
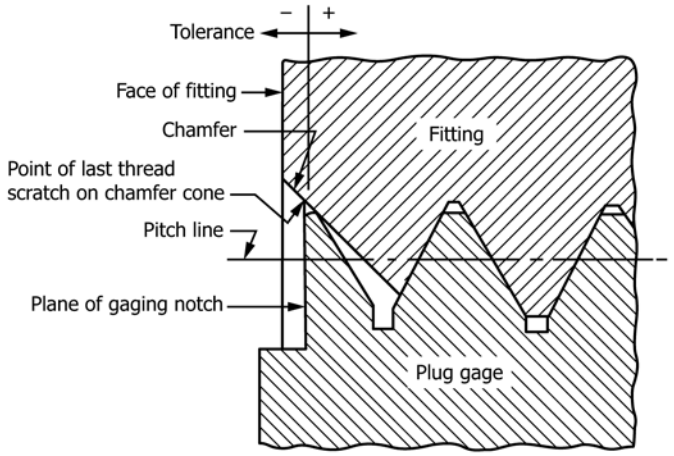


FIG. 8 Gaging Internal Taper Threads



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



NOTE—Plane of gaging notch should intersect crest of thread on gage.

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

NOTE 1—The chamfer illustrated is at 45° angle and is approximately ½ pitch in depth. However, these details are not requirements and are given only for information on the illustration shown. The chamfered portion of thread and the full chamfer cone are indicated by dotted lines.

NOTE 2—The reference point for the internal product thread is the starting end of the fitting, providing the chamfer does not exceed the major diameter of the internal thread. When a chamfer on the product thread exceeds this limit, the reference point becomes the last thread scratch on the chamfer cone, as illustrated.

FIG. 9 Gaging of Machined Chamfered Threads

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1498–08) that may impact the use of this standard.

(1) Conducted 5 year review.
(2) Corrected spelling in 4.8.
(3) Added (male) and (female) to Note 3.