



AEROSPACE STANDARD

AS71051**REV B.**

Issued 1999-06
Revised 2008-03
Reaffirmed 2015-07

Superseding AS71051A

Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT -
Design and Inspection Standard

RATIONALE

AS71051B has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE

This document establishes the requirements for Aeronautical National Form (ANPT) pipe threads, gages, and gaging methods for determining conformity of aeronautical taper pipe threads to this standard.

1.1 Purpose

Threads and gages covered by this standard 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.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS5200 Port or Fitting End, Internal Taper Pipe Thread, Design Standard

AS5201 Fitting End, External Taper Pipe Thread, Design Standard

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2.1.2 ASME Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

2.1.3 U.S. Government Publications

Available from Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch>.

MIL-G-10944 Gages, Dimensional Control

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 standard.

3.2 Dimensions

Taper pipe threads shall conform to dimensions as shown on Figure 2 and given in Tables 1 and 2, 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 1, and as shown on Figure 3. 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 $30^\circ \pm 1^\circ$ 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

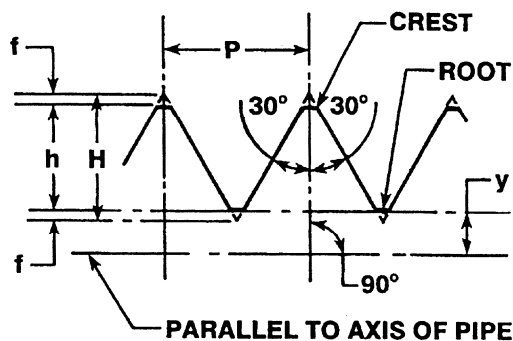
The tolerance on lead (pitch and helix) between any two pitches within the effective thread lengths L_2 and $L_1 + L_3$ shall be the basic pitch within .002 inch.

3.2.4 Taper of Thread

The taper of the thread shall be 3/4 inch per foot, $\pm 1/16$ 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° to the diameter given in Table 1.



n = Number of threads per inch.

p = Pitch of thread (measured parallel to axis) = $1/n$

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 ($1^\circ 47'$ 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⁾

TABLE 1A - DIMENSIONS 1-6

Nominal Pipe Size Inch	Threads per Inch	Truncation			
		Minimum		Maximum	
		Formula	Inch	Formula	Inch
1	2	3	4	5	6
1/16	27	.033P	.0012	.096P	.0036
1/8	27	.033P	.0012	.096P	.0036
1/4	18	.033P	.0018	.088P	.0049
3/8	18	.033P	.0018	.088P	.0049
1/2	14	.033P	.0024	.078P	.0056
3/4	14	.033P	.0024	.078P	.0056
1	11-1/2	.033P	.0029	.073P	.0063
1 1/4	11-1/2	.033P	.0029	.073P	.0063
1 1/2	11-1/2	.033P	.0029	.073P	.0063
2	11-1/2	.033P	.0029	.073P	.0063
2 1/2	8	.033P	.0041	.062P	.0078
3	8	.033P	.0041	.062P	.0078

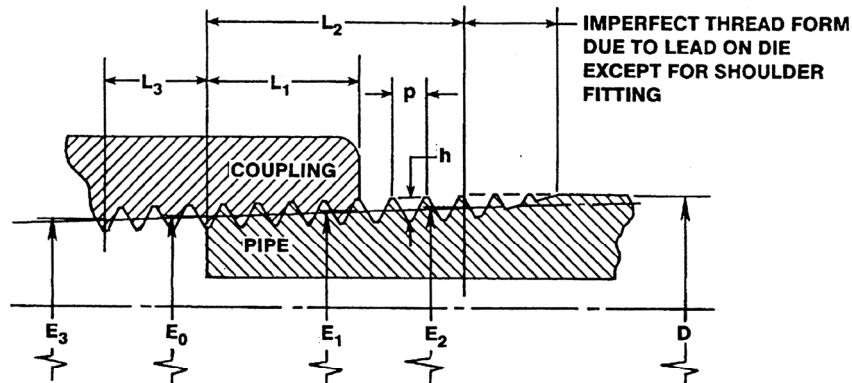
TABLE 1B - DIMENSIONS 7-12

Nominal Pipe Size Inch	Width of Flat				Chamfer J ²⁾ X 45° Approx Inch	Countersink Diameter K ³⁾ X 90° ±5° Inch
	Minimum Formula	Inch	Maximum Formula	Inch		
					J	K +.03 -.00
1	7	8	9	10	11	12
1/16	.038P	.0014	.111P	.0041	.03-.05	.312
1/8	.038P	.0014	.111P	.0041	.03-.05	.406
1/4	.038P	.0021	.102P	.0057	.04-.07	.562
3/8	.038P	.0021	.102P	.0057	.04-.07	.687
1/2	.038P	.0027	.090P	.0064	.05-.08	.875
3/4	.038P	.0027	.090P	.0064	.05-.08	1.062
1	.038P	.0033	.084P	.0073	.06-.09	1.312
1 1/4	.038P	.0033	.084P	.0073	.06-.09	1.641
1 1/2	.038P	.0033	.084P	.0073	.06-.09	1.906
2	.038P	.0033	.084P	.0073	.06-.09	2.500
2 1/2	.038P	.0048	.072P	.0090	.08-.11	2.906
3	.038P	.0048	.072P	.0090	.08-.11	3.531

¹⁾ See 3.2.7.

²⁾ J - External Threads.

³⁾ K - Internal Threads.



D = Outside diameter of pipe = Major diameter of pipe thread at L_2 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 = $3p$.
 $(L_1 + L_3)$ = Effective length of internal thread.
 E_0 = Basic pitch diameter thread at end of pipe = $D - (0.05D + 1.1)p$.
 E_1 = Basic pitch diameter thread at end of coupling = $E_0 + 0.0625L_1$.
 E_2 = Basic pitch diameter thread at end L_2 from end of pipe = $E_0 + 0.0625L_2$.
 E_3 = Basic pitch diameter thread at end L_3 from end of pipe = $E_0 - 0.1875p$.

FIGURE 2 - AERONAUTICAL NATIONAL TAPER PIPE THREAD DIMENSIONS

TABLE 2 - DIMENSIONS OF AERONAUTICAL NATIONAL TAPER PIPE THREADS

TABLE 2A - DIMENSIONS N - L₃

Nominal Pipe Size Inch	Threads per Inch n	Pitch $= \frac{1}{n}$ p Inch	Depth of Thread h, Max Inch	D Inch	Basic Lengths		
					L ₁ Inch	L ₂ Inch	(L ₁ + L ₃) Inch
1	2	3	4	5	6	7	8
1/16	27	.03704	.02963	.3125	.160	.26111	.27111
1/8	27	.03704	.02963	.405	.1615	.26385	.27261
1/4	18	.05556	.04444	.540	.2278	.40178	.39447
3/8	18	.05556	.04444	.675	.240	.40778	.40667
1/2	14	.07143	.05714	.840	.320	.53371	.53429
3/4	14	.07143	.05714	1.050	.339	.54571	.55329
1	11-1/2	.08696	.06957	1.315	.400	.68278	.66087
1 1/4	11-1/2	.08696	.06957	1.660	.420	.70678	.68087
1 1/2	11-1/2	.08696	.06957	1.900	.420	.72348	.68087
2	11-1/2	.08696	.06957	2.375	.436	.75652	.69687
2 1/2	8	.12500	.10000	2.875	.682	1.13750	1.05700
3	8	.12500	.10000	3.500	.766	1.20000	1.14100

TABLE 2B - DIMENSIONS E_0 - E_3

Nominal Pipe Size Inch	Basic Pitch Diameters			
	E_0 Inch	E_1 Inch	E_2 Inch	E_3 Inch
1	9	10	11	12
1/16	.27118	.28118	.28750	.26424
1/8	.36351	.37360	.38000	.35656
1/4	.47739	.49163	.50250	.46697
3/8	.61201	.62701	.63750	.60160
1/2	.75843	.77843	.79179	.74504
3/4	.96768	.98887	1.00179	.95429
1	1.21363	1.23863	1.25630	1.19733
1 1/4	1.55713	1.58338	1.60130	1.54083
1 1/2	1.79609	1.82234	1.84130	1.77978
2	2.26902	2.29627	2.31630	2.25272
2 1/2	2.71953	2.76216	2.79062	2.69609
3	3.34062	3.38850	3.41562	3.31719

NOTE: For selection of tap drills and taper pipe reamers, subtract the depth "h" from the pitch diameter at E_1 .

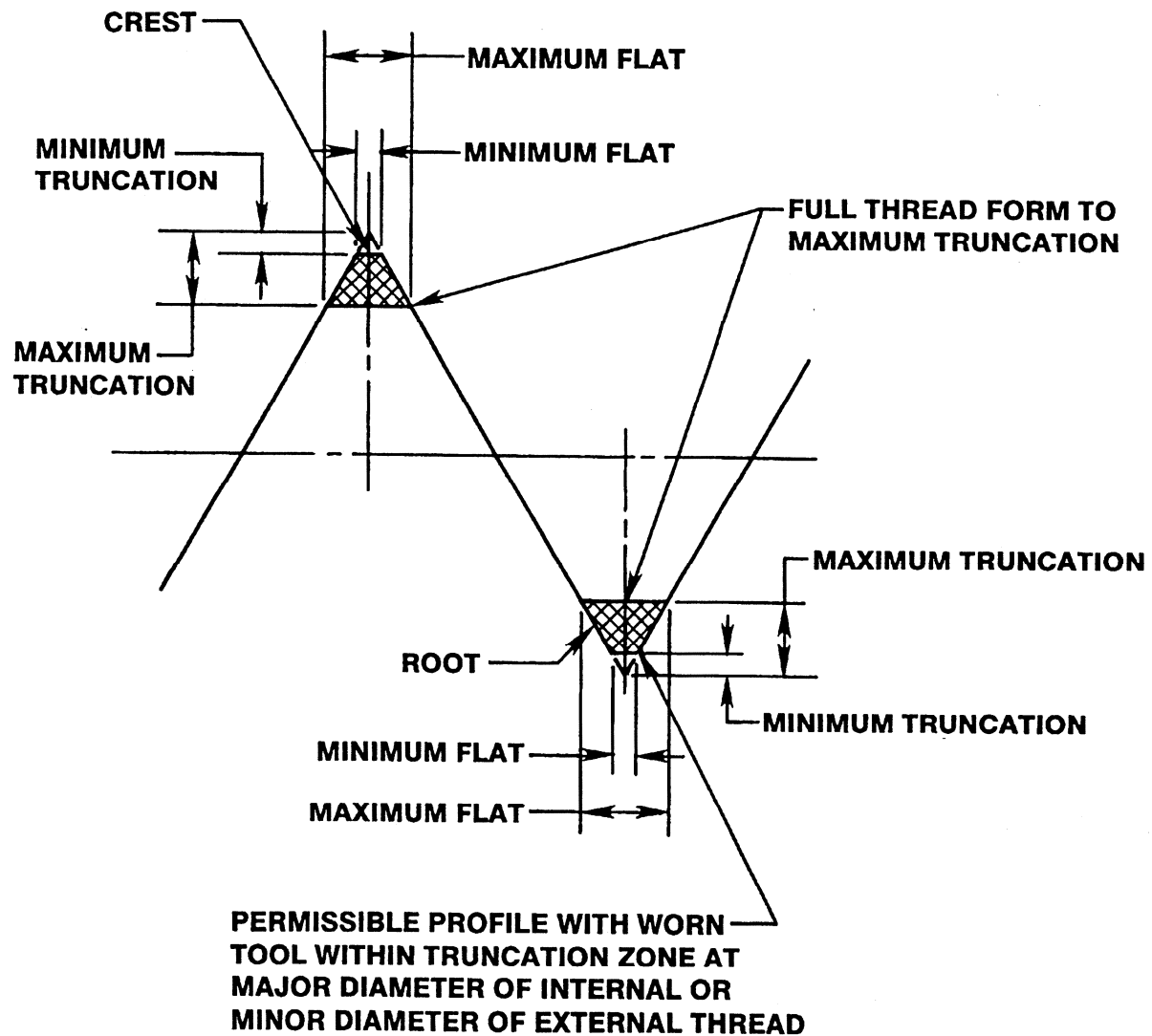


FIGURE 3 - CREST AND ROOT TRUNCATION TOLERANCE ZONES

3.2.6 External Threads

The entering end of external threads shall be chamfered 45° to the distance given in Table 1.

3.2.7 Thread Bosses

Externally pipe threaded bosses shall conform to the dimensions shown on AS5201, and internally pipe threaded bosses shall conform to the dimensions shown on AS5200.

3.2.8 Gages

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

3.2.9 Marking

Gages fabricated in conformance to this standard shall be plainly and permanently marked with "AS71051" to denote compliance with the aeronautical pipe thread requirements of this standard. Additional markings shall be applied as specified on gage drawings, or in the order or invitation for bids.

3.3 Formulae and Constants

The constants for six step plug and ring gages are given in Table 3. The formulae for six step plug and ring gages are as follows:

Taper Plugs Formulae:

D = Minor diameter at E_3 with max truncation = E_3^* - Col 4 of Table 3

$B_t = L_1 + L_3^*$

$B = B_t - (\text{Length equivalent of max truncation} - \text{min truncation}) = B_t$ - Col 5 of Table 3

$MN = B$ - Col 3 of Table 3 (one turn)

$MN_t = B_t$ - Col 3 of Table 3

$MX = B + \text{Col 3 of Table 3}$

$MX_t = B_t + \text{Col 3 of Table 3}$

Taper Rings Formulae:

D = Major diameter at E_2 with max truncation = $E_2^* + \text{Col 4 of Table 3}$

$B_t = L_2^*$

$B = B_t - (\text{Length equivalent of max truncation} - \text{min truncation}) = B_t$ - Col 5 of Table 3

$MN = B + \text{Col 3 of Table 3}$

$MN_t = B_t + \text{Col 3 of Table 3}$

$MX = B - \text{Col 3 of Table 3}$

$MX_t = B_t - \text{Col 3 of Table 3}$

*Product figured to 5 significant decimal places

TABLE 3 - CONSTANTS FOR SIX STEP PLUG AND RING GAGES

Threads per Inch	Constant Max Trunc	One Turn Length One Pitch	Twice the Addendum at Maximum Trunc	Length Equivalent of Max Trunc - Min Trunc
1	2	3	4 ¹⁾	5 ²⁾
27	.096	.03704	.02496	.07467
18	.088	.05556	.03833	.09778
14	.078	.07143	.05072	.10286
11-1/2	.073	.08696	.06261	.11130
8	.062	.12500	.09275	.11600

$$1) \text{ Sharp "V" thread depth - 2 (max truncation) } \frac{.866025}{n} - 2 \frac{(x)}{(n)} = \frac{.866025 - 2x}{n}$$

where:

x = maximum truncation constant

$$2) \text{ Length equivalent} = 32 (\text{max truncation} - \text{min truncation}) = 32 \frac{(x - y)}{(n)}$$

where:

x = maximum truncation constant

y = minimum truncation constant = .033

3.4 Workmanship

Workmanship shall be consistent with the tolerances herein specified. The threads shall be free from flaws, blow holes, abrupt terminations and other defects which would make them unsuitable for the purpose intended. Unless otherwise specified, the surface texture of the thread flanks and the roots shall be no greater than 100 μ in Ra in accordance with ASME B46.1.

4. INSPECTION PROVISIONS

4.1 Gages

Pipe threads shall be checked with gages that conform to Tables 4 and 5 and Figures 4, 5, and 6. The gages shall be subject to certification by a Government agency at the discretion of either the procuring activity or the Government inspector.