MIL-P-7105B
6 January 1965
Superseding
MIL-P-7105A
5 July 1962

MILITARY SPECIFICATION

PIPE THREADS, TAPER, AERONAUTICAL NATIONAL FORM, SYMBOL ANPT, GENERAL REQUIREMENTS FOR

This specification has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers the general requirements for aeronautical pipe threads and gages and gaging methods for aeronautical pipe threads.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-G-10944	Gages, Dimensional Control

STANDARDS

Air Force-Navy Aeronautical

AND10052	Bosses —— Standard Dimensions for External Pipe Thread
AND10053	Bosses —— Pipe-Thread, Internal, Standard Dimensions for

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

FSC 4730
FSC 5220

3. REQUIREMENTS

3.1 Form of thread. The Aeronautical National Taper Pipe Thread Form, Symbol ANPT, as shown on figure 1, shall be used for taper pipe threads covered by this specification.

3.2 Dimensions. Taper pipe threads shall conform to dimensions given in tables I and II, and shall be full profile within the L_2 and $L_1 + L_3$ lengths. The crest and root of the thread shall be truncated within the limits specified in table I, and as shown on figure 2. This applies to fully machined fittings and bosses and not to fittings made from nominal size pipe stock.

3.2.1 Tolerance. The tolerance for all taper pipe threads shall be plus or minus one turn (length of one pitch —— hereafter "pitch") on the inspection gage checked over the basic effective length of thread. External threads that are one turn under basic and internal threads that are one turn over basic shall be of correct form for not less than one pitch in excess of the respective L_2 and $L_1 + L_3$ lengths.

3.2.2 Thread angle. The thread angle when measured in the axial plane shall be such that its bisector will be perpendicular to the axis of the thread. Half of the thread angle shall be 30 degrees ±1 degree for all pitches with the exception of the 11-1/2 and 8 pitch threads which shall be within ±45 minutes.

3.2.3 Lead of thread. The tolerance on lead (pitch and helix) between any two pitches within the effective thread lengths L_2 and $L_1 + L_3$ shall be the basic pitch within 0.002 inch.

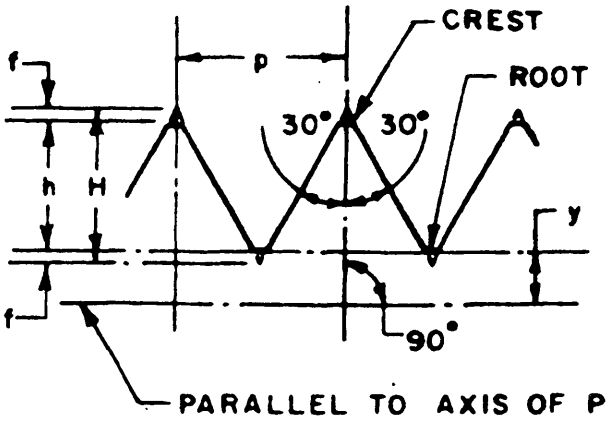
3.2.4 Taper of thread. The taper of the thread shall be 3/4 inch per foot, ±1/16 inch, when measured on the diameter and along the axis.

3.2.5 Internal threads. The entrance end of internal threads shall be countersunk 90 degrees to the diameter given in table I.

3.2.6 External threads. The entering end of external threads shall be chamfered 45 degrees to the distance given in table I.

3.2.7 Thread bosses. Externally pipe threaded bosses shall conform to the dimensions shown on AND10052, and internally pipe threaded bosses shall conform to the dimensions shown on AND10053.

3.2.8 Gage manufacture. Gages for checking pipe threads shall be in accordance with the requirements of this specification and MIL-G-10944.



n = Number of threads per inch.
p = Pitch of thread (measured parallel to axis) = $\frac{1}{n}$
H = Height of sharp V thread = 0.866025 p.
h = Basic depth of thread on product = 0.8 p.
f = Depth of truncation.
y = Angle of taper (1°47' approx.) = 3/4 inch per foot on diameter

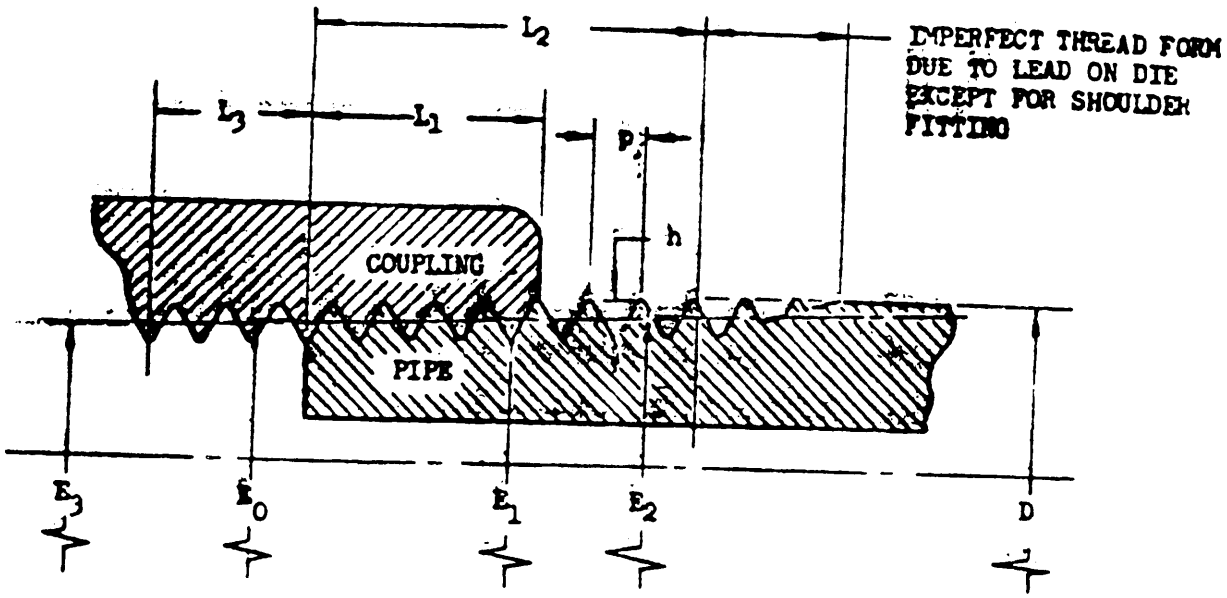
Figure 1. Aeronautical National Taper Pipe Thread Form and notation.

Table 1. Countersinking, chamfering, and limits on crest and root truncation[1].

1	2	3	4	5	6	7	8	9	10	11	12
Nominal pipe size (inches)	Threads per inch	Truncation				Width of flat				Chamfer	C sink
		Minimum		Maximum		Minimum		Maximum		45° Approx XJ	90° ±5° XK
		Formula	Inch	Formula	Inch	Formula	Inch	Formula	Inch	J^2	K^3 +0.03 -0.00
1/16	27	0.033P	0.0012	0.096P	0.0036	0.038P	0.0014	0.111P	0.0041	0.03-0.05	0.312
1/8	27	0.033P	0.0012	0.096P	0.0036	0.038P	0.0014	0.111P	0.0041	0.03-0.05	0.406
1/4	18	0.033P	0.0018	0.088P	0.0049	0.038P	0.0021	0.102P	0.0057	0.04-0.07	0.562
3/8	18	0.033P	0.0018	0.088P	0.0049	0.038P	0.0021	0.102P	0.0057	0.04-0.07	0.687
1/2	14	0.033P	0.0024	0.078P	0.0056	0.038P	0.0027	0.090P	0.0064	0.05-0.08	0.875
3/4	14	0.033P	0.0024	0.078P	0.0056	0.038P	0.0027	0.090P	0.0064	0.05-0.08	1.062
1	11-1/2	0.033P	0.0029	0.073P	0.0063	0.038P	0.0033	0.084P	0.0073	0.06-0.09	1.312
1-1/4	11-1/2	0.033P	0.0029	0.073P	0.0063	0.038P	0.0033	0.084P	0.0073	0.06-0.09	1.641
1-1/2	11-1/2	0.033P	0.0029	0.073P	0.0063	0.038P	0.0033	0.084P	0.0073	0.06-0.09	1.906
2	11-1/2	0.033P	0.0029	0.073P	0.0063	0.038P	0.0033	0.084P	0.0073	0.06-0.09	2.500
2-1/2	8	0.033P	0.0041	0.062P	0.0078	0.038P	0.0048	0.072P	0.0090	0.08-0.11	2.906
3	8	0.033P	0.0041	0.062P	0.0078	0.038P	0.0048	0.072P	0.0090	0.08-0.11	3.531

[1] See 3.2.7
[2] J — External threads.
[3] K — Internal threads.

TABLE II. *Dimensions of Aeronautical National Taper Pipe Threads*



D = Outside diameter of pipe = Major diameter of pipe thread at L_3 from end of pipe.
L_1 = Normal engagement by hand between external and internal threads.
L_2 = Effective length of external thread = p (0.8D + 6.8).
L_3 = Normal wrench take-up = 3p.
$(L_3 + L_2)$ = Effective length of internal thread.
E_0 = Basic pitch diameter of thread at end of pipe = D − (0.05D + 1.1)p.
E_1 = Basic pitch diameter of thread at end of coupling = E_0 + 0.0625L_1.
E_2 = Basic pitch diameter of thread at L_3 from end of pipe = E_0 + 0.0625L_3.
E_3 = Basic pitch diameter of thread at L_3 from end of pipe = E_0 − 0.1875p.

Nominal pipe size	Threads per inch n	Pitch = 1/n p	Depth of thread h(max)	D	Basic lengths			Basic pitch diameters			
					L_1	L_2	(L_1+L_3)	E_0	E_1	E_2	E_3
1	2	3	4	5	6	7	8	9	10	11	12
Inches		*Inch*	*Inch*	*Inches*	*Inch*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
1/16	27	0.03704	0.02963	0.3125	0.160	0.26111	0.27111	0.27118	0.28118	0.26750	0.26424
1/8	27	0.03704	0.02963	0.405	0.1615	0.26385	0.27261	0.36151	0.37360	0.38000	0.35656
1/4	18	0.05556	0.04444	0.540	0.2278	0.40178	0.39447	0.47739	0.49103	0.50250	0.46697
3/8	18	0.05556	0.04444	0.675	0.240	0.40778	0.40367	0.61201	0.62701	0.63750	0.60160
1/2	14	0.07143	0.05714	0.840	0.320	0.53371	0.53429	0.75843	0.77843	0.79179	0.74504
3/4	14	0.07143	0.05714	1.050	0.339	0.54571	0.55329	0.96708	0.98857	1.00179	0.95420
1	11½	0.08696	0.06957	1.315	0.400	0.68278	0.66087	1.21363	1.23863	1.25030	1.19733
1¼	11½	0.08696	0.06957	1.660	0.420	0.70678	0.68087	1.55713	1.58338	1.60130	1.54083
1½	11½	0.08696	0.06957	1.900	0.420	0.72348	0.68037	1.79609	1.82234	1.84130	1.77978
2	11½	0.08696	0.06957	2.375	0.436	0.75652	0.69057	2.26902	2.29527	2.31630	2.23272
2½	8	0.12500	0.10000	2.875	0.682	1.13750	1.05700	2.71953	2.76218	2.79062	2.69600
3	8	0.12500	0.10000	3.500	0.706	1.20000	1.14100	3.34062	3.38550	3.41562	3.31719

Notes: For selection of tap drills and taper pipe reamers, subtract the depth "h" from the pitch diameter at E_0.

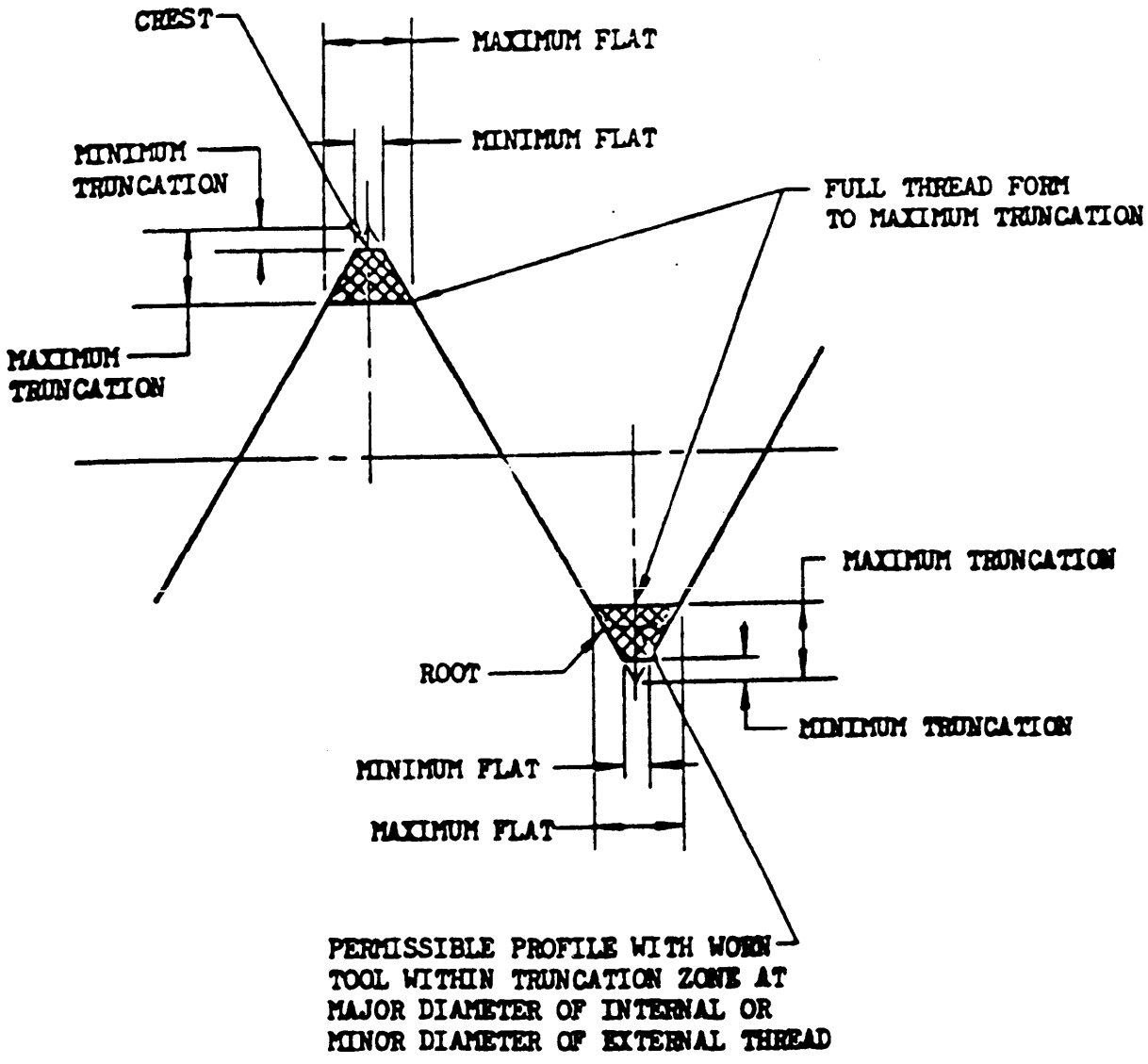


FIGURE 2. *Crest and root truncation tolerance zones.*

3.2.9 Marking. Gages fabricated in conformance with this specification shall be plainly and permanently marked with "MIL-P-7105B" to denote compliance with the aeronautical pipe thread requirements of this specification. Additional markings shall be applied as specified on gage drawings, or in the order or invitation for bids.

3.3 Formulae and constants. The formulae and constants for six step plug and ring gages are as follows:

1	2	3	4 (1)	5 (2)
TPI	Constant Max Trunc	One Turn Lgth One Pitch	Twice the Addendum at Maximum Trunc	Length Eqvt of Max Trunc-Min Trunc
27	0.096	0.03704	0.02496	0.07467
18	0.088	0.05556	0.03833	0.09778
14	0.078	0.07143	0.05072	0.10286
11-1/2	0.073	0.08696	0.06261	0.11130
8	0.062	0.12500	0.09275	0.11600

(1) Sharp "V" thread depth - 2(max trunc) $\frac{.866025}{n} - 2\left(\frac{x}{n}\right) = \frac{.866025 - 2X}{n}$

x = max trunc constant

(2) Length equivalent = 32 (max trunc - min trunc)

$= 32 \left(\frac{x - y}{n}\right)$

x = max trunc constant y = min trunc constant = 0.033

Taper Plugs

D = Minor diameter at E_3 with max trunc

D = E_3 - Col 3

$B_t = L_1 + L_3$*

B = B_t - Length equiv. of max trunc - Min trunc

B = B_t - Col 4

MN = B - Col 2 (one turn)

$MN_t = B_t$ - Col 2

MX = B + Col 2

$MX_t = B_t$ + Col 2

Taper Rings

D = Major diameter at E_2 with max trunc

D = E_2* + Col 3

B_t = L_2*

B = B_t - Length equivalent of max trunc - min trunc

B = B_t - Col 4

MN = B + Col 2

MN_t = B_t + Col 2

MX = B - Col 2

MX_t = B_t - Col 2

* Product figured to 5 significant decimal places

3.4 Workmanship. Workmanship shall be consistent with the tolerances herein specified. The threads shall have a smooth finish, and be free from flaws, blow holes, abrupt terminations and other defects which would make them unsuitable for the purpose intended.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Gages. Pipe threads shall be checked with gages that conform to tables III and IV and figures 3, 4, and 5. The gages shall be subject to certification by a Government agency at the discretion of either the procuring activity or the Government inspector.

4.3 Inspection gages shall not be used when worn beyond the basic dimensions by more than 1/2 turn (pitch). Proper allowance shall be made for any variation from basic when using a gage.

TABLE III. *Basic Dimensions of Threaded Plug and Ring Gages for Aeronautical National Taper Pipe Threads*

Nominal size of pipe	Number of threads per inch, n	Pitch p	Major diameter of plug gages			Pitch diameter of plug and ring gages			Minor diameter of ring gages				Increase in diameter per thread	Thickness of thin ring, L_4	Thickness of full ring, L_5
			At small end of L_4 [1]	At gaging notch of L_5 [1]	At small end of master L_3 [2]	Small end of ring gages or L_3 plug gages, E_0	At gaging notch L_5 plug gages or at large end of thin ring gage, E_4	At large end, full ring, E_5	Thin ring [1]		Full ring [1]				
									At small end	At large end	At small end	At large end			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Inches		*Inch*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inch*	*Inch*	*Inches*
1/16	27	0.03704	0.29614	0.30614	0.30081	0.27118	0.28118	0.28750	0.28022	0.28022	0.24022	0.26234	0.00231	0.160	0.26111
1/8	27	0.03704	0.38817	0.39856	0.39314	0.36351	0.37360	0.38000	0.34255	0.35264	0.33855	0.35581	0.00231	0.1615	0.26387
1/4	18	0.05556	0.51572	0.52996	0.52183	0.47739	0.49164	0.50250	0.44501	0.46018	0.43955	0.46117	0.00317	0.2278	0.40178
3/8	18	0.05556	0.65035	0.66535	0.65615	0.61201	0.62701	0.63750	0.58057	0.59557	0.57368	0.59917	00317	0.230	0.40778
1/2	14	0.07143	0.80914	0.82914	0.81557	0.75343	0.77813	0.79179	0.71800	0.73800	0.70771	0.73107	0.00446	0.320	0.53371
3/4	14	0.07143	1.01839	1.03958	1.02182	0.96768	0.98887	1.00179	0.92725	0.94844	0.91696	0.95107	0.00446	0.339	0.51571
1	11½	0.08696	1.27621	1.30121	1.28320	1.21303	1.23803	1.25630	1.16441	1.18911	1.15102	1.19370	0.00513	0.400	0.65278
1¼	11½	0.08696	1.61971	1.64599	1.62670	1.55713	1.58338	1.60130	1.50791	1.53416	1.49452	1.53870	0.00513	0.420	0.70678
1½	11½	0.08696	1.85870	1.88195	1.86566	1.79609	1.82234	1.84130	1.74687	1.77312	1.73348	1.77870	0.00513	0.420	0.72348
2	11½	0.08696	2.33163	2.35888	2.33859	2.26902	2.29627	2.31630	2.21960	2.24705	2.20611	2.25370	0.00513	0.436	0.75652
2½	8	0.12500	2.81228	2.85191	2.81953	2.7195	2.76216	2.79062	2.64878	2.69141	2.62678	2.69787	0.00781	0.652	1.13750
3	8	0.12500	3.43338	3.48125	3.44062	3.34062	3.38850	3.41562	3.26987	3.31775	3.24787	3.32287	0.00781	0.766	1.20000

[1] These dimensions are based on gage truncation formulas that are the same as column 5 of table I.

[2] L_1 ring gages are to be truncated $0.15p$.

[3] Major diameter of master thread setting plug gages to be truncated $0.033p$.

TABLE IV. *Tolerances for Aeronautical National Taper Pipe Thread plug and ring gages*

Nominal pipe size	Number of threads per inch, n	Tolerance on pitch diameter incl. taper [1] [2]	Tolerance on lead [3]	Tolerance on half angle (plus or minus) minutes [4]	Tolerance on major diameter of plug gage (minus)	Tolerance on minor diameter of ring gage (plus)	Total cumulative tolerances on pitch diameter	Maximum longitudinal variation from basic for plug or ring gage	Maximum stand-off between plug and ring gages at gaging notch when screwed together tightly by hand [5]
1	2	3	4	5	6	7	8	9	10
1/16	27	0.0002	0.0002	20	0.0005	0.0005	0.00088	0.0141	0.0282
1/8	27	0.0002	0.0002	20	0.0005	0.0005	0.00088	0.0141	0.0282
1/4	18	0.0003	0.0002	15	0.0005	0.0005	0.00102	0.0163	0.0326
3/8	18	0.0003	0.0002	15	0.0005	0.0005	0.00102	0.0163	0.0326
1/2	14	0.0003	0.0002	13	0.0005	0.0005	0.00107	0.0171	0.0342
3/4	14	0.0003	0.0002	13	0.0005	0.0005	0.00107	0.0171	0.0342
1	11½	0.0003	0.0003	10	0.0005	0.0005	0.00121	0.0194	0.0388
1¼	11½	0.0003	0.0003	10	0.0005	0.0005	0.00121	0.0194	0.0388
1½	11½	0.0003	0.0003	10	0.0005	0.0005	0.00121	0.0194	0.0388
2	11½	0.0003	0.0003	10	0.0005	0.0005	0.00121	0.0194	0.0388
2½	8	0.0004	0.0004	5	0.0005	0.0005	0.00137	0.0219	0.0438
3	8	0.0004	0.0004	5	0.0005	0.0005	0.00137	0.0219	0.0438

Dimensions in inches at 68° F.

[1] The taper of the pitch diameter cone shall be such that the pitch diameter will be within the tolerances given at all points. For example, if a gage is to maximum size at the small end, the taper shall be not greater than 0.750 inch per foot. If gage is to minimum size at the small end, the taper shall be not less than 0.750 inch per foot.

[2] Pitch diameter tolerance is to be applied plus on plug gages and minus on ring gages.

[3] Allowable variation in lead between any two threads.

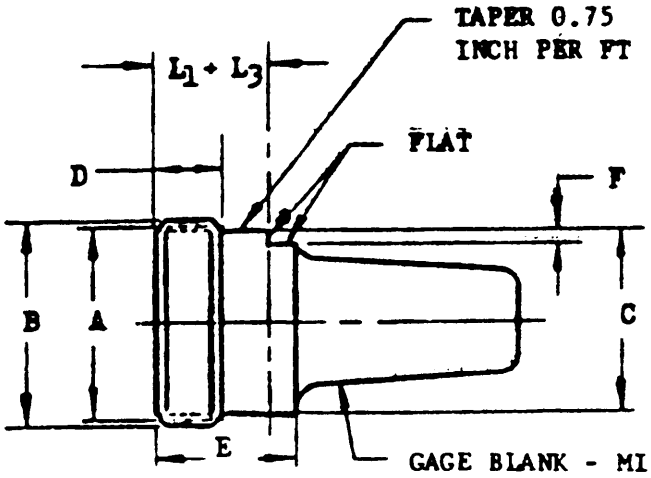
[4] In solving for the correction in diameter for angle errors the average error in half angle for the two sides of the thread regardless of their signs should be taken.

[5] Possible variations if both gages are at opposite extremes of the allowable tolerances.

The tolerance for the height from small end to gaging notch of the plug gage shall be +0.000 and −0.001 for sizes 1/16 to 2 inches, inclusive, and +0.000 and −0.002 for sizes 2½ inches and 3 inches.

The tolerance for the overall thread length of the plug gage shall be +0.005 and −0.000 for sizes 1/16 to 2 inches, inclusive, and +0.010 and −0.000 for sizes 2½ inches and 3 inches.

The tolerance for the thickness of the ring gage shall be +0.001 and −0.000 for sizes 1/16 to 2 inches, inclusive, and +0.002 and −0.000 for sizes 2½ inches and 3 inches.



Nominal size of pipe	Number of threads per inch, n	Small end E_1		Outside diameter at notch 0.020 to 0.025 below sharp root	Length of four pitches	Standard notch plus length of three pitches	Blank length	Notch depth
		Pitch diameter	Outside diameter [1]					
		A	B +.0005 −.0000	C	D	(L_1+L_3)	E	F
Inches		Inches	Inches	Inches	Inch	Inches	Inches	Inch
1/16	27	0.20424	0.28520	0.224–0.229	0.14815	0.27111	5/16	.020–.028
1/8	27	0.35656	0.37753	0.318–0.323	0.14815	0.27201	13/32	.030–.035
1/4	18	0.46697	0.49842	0.417–0.422	0.22222	0.39447	1/2	.030–.035
3/8	18	0.60160	0.63304	0.554–0.559	0.22222	0.40667	9/16	.030–.035
1/2	14	0.74504	0.78546	0.692–0.697	0.28571	0.53429	11/16	.040–.045
3/4	14	0.95429	0.99471	0.902–0.907	0.28571	0.55329	23/32	.040–.045
1	11½	1.19733	1.24654	1.138–1.143	0.34783	0.66087	3/4	.050–.055
1¼	11½	1.54083	1.59004	1.483–1.488	0.34783	0.68087	3/4	.050–.055
1½	11½	1.77978	1.82900	1.722–1.727	0.34783	0.68087	3/4	.050–.055
2	11½	2.25272	2.30193	2.196–2.201	0.34783	0.69087	3/4	.050–.055
2½(a)	8	2.69609	2.76684	2.628–2.633	0.50000	1.05700	1½	.050–.055
3(a)	8	3.31769	3.38794	3.254–3.259	0.50000	1.14109	1½	.050–.055

Dimensions in inches at 68° F.

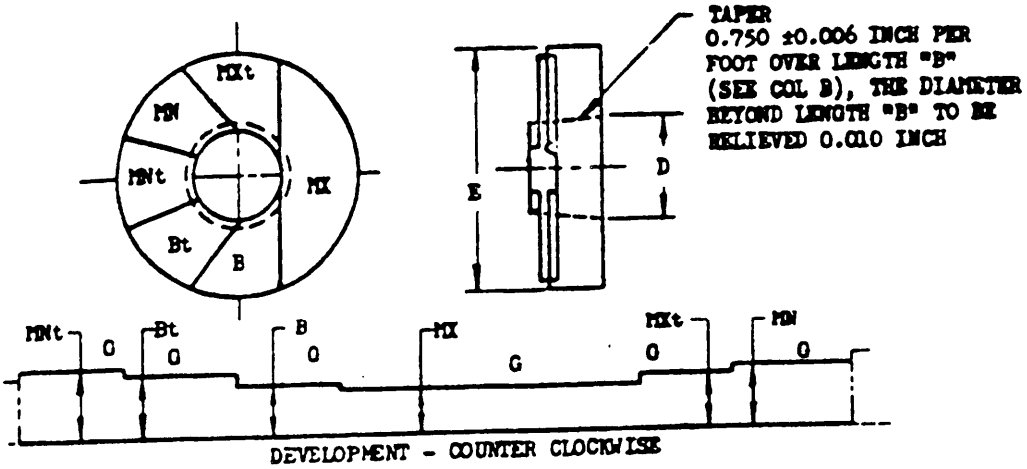
[1] Major diameter "B" is based on 0.15p truncation.

The end tolerances and distances between gaging notch and small end of gage shall conform to tolerances shown in table IV.

The following information shall be marked on relieved portion of blank or shank: "size", "L_4".

(a) Gages for pipe sizes 2½ inches and 3 inches to fit standard trilock handle.

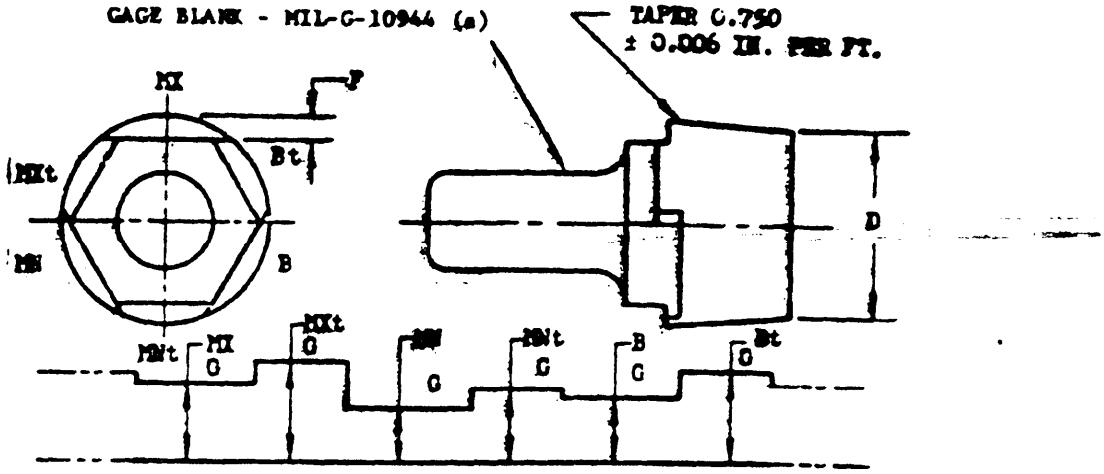
FIGURE 3. *Taper thread-L_3 plug gage.*



Pipe Size	Major DIA at L_2, Basic Thread with Min Trunc	Basic Pipe Thread		Minimum THD (Plus 1 Turn)		Maximum THD (Minus 1 Turn)		Ring Diameter
		Min Trunc	Max Trunc	Min Trunc	Max Trunc	Min Trunc	Max Trunc	
	D +.00015 ±.00000	B ±.001	Bt +.000 −.002	MN ±.001	MNt +.000 −.002	MX ±.001	MXt +.000 −.002	E
Inches	Inches	Inches	Inches	Inches	Inches	Inch	Inches	Inches
1/16	0.31246	0.18644	0.26111	0.22348	0.29815	0.14940	0.22407	1 1/4
1/8	0.40496	0.18918	0.26385	0.22622	0.30089	0.15214	0.22681	1 1/4
1/4	0.54083	0.30400	0.40178	0.35956	0.45734	0.24844	0.34622	1/1/2
3/8	0.67583	0.31000	0.40778	0.36556	0.46334	0.25444	0.35222	1 3/4
1/2	0.84251	0.43085	0.53371	0.50228	0.60514	0.35942	0.46228	2
3/4	1.05251	0.44285	0.54571	0.51428	0.61714	0.37142	0.47428	2 1/4
1	1.31891	0.57148	0.68278	0.65844	0.76974	0.48452	0.59582	2 5/8
1 1/4	1.66391	0.59548	0.70678	0.68244	0.79374	0.50852	0.61982	3 1/8
1 1/2	1.90391	0.61218	0.72348	0.69914	0.81044	0.52522	0.63652	3 3/8
2	2.37891	0.64522	0.75652	0.73218	0.84348	0.55826	0.66956	4
2 1/2	2.88337	1.02150	1.13750	1.14650	1.26250	0.89650	1.01250	4 3/4
3	3.50837	1.08400	1.20000	1.20900	1.32500	0.95900	1.07500	5 1/2

Dimensions in inches at 68°F
See paragraph 3.3

Figure 4. Plain taper ring gage.



DEVELOPMENT - COUNTER CLOCKWISE

Pipe Size	Minor Dia at L_3, Basic Thread with Min Trunc	Basic Pipe Thread		Minimum THD (Minus 1 Turn)		Maximum THD (Plus 1 Turn)		Depth of Notch
		Min Trunc	Max Trunc	Min Trunc	Max Trunc	Min Trunc	Max Trunc	
	D $\pm.00015$ $-.00000$	B $\pm.001$	Bt $\pm.000$ $-.002$	MN $\pm.001$	MNt $\pm.000$ $-.002$	MX $\pm.001$	MXt $\pm.000$ $-.002$	F
	Inches	Inches	Inches	Inch	Inches	Inches	Inches	Inch
1/16	0.23928	0.19644	0.27111	0.15940	0.23407	0.23348	0.30815	.032-.037
1/8	0.33160	0.19794	0.27261	0.16090	0.23557	0.23498	0.30965	.055-.060
1/4	0.42864	0.29669	0.39447	0.24113	0.33891	0.35225	0.45003	.055-.060
3/8	0.56327	0.30859	0.40667	0.25333	0.35111	0.36445	0.46223	.085-.090
1/2	0.69432	0.43143	0.53429	0.36000	0.46286	0.50286	0.60572	.057-.062
3/4	0.90357	0.45043	0.55329	0.37900	0.48186	0.52186	0.62472	.120-.125
1	1.13472	0.54957	0.66087	0.46261	0.57391	0.63653	0.74783	.120-.125
1 1/4	1.47822	0.56957	0.66087	0.46261	0.59391	0.65653	0.76783	.120-.125
1 1/2	1.71717	0.56957	0.66087	0.48261	0.59391	0.65653	0.76783	.120-.125
2	2.19011	0.58557	0.69687	0.49861	0.60991	0.67253	0.78383	.120-.125
(a)2 1/2	2.60334	0.94100	1.05700	0.81600	0.93200	1.06600	1.18200	.120-.125
(a)3	3.22444	1.02500	1.14100	0.90000	1.01600	1.15000	1.26600	.120-.125

Dimensions in inches at 68°F.

(a) Gages for pipe sizes 2½ inches and 3 inches to fit standard trilock handle.

See paragraph 3.3

Figure 5. Plain taper plug gage.

4.3.1 L_1 and L_3 thread plug gages may be used, having three gaging notches, basic, maximum, and minimum, representing the tolerance of plus or minus one turn (pitch), the maximum notch being one turn (pitch) above basic and the minimum notch one turn (pitch) below basic, and all three notches equally spaced around the gage diameter.

4.4 Gaging

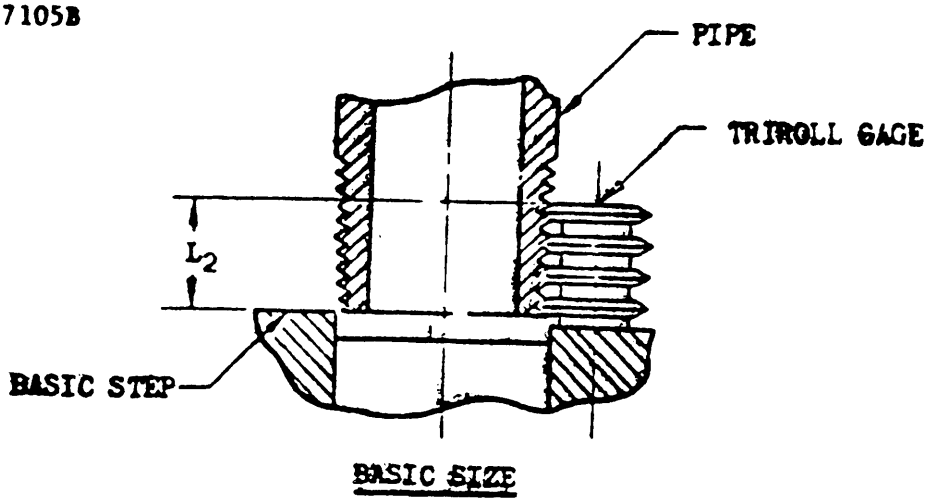
4.4.1 External thread. In the case of external threads, the fitting or pipe is within the extreme limits when the end of the fitting or pipe is within the minimum or maximum steps of the triroll gage one turn (pitch) either way of basic step (see fig. 6), or within one turn (pitch) either way of the small end of the ring (see figs. 7 and 8).

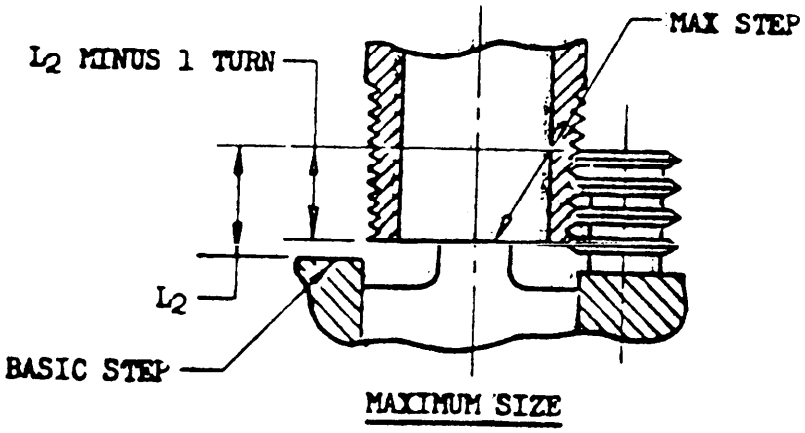
4.4.1.1 Gaging with the triroll gage. When J-S triroll pipe gages are used in gaging external threads, the gage is screwed on until perceptible resistance is encountered; the thread is then ready for gaging. This type of gage should not be forced over the product thread. Fundamentally, the J-S triroll pipe gage is a visual gage and corrections of the thread elements, that is, taper, angle, lead, root, thread form, etc., are determined by "sighting" the contact between the gage rolls and the thread being gaged.

4.4.1.2 Internal thread. The thread is within the extreme limits in the case of internal threads when the basic gaging notch of the thread plug gage is within one turn (pitch) either way of the fitting or boss face when screwed in tightly by hand (see figs. 9 and 10).

4.4.1.3 Should drawings and other data furnished by the procuring activity require external and internal threads to be chamfered or countersunk in excess of the dimensions shown in table I, the thread size shall be determined by using as the reference point the end of the chamfer or bottom of the countersink (first thread scratch) instead of from the end of the pipe or fitting.

4.4.2 Thread angle. Routine inspection shall be made by visual observation when a triroll gage, or equivalent, is used. More accurate determinations at the option of the procuring activity may be made by selective samples measured for thread angle in an approved type of microscope or optical projection equipment. Cross sections or cast proofs may be made of internal threads and measured by the same means to determine accuracy of thread angle.





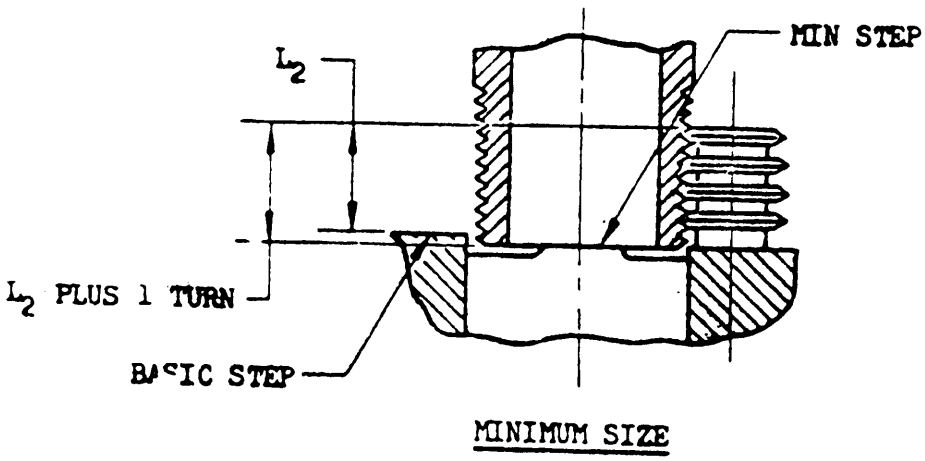


FIGURE 6. *Application of triroll gage.*

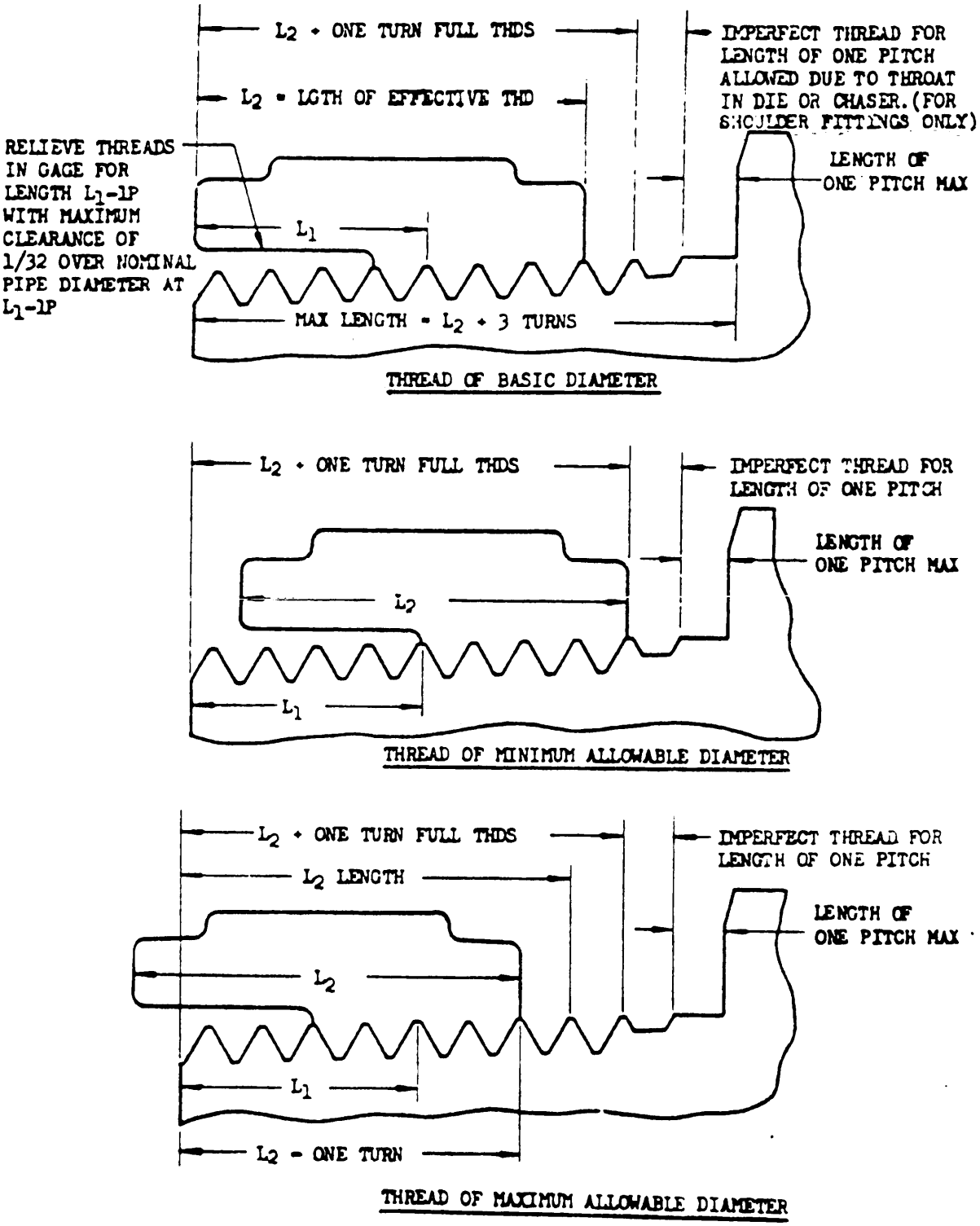
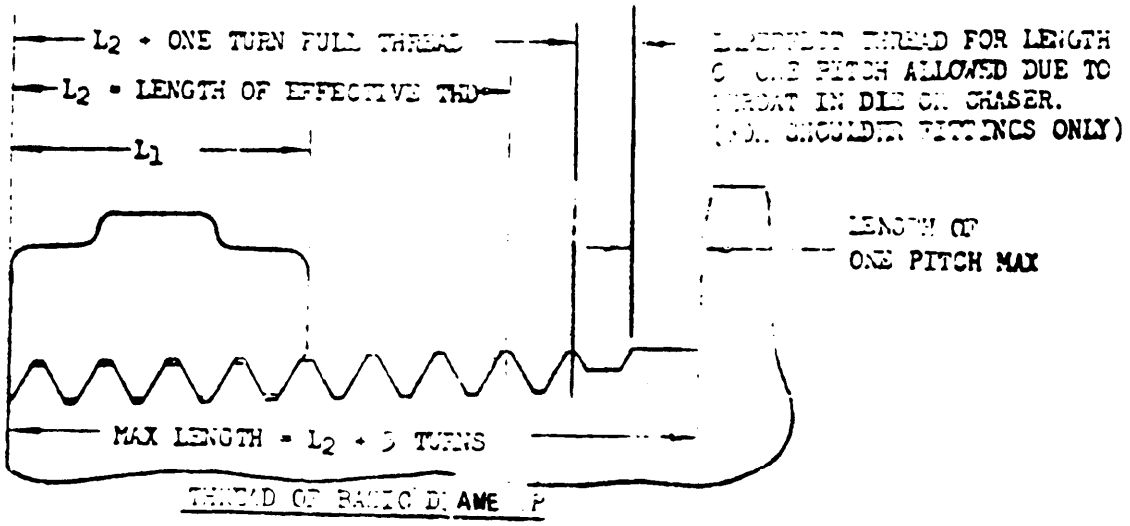
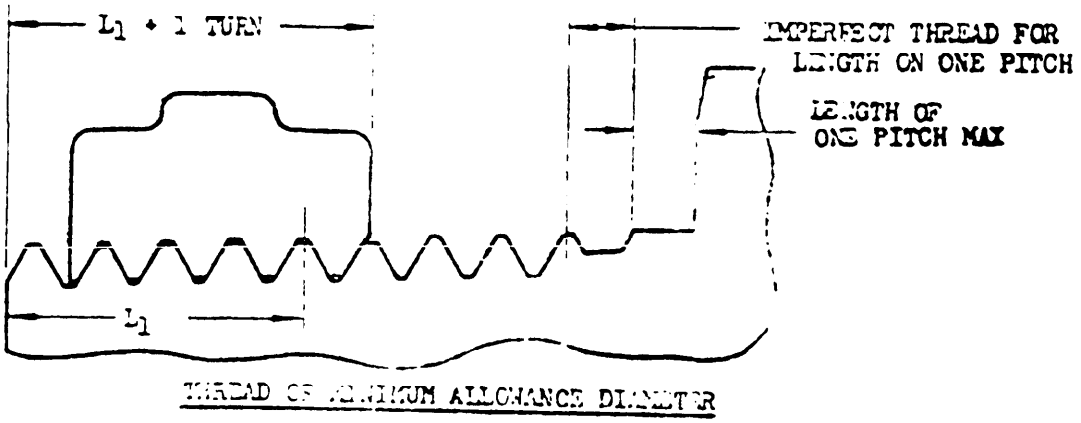


FIGURE 7. *Application of full ring taper thread gage.*





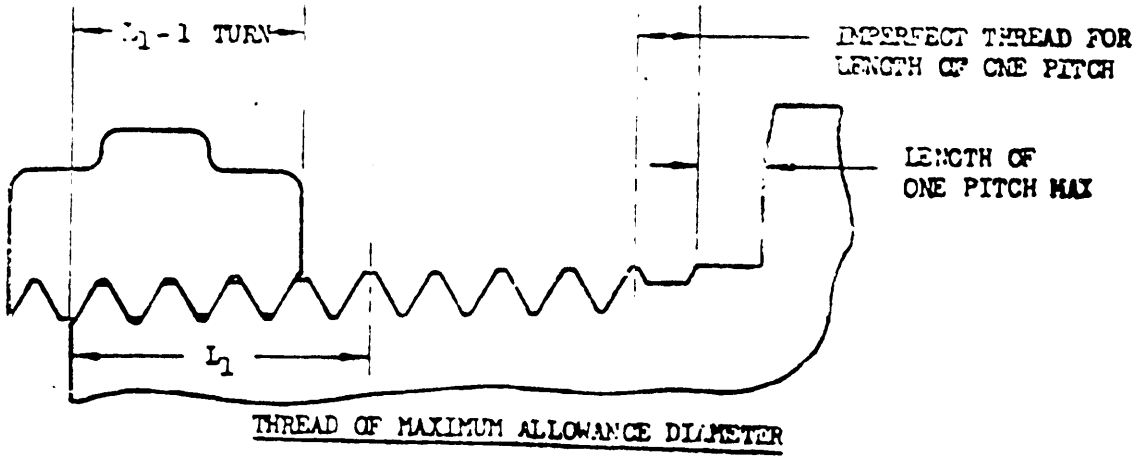


FIGURE 8. *Application of thin ring taper thread gage (0.16p).*

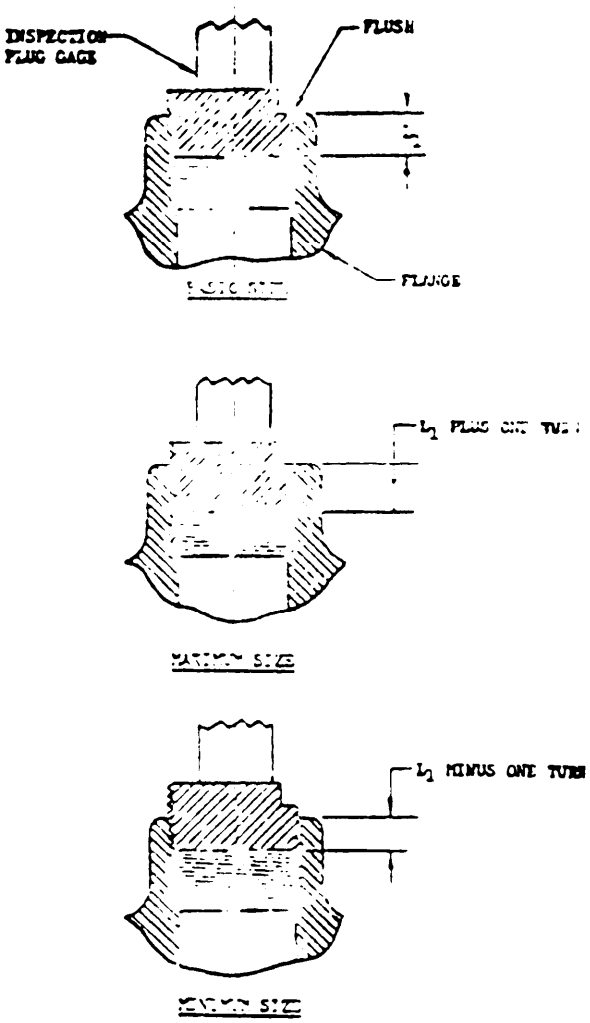


FIGURE 9. *Application of L_1 taper thread plug gage.*

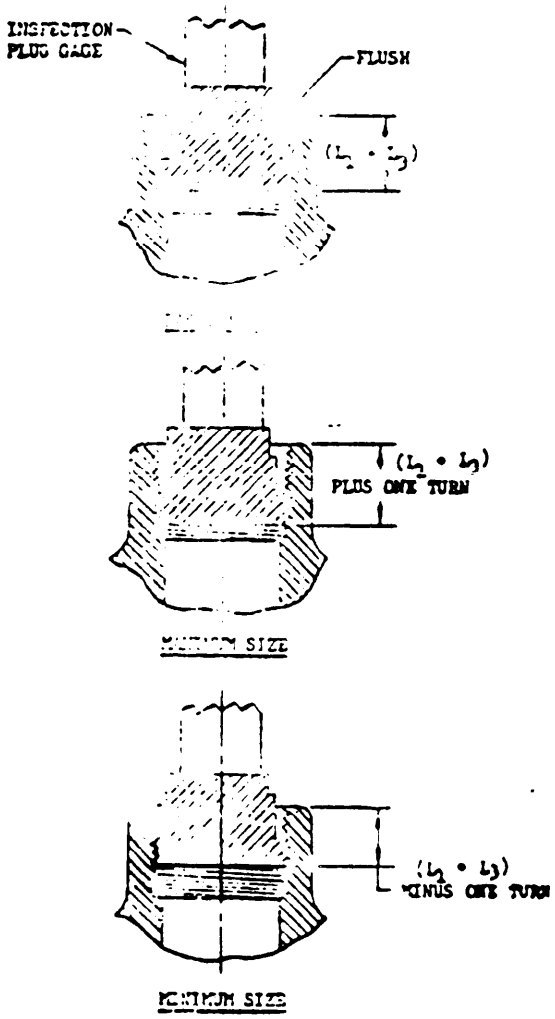


FIGURE 10. *Application of L_3 taper thread plug gage.*

4.4.3 Thread taper. The thread taper shall be measured over the effective length L_2 or (L_1 + L_3). The taper of external threads may be determined in the same manner described for thread angle. When pipe thread ring gages are used, the application shall involve the use of L_2 ring with thread relief as shown on figure 7 (having full profile, maximum truncation of product on remaining threads of gage) and L_1 ring (truncated 0.15p). The L_2 ring gage shall be screwed onto the product tightly by hand and the position of the face at the small end of the ring with the end of the product noted. The operation shall then be repeated with the L_1 ring gage. The relative position of the reference points of the two gages shall not vary more than 1/2 turn (pitch). Such defects as are produced by excessive chamfer in the throat of the dies or chasers, worn die or chaser threads, and thread angle errors, will be revealed to a small extent, within the limits of combination pipe ring gaging as shown on figures 7 and 8. The taper of internal threads can be determined by the use of an L_1 and an L_3 plug gage. The L_1 pipe thread plug gage shall be screwed into the internal thread of the product tightly by hand, and the position of the gaging notch with relation to the face or reference point of the product noted. The operation shall then be repeated with the L_3 pipe thread plug gage. The position of the relative gaging notch on the L_3 gage shall not vary more than 1/2 turn (pitch) from that position noted when gaging with the L_1 gage. For example, if the basic notch of the L_1 gage is 1/2 turn (pitch) above the face or reference point of the product, then the basic notch of the L_3 gage shall likewise be 1/2 turn (pitch) above the face or reference point of the product if the internal thread is normal or, if not, it shall be within the permissible tolerance of 1/2 turn (pitch) from this position, i.e., 1/2 turn (pitch) above or below the position previously noted with the L_1 gage. Such defects as belled holes due to excessively worn taps, excessive tap chamfer, shallow depths due to short taps, excessive regrinds and cutoffs, and excessive truncation at the major diameter, are readily determined in the same manner.

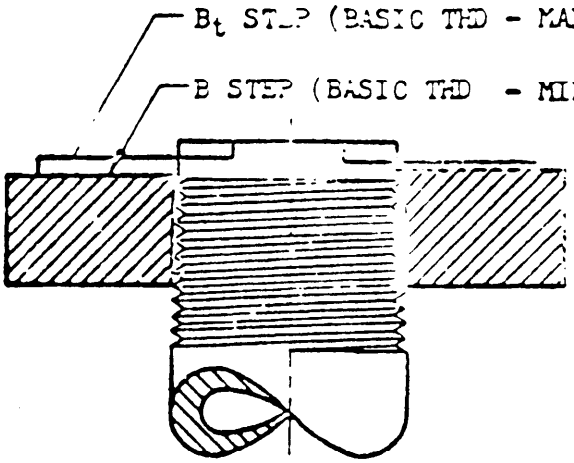
Note: The radial location of the relative gaging notches is not important. Only the variation from the face of the product is considered as explained in 4.4.3.

4.4.4 Major diameter — truncation. The major diameter or truncation of the external thread shall be measured over the effective length L_2 and checked in relation to the thread size. When the thread ring or thread triroll gage indicates the thread size to be basic, the basic and maximum basic truncation reference steps of the plain taper ring gage only shall be used in determining the allowable variation in major diameter. The small end

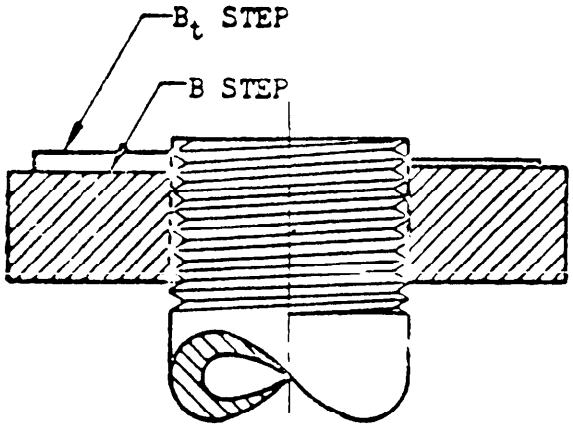
of the threaded product shall be within these two steps and shall not protrude beyond the maximum basic truncation step of the plain taper ring gage when the ring gage is slipped tightly (do not force) over the product (see fig. 11). The same gaging principle shall be applied when a thread size is minimum or maximum or at any intermediate position or size which may be estimated. Off taper or out-of-round (egg-shaped) is indicated by excessive shake or play (see fig. 11).

4.4.5 Gaging with the plain taper triroll gage. When J-S plain taper triroll gages are used for gaging the major diameter of external pipe threads, the gage is slipped over the product until a perceptible resistance is encountered between the rolls of the gage and the major diameter of the product, during which simultaneous contact is made between the end of the product, and the flush-pin contact flange. The product is then ready for gaging. The same principle of gaging is in effect as explained in 4.4.4, except the gage references are located on the end of the flush-pin and the hub at the rear of the plain taper triroll gage. The three steps on the hub represent increments of one turn (pitch) and are identified as basic, maximum, and minimum. The step on the end of the flush-pin represents the allowable variation on the major diameter (or thread crest truncation) of the product transposed into longitudinal travel of the flush-pin. If the pipe thread gage indicates the product thread to be basic, the basic step on the hub of the triroll gage only shall be used, and the major diameter of the product is within the specified tolerances for truncation when the step of the flush-pin does not project beyond the basic step of the gaging hub (see fig. 12). The same gaging principle shall be applied when the thread size is maximum or minimum, or at any intermediate position or size which may be estimated. Off taper is indicated by excessive shake and may for all practical purposes be measured by inserting thickness gage between the gage rolls and the major diameter of the product at the point of extreme gap. One thickness gage will not suffice as the product may be canted in the gage.

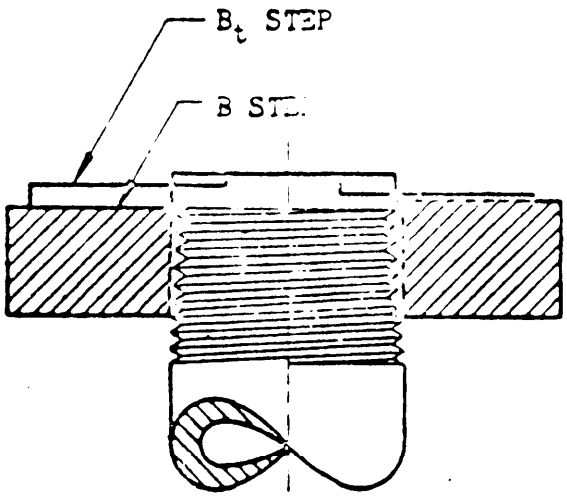
4.4.6 Minor diameter - truncation. The minor diameter of the internal thread shall be checked in relation to the thread size. When the thread plug gage indicates the thread size to be basic, the basic and maximum basic truncation reference steps of the plain taper plug gage only shall be used in determining the allowable variation in minor diameter. The face of the fitting or boss shall be within these two steps and the maximum basic truncation step of the plain taper plug gage shall not be below the reference surface of the product (see fig. 13). The same gaging principle shall be applied when a thread size is minimum or maximum or at any intermediate position or size which may be estimated. Off taper or out-of-round (egg-shaped) is indicated by excessive shake as shown in figure 13.



MAJOR DIAMETER OF PIPE IS BASIC WHEN END OF THREAD IS FLUSH WITH THE BASIC STEP OF PLAIN TAPER RING GAGE

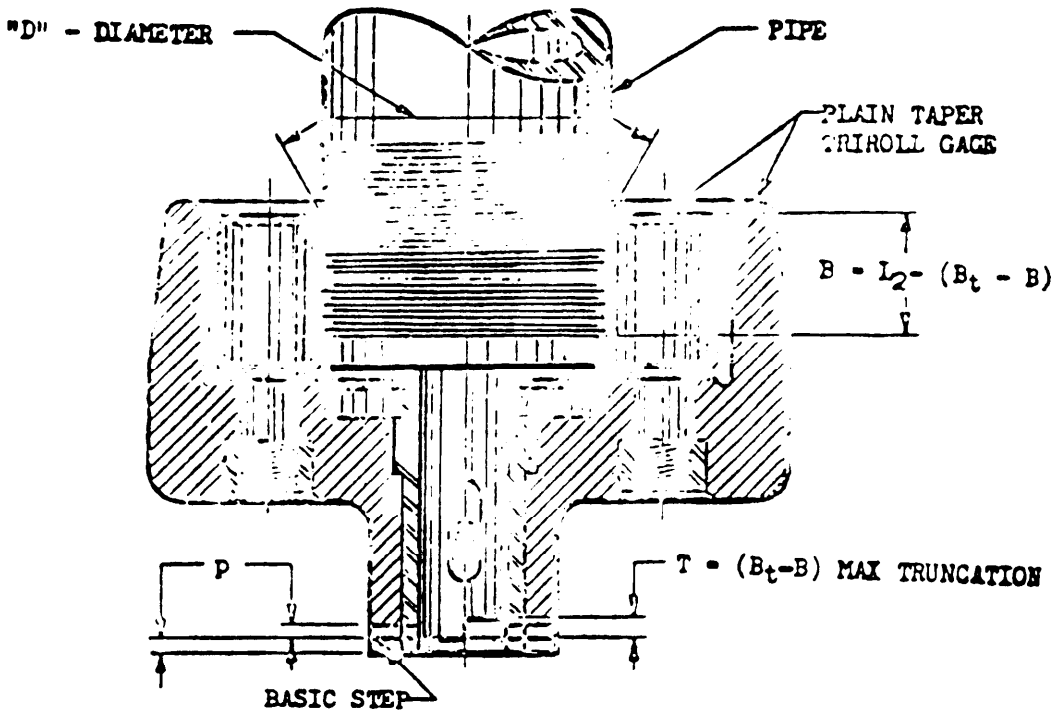


THREAD IS UNDERSIZE OR EXCESSIVELY TRUNCATED ON MAJOR DIAMETER WHEN END OF THREAD EXTENDS BEYOND THE APPLICABLE MAX TRUNCATION STEP OF PLAIN TAPER RING GAGE. ILLUSTRATION SHOWS EXAMPLE OF BASIC THREAD EXCESSIVELY TRUNCATED



OFF TAPER WILL BE INDICATED BY SHAKY FIT OF PLAIN TAPER RING GAGE

FIGURE 11. *Application of plain taper ring gage.*



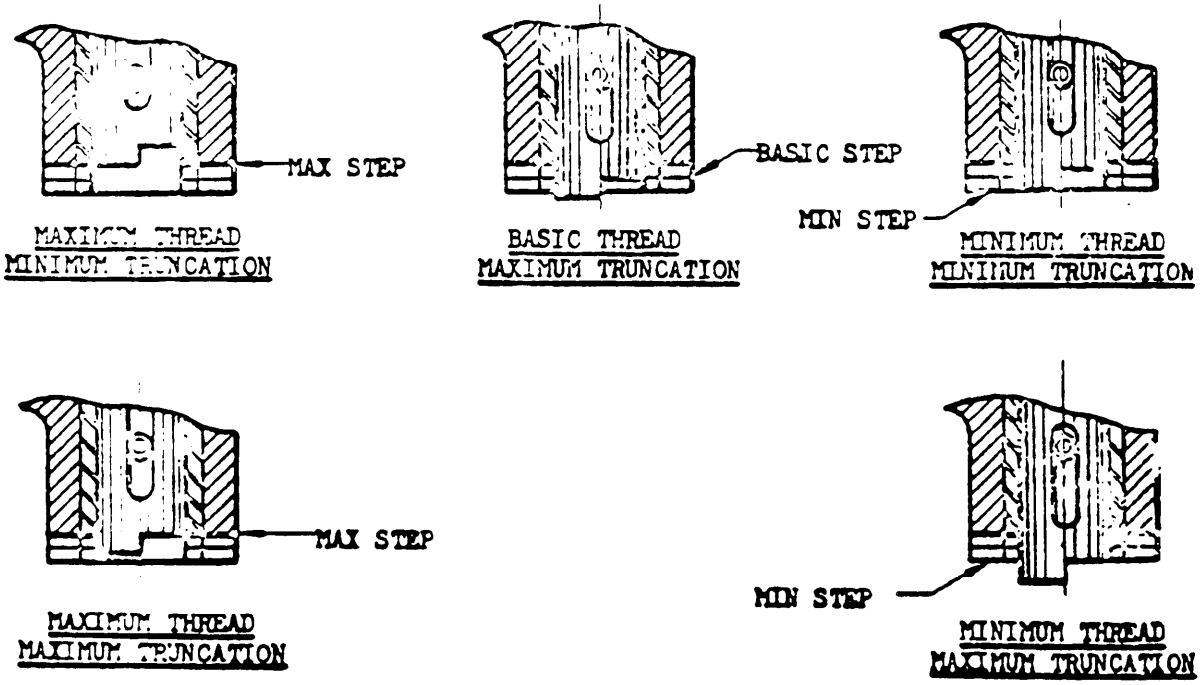


FIGURE 12. *Application of plain taper triroll gage.*

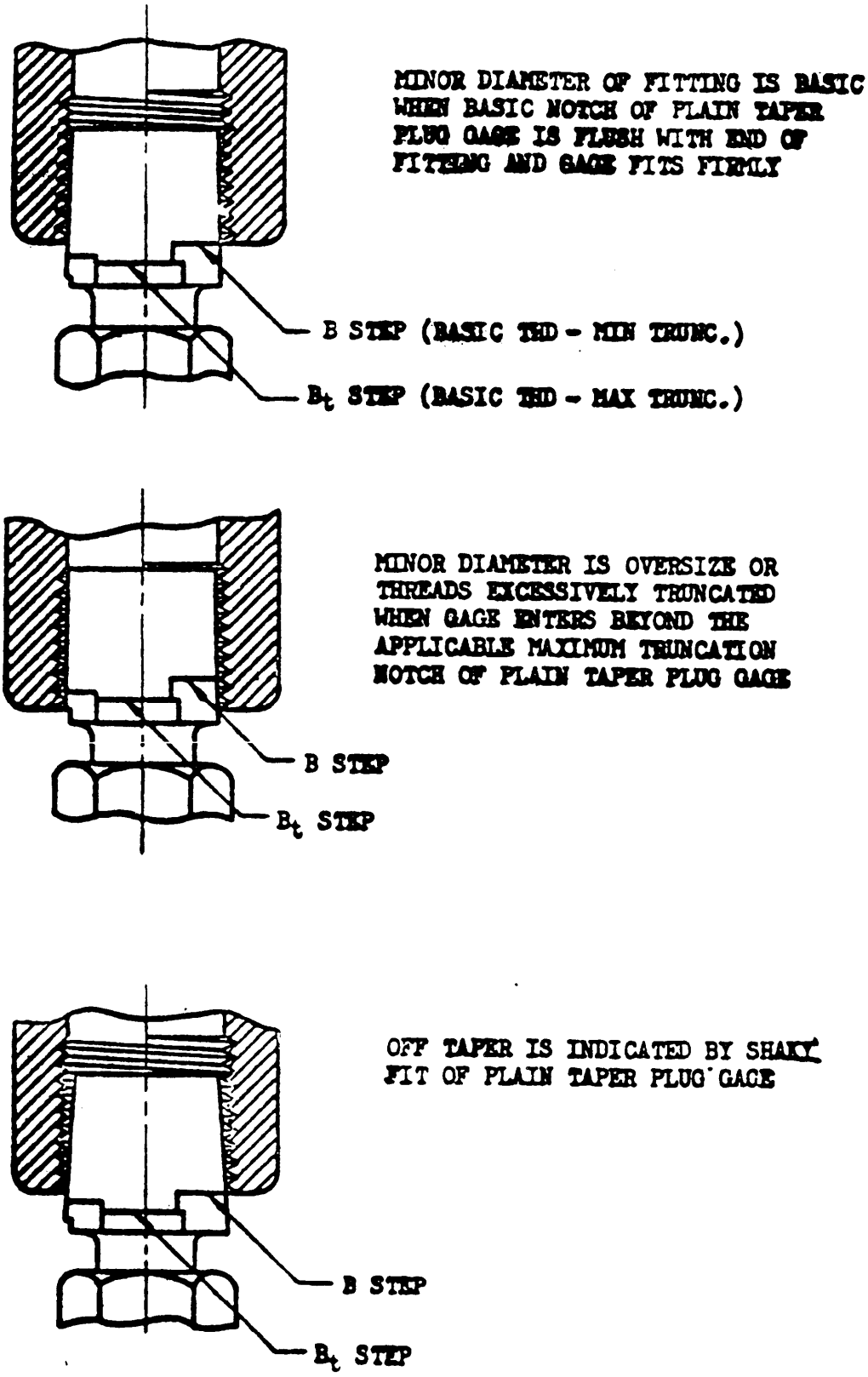


FIGURE 13. *Application of plain taper plug gage.*

4.5 Roundness of internal threads. Internal threads for use in high pressure gas systems where a sealant cannot be used shall be checked for off taper and roundness. A suitable plain taper, minor diameter, dial indicating plug gage shall be used to determine total off taper and roundness of minor diameter within the following limits:

1/8	inch	ANPT	--0.002 inch
1/4	inch	ANPT	--0.003 inch
1/2	inch	ANPT	--0.004 inch
1	inch	ANPT	--0.005 inch

The maximum out-of-round is the same as wobble, with the exception that no more than 1/2 the maximum tolerance can be allowed on a side.

5. PREPARATION FOR DELIVERY

5.1 Not applicable

6. NOTES

6.1 Intended use. Threads and gages covered by this specification are intended for use on pipe, plugs, fittings, and similar devices in aeronautical components and equipment requiring a sealed thread joint and where straight threads and gaskets or O rings are inadequate.

6.2 U. S. Air Force drawings. The following U. S. Air Force drawings, Inspection and Basic Master Setting Plug Gages, may be obtained upon application to the Commander, Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio:

48C20190	Gage Assembly-Plug, Pipe Taper, Threaded, Basic Master Setting
48C20191	Gage Assembly-Plug, Pipe Taper, Plain, Basic Master Setting
48C20192	Gage Assembly-Plug, Pipe Taper, Threaded, L_1 and L Members
48C20193	Gage Assembly-Plug, Pipe Taper, Plain

6.3 Accuracy of dimensions. The dimensions in this specification, given in inches to five decimal places, implies a greater degree of precision than is ordinarily attained; these dimensions are so expressed for the purpose of eliminating errors in computations. Original calculations were made to more than five places and rounded off to five places.

6.4 Interchangeability. The E1 internal diameter and the L1 handtight engagement values for the 1/8- and 1/4-inch sizes shown in table II have been revised to correct for a disproportionate number of pitches for handtight engagement. Threads made in accordance with previous issues of this specification are interchangeable functionally with threads made in accordance with this specification. Gages in accordance with previous editions of this specification are not suitable for gaging threads in accordance with this specification. All new gages should be made to the new dimensions. Old gages should be retained in service until worn out or until the transition is complete, whichever comes first.

Custodians:
Army - WC
Air Force - 11
Navy - none

Review activities:
Army - MO, WC
Air Force - 11, 69, 70
Navy - none

User activities:
Air Force - 67, 71

Preparing activity:
Air Force - 11
Project No. 4730-0293

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SPECIFICATION ANALYSIS SHEET	Form Approved Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use of the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

ORGANIZATION	CITY AND STATE

CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A
☐ Direct Government Contract ☐ Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?
   ☐ YES ☐ NO IF "YES" IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)	DATE

DD Form 1426