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NOTICE OF ADOPTION

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17 February 1989 for
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11 January 1988

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NOTE: Use of this standard is subject to all requirements and limitations of FED-STD-H28/13, Screw-Thread Standards for Federal Services Section 13, Stub Acme Threads.

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ASME/ANSI B1.8-1988

(REVISION OF ANSI B1.8-1977)

REAFFIRMED 1994

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PLEASE SEE ASME MANUAL AS-11

STUB ACME SCREW THREADS

The American Society of
Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

STUB ACME SCREW THREADS

ASME/ANSI B1.8-1988

(REVISION OF ANSI B1.8-1977)

The American Society of Mechanical Engineers

345 East 47th Street, New York, N.Y. 10017

Date of Issuance: April 30, 1988

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.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment which provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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FOREWORD

(This Foreword is not part of ASME/ANSI B1.8-1988.)

The Standards Committee on the Standardization and Unification of Screw Threads, B1, was organized in June 1921 with the Society of Automotive Engineers and the American Society of Mechanical Engineers as joint sponsors under the procedures of the American Standards Association (ASA), now the American National Standards Institute (ANSI). This Committee was reorganized in May 1929, and its work was divided among five subcommittees as follows:

No. 1 — Scope and Arrangement of American Standard
No. 2 — Terminology and Form Threads, Except Gages
No. 3 — Special Threads and Twelve Pitch Series, Except Gages
No. 4 — Acme Threads, Except Gages
No. 5 — Screw Thread Gages

National standardization of Acme screw threads in the United States began in 1932 when Subcommittee No. 4 on Acme Threads of Sectional Committee B1 held its first meeting in New York. A report was presented on the types of Acme threads and the range of sizes and pitches in use in this country. It was prepared by C. W. Bettcher with the assistance of F. L. Woodcock. This report developed into a draft standard. When it was finally approved as an American Standard with the designation ASA B1.3-1941, it contained a section of introductory notes and tables covering general purpose screws and general purpose nuts, basic dimensions of general purpose Acme threads with special and standard pitches, basic dimensions of 29 deg. stub threads, measurements over three wires for Acme threads, basic dimensions of 60 deg. stub threads, and basic proportions for modified square threads.

In December 1942, to meet the war emergency, the National Aircraft Standards Committee of the Aeronautical Chamber of Commerce requested the ASA to consider establishing an American war standard for special Acme screw threads for use in aircraft construction. Recognizing the vital importance of aircraft production to the war effort, the ASA at once initiated this project and organized a special committee to develop the standard. At the London Conference on the unification of screw threads held in the summer of 1944, it was proposed that a war standard on Stub Acme threads also be drawn up. Early in March 1945, therefore, the work on this proposed standard was begun and a draft prepared as a result of the discussion with the British and Canadian experts at the Ottawa Conference in October 1945. This draft was dated March 1946 and was submitted to the ASA War Committee on Acme Threads and the ASA War Committee on Screw Threads in April 1946 for approval by letter ballot. However, a Stub Acme war standard was never issued.

In April 1946, the Subcommittees of Standards Committee B1 were reorganized to include the responsibility of the ASA War Committee. Subcommittee No. 2 on Acme and Stub Acme Threads revised the March 1946 draft on Stub Acme screw threads and on March 31, 1948, distributed the January 1948 draft to industry for criticism and comment.

The final draft of the proposed standard on Stub Acme screw threads was completed in June 1951 and was submitted to Sectional Committee B1 for letter ballot on September 17, 1951; it was approved with minor amendments. Following approval by the sponsor organizations, the proposed standard was submitted to the ASA for approval and designation as an American Standard. This was granted on May 7, 1952.

The next revisions were approved by ANSI as American National Standards on May 14, 1973, and May 11, 1977, respectively. Revisions were minor.

On September 2, 1981, the B1 Committee was reorganized as an ASME Standards Committee. The B1.8 Subcommittee developed this edition, which was subsequently approved by the ASME B1 Committee, submitted to ANSI, and adopted as an American National Standard on January 11, 1988.

ASME STANDARDS COMMITTEE B1
Standardization and Unification of Screw Threads

(The following is the roster of the Committee at the time of approval of this Standard.)

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STUB ACME SCREW THREADS

GENERAL AND HISTORICAL

When formulated prior to 1895, regular Acme screw threads were intended to replace square threads and a variety of threads of other forms used chiefly for the purpose of producing traversing motions on machines, tools, etc. For current information on Acme threads, see the latest edition of ASME/ANSI B1.5.

The Stub Acme thread came into being early in the 1900s. Its use has been generally confined to those unusual applications where a coarse-pitch thread of shallow depth is required due to mechanical or metallurgical considerations.

Federal Government Use. When this Standard is approved by the Department of Defense and Federal Agencies and is incorporated into FED-STD H28/13, Screw Thread Standards for Federal Services, Section 13, the use of this Standard by the Federal Government is subject to all the requirements and limitations of FED-STD H28/13.

1 SPECIFICATIONS FOR STUB ACME THREADS

1.1 Angle of Thread

The included angle between the flanks of the thread measured in an axial plane shall be 29 deg. The line bisecting this 29 deg. angle shall be perpendicular to the axis of the screw thread.

1.2 Pitch of Thread

The pitch of a thread is the distance, measured parallel to its axis, between corresponding points on adjacent thread forms.

1.3 Height of Thread

The basic height of the standard Stub Acme thread shall be equal to 0.3 pitch. When design requirements necessitate use of a lesser or greater thread height, the data should be obtained from Appendix A.

1.4 Thickness of Thread

The basic thickness of the thread at a diameter smaller than the basic major diameter (i.e., the basic pitch diameter) by 0.3 pitch shall be equal to one-half the pitch.

1.5 Allowance (Minimum Clearance) at Major and Minor Diameters

A minimum diametral clearance is provided at the minor diameter of all Stub Acme thread assemblies by establishing the maximum minor diameter of external threads 0.020 in. below the basic minor diameter on threads 10 pitch and coarser, and 0.010 in. below the basic minor diameter for finer pitches.

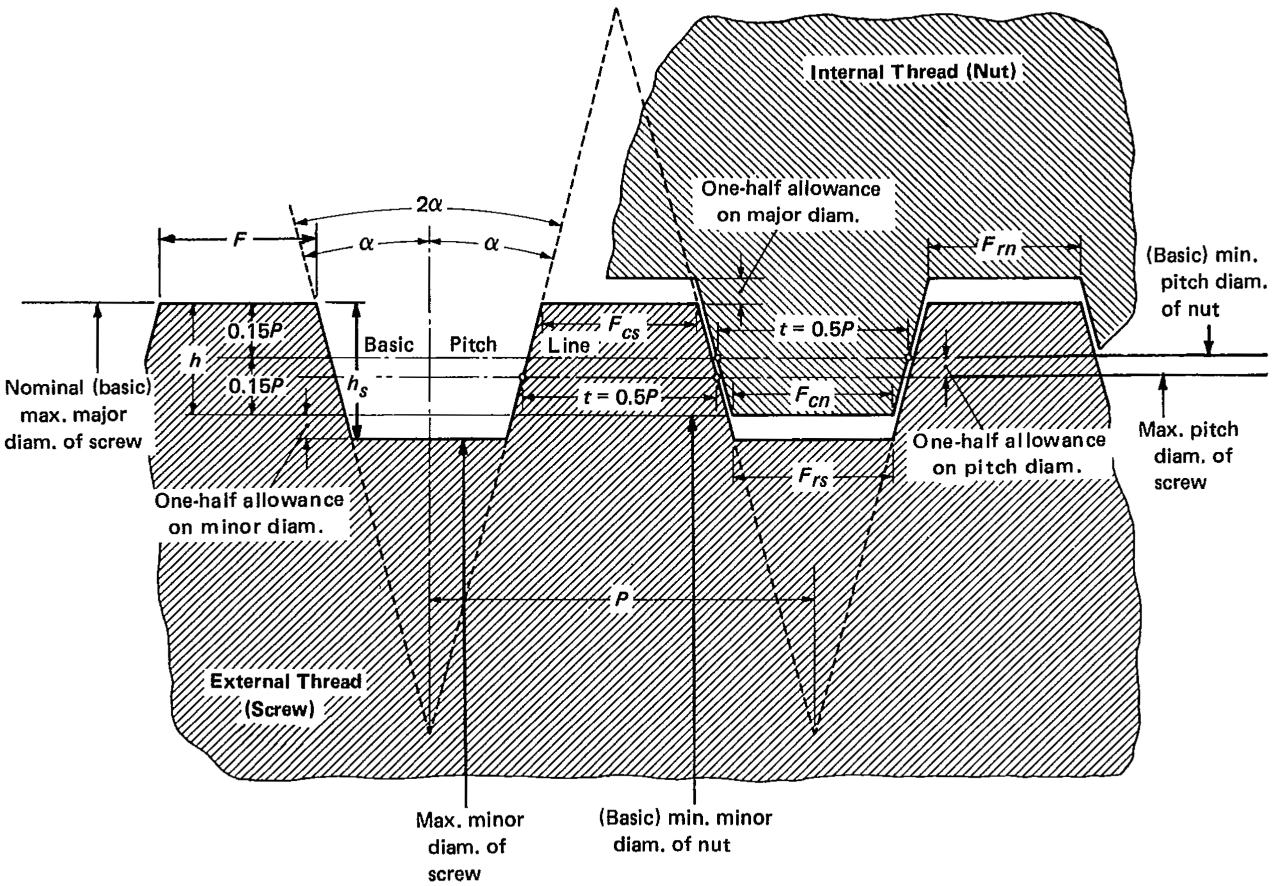
A minimum diametral clearance at the major diameter is obtained by establishing the minimum major diameter of the internal thread 0.020 in. above the basic major diameter for threads 10 pitch and coarser, and 0.010 in. above the basic major diameter for finer pitches.

1.6 Basic Thread Form Dimensions

The basic dimensions of the Stub Acme thread form for the most generally used pitches are given in Table 2. The basic thread form is symmetrical and is illustrated in Fig. 1.

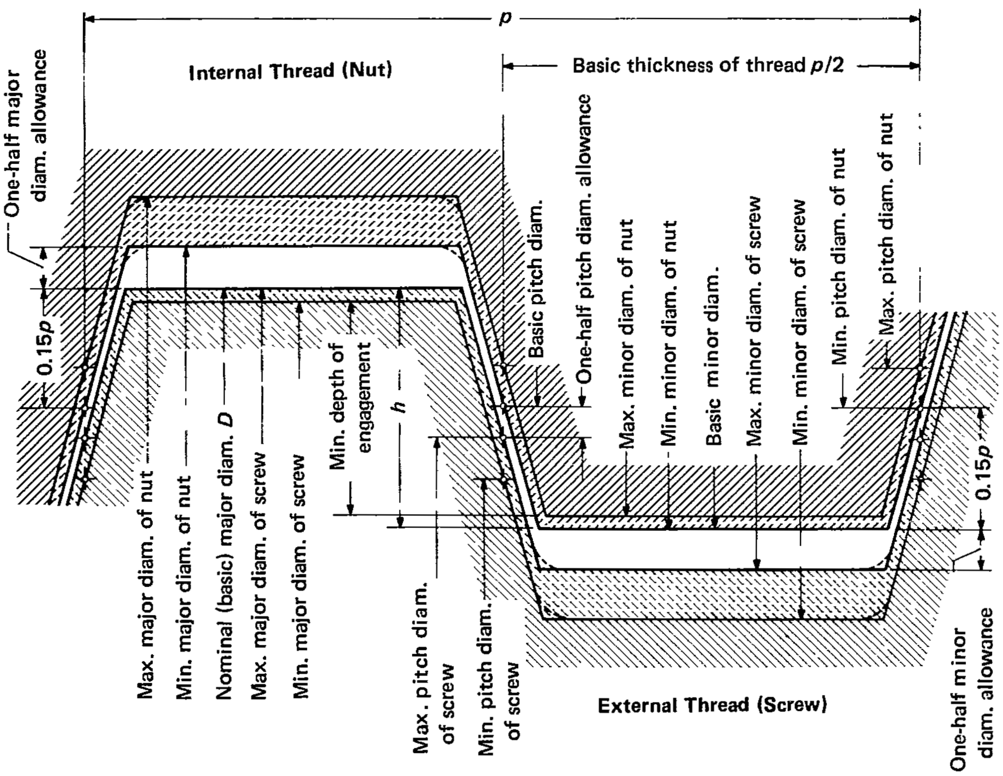
1.7 Stub Acme Screw Thread Series

The series of diameters and associated pitches of Stub Acme threads listed in Table 3 are recommended as preferred. These diameters and pitches have been carefully selected to meet the present needs with the fewest number of items in order to reduce to a minimum the inventory of both tools and gages. If other combinations of diameter and pitch are required, calculate thread dimensions in accordance with the formulas in Fig. 2.



2α = 29 deg.
α = 14 deg. 30 min
P = pitch
n = number of threads/in.
N = number of turns/in.
h = $0.3P$, basic thread height
F_{cn} = $0.4224P$, basic width of flat of crest of internal thread
F_{cs} = $0.4224P - 0.259 \times$ (pitch diameter allowance on external thread)
F_{rn} = $0.4224P - 0.259 \times$ (major diameter allowance of internal thread)
F_{rs} = $0.4224P - 0.259 \times$ (minor diameter allowance on external thread − pitch diameter allowance on external thread)

FIG. 1 STUB ACME FORM OF THREAD



Formulas for Determining Diameters

External Threads (Screws)
(Basic) max. major diam. = nominal size or diameter D
min. major diam. = external max. major diam. minus tolerance from Table 1, column 1
max. pitch diam. = internal min. pitch diam. minus allowance from Table 5, column 3
min. pitch diam. = external max. pitch diam. minus tolerance from Table 6
max. minor diam. = internal min. minor diam. minus allowance from para. 1.5
min. minor diam. = external max. minor diam. minus tolerance from Table 1, column 3

Internal Threads (Nuts)
min. major diam. = external max. major diam. plus allowance from para. 1.5
max. major diam. = internal min. major diam. plus tolerance from Table 1, column 2
(Basic) min. pitch diam. = external max. major diam. minus basic thread height from Table 3, column 8
max. pitch diam. = internal min. pitch diam. plus tolerance from Table 6
(Basic) min. minor diam. = external max. major diam. minus 2 × basic thread height from Table 2, column 3
max. minor diam. = internal min. minor diam. plus tolerance from Table 1, column 4

p = pitch
h = basic thread height

FIG. 2 DISPOSITION OF ALLOWANCES, TOLERANCES, AND CREST CLEARANCES FOR STUB ACME THREADS

1.8 Classification and Tolerances, Stub Acme Screw Threads

Only one class of thread for general usage is established herein. This class corresponds to Class 2G (general purpose) of the American National Standard on Acme Threads, ASME/ANSI B1.5. If a fit having less backlash is required, the tolerances and allowances for general purpose thread Class 3G or 4G of ASME/ANSI B1.5 may be used to determine the limiting dimensions for mating threads.

1.9 Basic Diameters

The maximum major diameter of the external thread is basic and is the nominal size for all classes. The minimum pitch diameter of the internal thread is basic and equal to the basic major diameter minus the basic thread height h. The basic minor diameter is the minimum minor diameter of the internal thread. It is equal to the basic major diameter minus twice the basic thread height $2h$.

1.10 Length of Engagement

The tolerances specified herein are applicable to lengths of engagement not exceeding twice the nominal major diameter.

1.11 Tolerances

The tolerances on diameters of internal threads are plus, being applied from the minimum sizes to above the minimum sizes. The tolerances on diameters of external threads are minus, being applied from the maximum sizes to below the maximum sizes. The tolerances on the major and minor diameters of external and internal threads are based upon the data in Table 1.

The pitch diameter tolerances for an external or internal thread are the same (see Table 6). Pitch diameter tolerance includes the effects of all variations in thread form and profile including lead (helix), flank angle, taper, and roundness. When gaged with GO/NOT GO gaging in accordance with this Standard, the functional diameter/size is controlled within these limits over the standard GO gage length. Product pitch diameter size, lead (helix), flank angle, taper, and roundness per the above are not individually controlled.

TABLE 1 TOLERANCES ON MAJOR AND MINOR DIAMETERS OF EXTERNAL AND INTERNAL THREADS

Major Diameter Tolerance		Minor Diameter Tolerance	
External Thread	Internal Thread	External Thread	Internal Thread
1	2	3	4
$0.05p$	1.0 × pitch diameter tolerance (1)	1.0 × pitch diameter tolerance (1)	$0.05p$

NOTE:
(1) Pitch diameter tolerances for various practicable combinations of diameter and pitch are given in Table 6.

1.12 Allowances (Minimum Clearances)

Allowances applied to the pitch diameter of the external thread are based on the major diameter and are given in Table 5.

When the product has a length of engagement greater than the standard length of the thread gage as shown in Table 10, column 3, and lead variations not exceeding values shown in the notes to that table, and when GO thread gages of these lengths are to be used, the maximum pitch diameter of the external thread shall be decreased by the amount shown in Table 10, column 5. If the lead variations in the product are greater than indicated, the allowance for the gage stated in column 5 should be increased proportionally. However, if methods of gaging the external thread that will detect angle variation and cumulative lead variation are used, the pitch diameter of the thread shall be below the tabular maximum pitch diameter by an amount sufficient to compensate for the measured variations.

An increase of 10% in the allowance is recommended for each inch, or fraction thereof, that the length of engagement exceeds two diameters.

1.13 Limiting Dimensions

Limiting dimensions for Stub Acme threads of the preferred series of diameters and pitches are given in Table 7. The application of these limits is illustrated in Fig. 2.

1.14 Thread Designations

The following designations are recommended for use on drawings and in specifications, and on tools and gages; right-hand threads are assumed unless LH is specified.

Example

0.500–10 Stub Acme
- Nominal size: 0.500
- Number of threads/in.: 10
- Thread series: Stub Acme

Example

1.750–0.250*P*–0.5*L*–Stub Acme–3G-LH
- Nominal size: 1.750
- Pitch: 0.250*P*
- Lead, double-start thread: 0.5*L*
- Stub Acme thread form: Stub Acme
- Class 3G (see para. 1.8): 3G
- Left-hand: LH

2 GAGES FOR STUB ACME SCREW THREADS

SPECIAL NOTE:

Work is in progress to write an ASME/ANSI B1 standard for screw thread gaging systems suitable for determining the acceptability of Acme/Stub Acme screw threads on external and internal threaded products. The draft of ASME B1.24, Gages and Gaging for General Purpose Acme, Centralizing Acme, and Stub Acme Threads, uses the guidelines as noted in ANSI/ASME B1.3M, which have been established for uniform inch and metric screw threads.

This standard will establish the criteria for product screw thread acceptance when a specified gaging system is used for both in-process control and final dimensional conformance. The format for this standard will follow that already established by ANSI/ASME B1.3M, Unified Inch and Metric Screw Threads.

A screw thread gaging system for external/internal Acme/Stub Acme screw threads comprises a listing of those screw thread characteristics that must be inspected for each specified system and the gage, gages, or gaging systems which shall be used when inspecting those characteristics.

In the interim, until this standard has been completed and released, the following clarifying statement shall apply.

IT IS TO BE UNDERSTOOD THAT NO PREFERENCE IS GIVEN TO LIMIT TYPE THREADED PLUGS AND RINGS OVER OTHER AVAILABLE ATTRIBUTE TYPE GAGES, SUCH AS THREAD SNAP GAGES, OR VARIABLE TYPE LIMIT AND SIZE INDICATING THREADED GAGES FOR BOTH DIMENSIONAL CONFORMANCE AND IN-PROCESS CONTROL.

Both GO and NOT GO gages, which represent the product limits or adequate gaging instruments for thread elements, are necessary for the proper inspection of Stub Acme threads. The dimensions of GO and NOT GO gages should be in accordance with the following principles:

(*a*) the GO gage should check simultaneously as many elements as possible, and a NOT GO gage can effectively check but one element;

(*b*) permissible variations in the gages be kept within the extreme product limits.

2.1 Gage Tolerances

Tolerances for the thread elements of GO and NOT GO gages for Stub Acme threads are given in Table 9.

(*a*) *Tolerances on Pitch Diameter.* The pitch diameter tolerances for gages for external and internal threads are given in Table 9, column 2.

(*b*) *Tolerances on Major and Minor Diameters.* The major and minor diameter tolerances for Stub Acme thread gages are given in Table 9, column 3.

(*c*) *Tolerances on Lead.* The variation in lead of all Stub Acme thread gages shall not exceed 0.0003 in. between any two threads not farther apart than 1 in. However, the cumulative variation in lead shall not exceed the following:

(*1*) 0.0004 in., for gages with a length over 1 in. to 3 in., inclusive;

(*2*) 0.0005 in., for gages with a length over 3 in. to 5 in., inclusive;

(*3*) 0.0007 in., for gages with a length over 5 in. to 10 in., inclusive.

For multiple threads, the cumulative tolerance for any length of gage shall be obtained by multiplying by 1.5 the above tolerance applicable to that length.

(*d*) *Tolerances on Angle of Gage Threads.* The tolerances on angle of thread, as specified in Table 9, column 4 for the various pitches, are tolerances on one-half of the included angle. This ensures that the bisector of the included angle will be perpendicular to the axis of the thread within proper limits. The deviation from the true thread form caused by such irregularities as convex or concave flanks of the thread, or slight projections on the thread form, should not exceed the tolerances permitted on the angle of thread.

2.1.1 Gages for External Threads

(*a*) *GO Thread Ring, Thread Snap, or Indicating Gage*

(*1*) *Major Diameter.* The major diameter of the GO thread ring, thread snap, or indicating gage shall clear a diameter greater than the maximum major diameter of the external thread by 0.01 in.

(*2*) *Pitch Diameter.* The size of a GO thread gage is determined by its fit or setting on the maximum-material-limit thread setting plug gage.

(*3*) *Minor Diameter.* The minor diameter shall be the same as the maximum minor diameter of the external thread plus 0.005 in. for pitches finer than 10 threads/in., and plus 0.010 in. for 10 threads/in. and coarser. The tolerance shall be minus.

(*4*) *Length.* The length shall approximate the length of engagement, but shall not exceed the length specified in Table 10, column 3.

(*b*) *Maximum-Material-Limit Thread Setting Plug for GO Thread Ring, Thread Snap, or Indicating Gages*

(*1*) *Major Diameter.* The major diameter of the maximum-material-limit thread setting plug shall be the same as the maximum major diameter of the external thread. The gage tolerance shall be plus.

(*2*) *Pitch Diameter.* The pitch diameter shall be the same as the maximum pitch diameter of the external thread, except when modified in accordance with Table 10. The tolerance shall be minus.

(*3*) *Minor Diameter.* The minor diameter shall be cleared below the minimum minor diameter of the GO thread ring, thread snap, or indicating gage.

(*4*) *Length.* The length should approximate the length of the GO gage. See ASME/ANSI B47.1.

(*c*) *NOT GO Thread Ring, Thread Snap, or Indicating Gage*

(*1*) *Major Diameter.* The major diameter of the NOT GO thread ring, thread snap, or indicating gage shall clear a diameter greater than the maximum major diameter of the external thread by 0.010 in.

(*2*) *Pitch Diameter.* The size of a NOT GO thread gage shall be determined by its fit or setting on the minimum-material-limit thread setting plug gage.

(*3*) *Minor Diameter.* The minor diameter shall be the basic minor diameter of the internal thread plus $0.15p$ with tolerance plus. If this results in a minor diameter greater than the gage P.D. size, the gage P.D. size shall be used for the minor diameter with the tolerance minus.

(*4*) *Length.* The length shall approximate three pitches except that, for multiple threads, the length shall provide at least one full turn of thread (see para. 2.1.4).

(*d*) *Minimum-Material Thread Setting Plug for NOT GO Thread Gage*

(*1*) *Major Diameter.* The major diameter of the minimum-material-limit thread setting plug shall be the same as the maximum major diameter of the external thread. The gage tolerance shall be plus.

(*2*) *Pitch Diameter.* The pitch diameter shall be the same as the minimum pitch diameter of the external thread with the tolerance plus.

(*3*) *Minor Diameter.* The minor diameter shall be cleared below the minimum minor diameter of the NOT GO thread gage.

(*4*) *Length.* The length shall be at least equal to the length of the NOT GO thread gage (see ASME/ANSI B47.1).

(*e*) *GO Plain Ring, Snap, or Indicating Gage for Major Diameter.* The diameter of the GO plain ring gage or the gaging dimension of the GO plain snap gage shall be the same as the maximum major diameter of the external thread. Tolerances are shown in Table 8 and shall be minus.

(*f*) *NOT GO Plain Ring, Snap, or Indicating Gage for Major Diameter.* The gaging dimension of the NOT GO plain snap gage shall be the same as the minimum major diameter of the external thread. Tolerances are shown in Table 8 and shall be plus.

2.1.2 Gages for Internal Thread

(*a*) *GO Thread Plug or Indicating Gage*

(*1*) *Major Diameter.* The major diameter of the GO thread plug gage or indicating gage shall be equal to the minimum major diameter of the internal thread minus 0.005 in. for pitches finer than 10 threads/in., and minus 0.010 in. for 10 threads/in. and coarser. The tolerance shall be plus.

(*2*) *Pitch Diameter.* The pitch diameter shall be equal to the minimum (basic) pitch diameter of the internal thread with the tolerance plus.

(*3*) *Minor Diameter.* The minor diameter shall clear a diameter smaller than the minimum minor diameter of the internal thread by 0.010 in.

(*4*) *Length.* The length shall approximate the length of engagement (see notes to Table 10) but shall not exceed twice the nominal major diameter unless otherwise specified.

(*b*) *NOT GO Thread Plug or Indicating Gage*

(*1*) *Major Diameter.* The major diameter of the NOT GO thread plug gage or indicating gage shall be equal to the maximum (basic) major diameter of the external thread minus $0.15p$ with the tolerance minus. If this results in a major diameter smaller than the gage P.D. size, the gage P.D. size shall be used for the major diameter with the gage tolerance plus.

(*2*) *Pitch Diameter.* The pitch diameter shall be the same as the maximum pitch diameter of the internal thread with the tolerance minus.

(*3*) *Minor Diameter.* The minor diameter shall clear a diameter less than the minimum minor diameter of the internal thread by 0.01 in.

(*4*) *Length.* The length should approximate three pitches except that, for multiple threads, the length shall provide at least one full turn of thread (see para. 2.1.4).

(*c*) *GO Plain Plug or Indicating Gage for Minor Diameter of Internal Thread.* The diameter of the GO plain plug gage shall be the same as the minimum minor diameter of the internal thread. The gage tolerance shall be plus (see Table 8). The gage shall be in accordance with ASME/ANSI B47.1.

(*d*) *NOT GO Plain Plug or Indicating Gage for Minor Diameter of Internal Thread.* The diameter of the NOT GO plain plug gage shall be the same as the maximum minor diameter of the internal thread. The gage tolerance shall be minus (see Table 8). The gage length shall be in accordance with ASME/ANSI B47.1.

2.1.3 Runout. When a special check of the runout between the major, pitch, and minor diameters of an external or internal thread is required, the method of checking this characteristic must be determined regardless of feature size for each individual application (see ANSI Y14.5M).

2.1.4 Gage Dimensions. It is recommended that wherever possible the general dimensions of the gages be in accordance with ASME/ANSI B47.1.

2.1.5 Other Gaging. Section 2 outlines the usage of GO and NOT GO thread plugs and thread ring or thread snap or indicating gages and their associated setting thread plug gages. It also covers the usage of plain plug gages for checking the minor diameter of internal threaded product.

While these types of limit gages are generally used to ensure assembleability of product, they may not provide enough information to ensure that all of the elements of the mating threaded products conform to the tabulated limits of size, etc.

When complete details of thread elements are required, it will be necessary to use other commercially available types of gaging or inspection equipment to obtain this data.

2.1.6 Wire Measurement of Stub Acme Threads. Refer to Appendix B for details of wire sizes and measurement of 29 deg. included angle threads. Because of the shallow depth of Stub Acme threads, it may be necessary to grind a flat on measuring wires to clear the root of the threads when best size wires are used.

TABLE 2 STUB ACME SCREW THREAD FORM, DESIGN DIMENSIONS

Threads/in.	Pitch p	Height of Thread (Basic) $h = 0.3p$	Total Height of Thread $h_s = h +$ 1/2 Allowance (1)	Thread Thickness (Basic) $t = p/2$	Width of Flat: Crest of Internal Thread (Basic) $F_{cn} = 0.4224p$	Width of Flat: Root of Internal Thread $F_{rn} = 0.4224p - 0.259 \times$ Allowance (1)
1	2	3	4	5	6	7
16	0.06250	0.01875	0.0238	0.03125	0.0264	0.0238
14	0.07143	0.02143	0.0264	0.03571	0.0302	0.0276
12	0.08333	0.02500	0.0300	0.04167	0.0352	0.0326
10	0.10000	0.03000	0.0400	0.05000	0.0422	0.0370
9	0.11111	0.03333	0.0433	0.05556	0.0469	0.0417
8	0.12500	0.03750	0.0475	0.06250	0.0528	0.0476
7	0.14268	0.04285	0.0529	0.07143	0.0603	0.0551
6	0.16667	0.05000	0.0600	0.08333	0.0704	0.0652
5	0.20000	0.06000	0.0700	0.10000	0.0845	0.0793
4	0.25000	0.07500	0.0850	0.12500	0.1056	0.1004
3 1/2	0.28571	0.08571	0.0957	0.14286	0.1207	0.1155
3	0.33333	0.10000	0.1100	0.16667	0.1408	0.1356
2 1/2	0.40000	0.12000	0.1300	0.20000	0.1690	0.1638
2	0.50000	0.15000	0.1600	0.25000	0.2112	0.2060
1 1/2	0.66667	0.20000	0.2100	0.33333	0.2816	0.2764
1 1/3	0.75000	0.22500	0.2350	0.37500	0.3168	0.3116
1	1.00000	0.30000	0.3100	0.50000	0.4224	0.4172

NOTE:
(1) Allowance shown in Table 4, column 3.

TABLE 3 STUB ACME SCREW THREADS, STANDARD SERIES, BASIC DIMENSIONS

Nominal Sizes		Threads/in. n	Basic Diameters: Major Diameter D	Basic Diameters: Pitch Diameter $D_2 = D - h$	Basic Diameters: Minor Diameter $D_1 = D - 2h$	Thread Data: Pitch p	Thread Data: Thread Thickness at Pitch Line $t = p/2$	Thread Data: Basic Thread Height $h = 0.3p$	Thread Data: Basic Width of Flat F 0.4224p	Lead Angle at Basic Pitch Diameter λ: deg.	min
1		2	3	4	5	6	7	8	9	10	
0.2500	1/4	16	0.2500	0.2312	0.2125	0.06250	0.03125	0.01875	0.0264	4	54
0.3125	5/16	14	0.3125	0.2911	0.2696	0.07143	0.03572	0.02143	0.0302	4	28
0.3750	3/8	12	0.3750	0.3500	0.3250	0.08333	0.04167	0.02500	0.0352	4	20
0.4375	7/16	12	0.4375	0.4125	0.3875	0.08333	0.04167	0.02500	0.0352	3	41
0.5000	1/2	10	0.5000	0.4700	0.4400	0.10000	0.05000	0.03000	0.0422	3	52
0.6250	5/8	8	0.6250	0.5875	0.5500	0.12500	0.06250	0.03750	0.0528	3	52
0.7500	3/4	6	0.7500	0.7000	0.6500	0.16667	0.08333	0.05000	0.0704	4	20
0.8750	7/8	6	0.8750	0.8250	0.7750	0.16667	0.08333	0.05000	0.0704	3	41
1.0000	1	5	1.0000	0.9400	0.8800	0.20000	0.10000	0.06000	0.0845	3	52
1.1250	1 1/8	5	1.1250	1.0650	1.0050	0.20000	0.10000	0.06000	0.0845	3	25
1.2500	1 1/4	5	1.2500	1.1900	1.1300	0.20000	0.10000	0.06000	0.0845	3	4
1.3750	1 3/8	4	1.3750	1.3000	1.2250	0.25000	0.12500	0.07500	0.1056	3	30
1.5000	1 1/2	4	1.5000	1.4250	1.3500	0.25000	0.12500	0.07500	0.1056	3	12
1.7500	1 3/4	4	1.7500	1.6750	1.6000	0.25000	0.12500	0.07500	0.1056	2	43
2.0000	2	4	2.0000	1.9250	1.8500	0.25000	0.12500	0.07500	0.1056	2	22
2.2500	2 1/4	3	2.2500	2.1500	2.0500	0.33333	0.16667	0.10000	0.1408	2	50
2.5000	2 1/2	3	2.5000	2.4000	2.3000	0.33333	0.16667	0.10000	0.1408	2	32
2.7500	2 3/4	3	2.7500	2.6500	2.5500	0.33333	0.16667	0.10000	0.1408	2	18
3.0000	3	2	3.0000	2.8500	2.7000	0.50000	0.25000	0.15000	0.2112	3	12
3.5000	3 1/2	2	3.5000	3.3500	3.2000	0.50000	0.25000	0.15000	0.2112	2	43
4.0000	4	2	4.0000	3.8500	3.7000	0.50000	0.25000	0.15000	0.2112	2	22
4.5000	4 1/2	2	4.5000	4.3500	4.2000	0.50000	0.25000	0.15000	0.2112	2	6
5.0000	5	2	5.0000	4.8500	4.7000	0.50000	0.25000	0.15000	0.2112	1	53

TABLE 4 TOLERANCES AND ALLOWANCES FOR MAJOR AND MINOR DIAMETERS, STUB ACME SCREW THREADS, STANDARD SERIES

Size		Threads/in. n	Allowances From Basic Major and Minor Diameters: Major (2) Diameter All Internal Threads (Plus)	Allowances From Basic Major and Minor Diameters: Minor (3) Diameter All External Threads (Minus)	Tolerance on Minor Diameter All Internal Threads (Plus) $0.05p$	Tolerance on Major Diameter All External Threads (Minus) $0.05p$	Tolerance (1) on Major Diameter All Internal Threads (Plus) and Minor Diameter All External Threads (Minus)
1		2	3	4	5	6	7
0.2500	1/4	16	0.010	0.010	0.0031	0.0031	0.0105
0.3125	5/16	14	0.010	0.010	0.0036	0.0036	0.0114
0.3750	3/8	12	0.010	0.010	0.0042	0.0042	0.0123
0.4375	7/16	12	0.010	0.010	0.0042	0.0042	0.0126
0.5000	1/2	10	0.020	0.020	0.0050	0.0050	0.0137
0.6250	5/8	8	0.020	0.020	0.0062	0.0062	0.0154
0.7500	3/4	6	0.020	0.020	0.0083	0.0083	0.0174
0.8750	7/8	6	0.020	0.020	0.0083	0.0083	0.0179
1.0000	1	5	0.020	0.020	0.0100	0.0100	0.0194
1.1250	1 1/8	5	0.020	0.020	0.0100	0.0100	0.0198
1.2500	1 1/4	5	0.020	0.020	0.0100	0.0100	0.0201
1.3750	1 3/8	4	0.020	0.020	0.0125	0.0125	0.0220
1.5000	1 1/2	4	0.020	0.020	0.0125	0.0125	0.0223
1.7500	1 3/4	4	0.020	0.020	0.0125	0.0125	0.0229
2.0000	2	4	0.020	0.020	0.0125	0.0125	0.0235
2.2500	2 1/4	3	0.020	0.020	0.0167	0.0167	0.0263
2.5000	2 1/2	3	0.020	0.020	0.0167	0.0167	0.0268
2.7500	2 3/4	3	0.020	0.020	0.0167	0.0167	0.0273
3.0000	3	2	0.020	0.020	0.0250	0.0250	0.0316
3.5000	3 1/2	2	0.020	0.020	0.0250	0.0250	0.0324
4.0000	4	2	0.020	0.020	0.0250	0.0250	0.0332
4.5000	4 1/2	2	0.020	0.020	0.0250	0.0250	0.0339
5.0000	5	2	0.020	0.020	0.0250	0.0250	0.0346

GENERAL NOTE:
Pitch diameter tolerances for various practicable combinations of diameter and pitch are given in Table 6.

NOTES:
(1) The values in this column were developed by the following formula:

$$2G \text{ tolerance} = \text{pitch increment } (0.030\sqrt{1/n}) + \text{diameter increment } (0.006\sqrt{D})$$

This formula reduces to

$$0.006\,(\sqrt{D} + 5\sqrt{p})$$

These values equal the P.D. tolerance.
(2) The minimum clearance at the major diameter between the internal and external threads is equal to values in column 3.
(3) The minimum clearance at the minor diameter between the internal and external threads is equal to the values in column 4.

TABLE 5 PITCH DIAMETER ALLOWANCES FOR STUB ACME SCREW THREADS

Nominal Size Range		Allowances on External Threads (1) $0.008\sqrt{D}$
Above	To and Including	
1	2	3
0	0.1875	0.0024
0.1875	0.3125	0.0040
0.3125	0.4375	0.0049
0.4375	0.5625	0.0057
0.5625	0.6875	0.0063
0.6875	0.8125	0.0069
0.8125	0.9375	0.0075
0.9375	1.0625	0.0080
1.0625	1.1875	0.0085
1.1875	1.3125	0.0089
1.3125	1.4375	0.0094
1.4375	1.5625	0.0098
1.5625	1.8750	0.0105
1.8750	2.1250	0.0113
2.1250	2.3750	0.0120
2.3750	2.6250	0.0126
2.6250	2.8750	0.0133
2.8750	3.2500	0.0140
3.2500	3.7500	0.0150
3.7500	4.2500	0.0160
4.2500	4.7500	0.0170
4.7500	5.5000	0.0181

NOTE:
(1) The values in this column are to be used for any nominal size within the range shown in columns 1 and 2. These values are calculated from the mean of the range. It is recommended that the nominal sizes given in Table 3 be used whenever possible.

TABLE 6 PITCH DIAMETER TOLERANCES FOR STUB ACME SCREW THREADS

Threads/in. n	Pitch Increment $0.030\sqrt{1/n}$	Nominal Diameter (1) 1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8
16	0.00750	0.0105	0.0109	0.0112	0.0115	0.0117	0.0122	0.0127	...
14	0.00802	...	0.0114	0.0117	0.0120	0.0123	0.0128	0.0132	0.0136
12	0.00866	...	...	0.0123	0.0126	0.0129	0.0134	0.0139	0.0143
10	0.00949	...	...	0.0132	0.0135	0.0137	0.0142	0.0147	0.0151
8	0.01061	...	...	...	...	0.0148	0.0154	0.0158	0.0162
6	0.01225	...	...	...	...	...	...	0.0174	0.0179
5	0.01342	...	...	...	...	...	...	...	0.0190
Diameter Increment $0.006\sqrt{D}$ →		0.00300	0.00335	0.00367	0.00397	0.00424	0.00474	0.00520	0.00561

Threads/in. n	Pitch Increment $0.030\sqrt{1/n}$	Nominal Diameter (1) 1	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4	2	2 1/4
14	0.00802	0.0140	...	...	...	...	...	...	...
12	0.00866	0.0147	0.0150	0.0154	...	...	...	...	...
10	0.00949	0.0155	0.0158	0.0162	0.0165	0.0168	0.0174	...	...
8	0.01061	0.0166	0.0170	0.0173	0.0176	0.0180	0.0185	0.0191	...
6	0.01225	0.0182	0.0186	0.0190	0.0193	0.0196	0.0202	0.0207	0.0212
5	0.01342	0.0194	0.0198	0.0201	0.0205	0.0208	0.0214	0.0219	0.0224
4	0.01500	...	0.0214	0.0217	0.0220	0.0223	0.0229	0.0235	0.0240
3	0.01732	...	...	...	...	0.0247	0.0253	0.0258	0.0263
2 1/2	0.01897	...	...	...	...	...	0.0269	0.0275	0.0280
2	0.02121	...	...	...	...	...	...	0.0297	0.0302
Diameter Increment $0.006\sqrt{D}$ →		0.00600	0.00636	0.00671	0.00704	0.00735	0.00794	0.00849	0.00900

Threads/in. n	Pitch Increment $0.030\sqrt{1/n}$	Nominal Diameter (1) 2 1/2	2 3/4	3	3 1/2	4	4 1/2	5	
5	0.01342	0.0229	...	...	...	...	...	...	
4	0.01500	0.0245	0.0249	0.0254	0.0262	0.0270	...	...	
3	0.01732	0.0268	0.0273	0.0277	0.0285	0.0293	0.0300	0.0307	
2 1/2	0.01897	0.0285	0.0289	0.0294	0.0302	0.0310	0.0317	0.0324	
2	0.02121	0.0307	0.0312	0.0316	0.0324	0.0332	0.0339	0.0346	
1 1/2	0.02449	...	...	0.0349	0.0357	0.0365	0.0372	0.0379	
1 1/3	0.02598	...	...	0.0364	0.0372	0.0380	0.0387	0.0394	
1	0.03000	...	...	...	0.0412	0.0420	0.0427	0.0434	
Diameter Increment $0.006\sqrt{D}$ →		0.00949	0.00995	0.01039	0.01122	0.01200	0.01273	0.01342	

GENERAL NOTES:
(a) The equivalent tolerance on thread thickness is 0.259 times the pitch diameter tolerance.
(b) The pitch diameter tolerances shown in this Table equal the sum of the pitch increment in the second column and the diameter increment in the last line, which reduces to $0.006(\sqrt{D} + 5\sqrt{p})$.

NOTE:
(1) For an intermediate nominal diameter, apply the pitch diameter tolerance for the next larger nominal diameter given in this Table.

TABLE 7 LIMITING DIMENSIONS AND TOLERANCES, STUB ACME SCREW THREADS, STANDARD SERIES

Limiting Diameters and Tolerances		Nominal Diameter *D*											
		1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
		Threads/in.											
		16	14	12	12	10	8	6	6	5	5	5	4
External Threads													
Major Diam.	Max. *D*	0.2500	0.3125	0.3750	0.4375	0.5000	0.6250	0.7500	0.8750	1.0000	1.1250	1.2500	1.3750
	Min.	0.2469	0.3089	0.3708	0.4333	0.4950	0.6188	0.7417	0.8667	0.9900	1.1150	1.2400	1.3625
	Tol.	0.0031	0.0036	0.0042	0.0042	0.0050	0.0062	0.0083	0.0083	0.0100	0.0100	0.0100	0.0125
Pitch Diam.	Max.	0.2272	0.2871	0.3451	0.4076	0.4643	0.5812	0.6931	0.8175	0.9320	1.0565	1.1811	1.2906
	Min.	0.2167	0.2757	0.3328	0.3950	0.4506	0.5658	0.6757	0.7996	0.9126	1.0367	1.1610	1.2686
	Tol.	0.0105	0.0114	0.0123	0.0126	0.0137	0.0154	0.0174	0.0179	0.0194	0.0198	0.0201	0.0220
Minor Diam.	Max.	0.2024	0.2597	0.3150	0.3775	0.4200	0.5300	0.6300	0.7550	0.8600	0.9850	1.1100	1.2050
	Min.	0.1919	0.2483	0.3027	0.3649	0.4063	0.5146	0.6126	0.7371	0.8406	0.9652	1.0899	1.1830
	Tol.	0.0105	0.0114	0.0123	0.0126	0.0137	0.0154	0.0174	0.0179	0.0194	0.0198	0.0201	0.0220
Internal Threads													
Major Diam.	Min.	0.2600	0.3225	0.3850	0.4475	0.5200	0.6450	0.7700	0.8950	1.0200	1.1450	1.2700	1.3950
	Max.	0.2705	0.3339	0.3973	0.4601	0.5337	0.6604	0.7874	0.9129	1.0394	1.1648	1.2901	1.4170
	Tol.	0.0105	0.0114	0.0123	0.0126	0.0137	0.0154	0.0174	0.0179	0.0194	0.0198	0.0201	0.0220
Pitch Diam.	Min.	0.2312	0.2911	0.3500	0.4125	0.4700	0.5875	0.7000	0.8250	0.9400	1.0650	1.1900	1.3000
	Max.	0.2417	0.3025	0.3623	0.4251	0.4837	0.6029	0.7174	0.8429	0.9594	1.0848	1.2101	1.3220
	Tol.	0.0105	0.0114	0.0123	0.0126	0.0137	0.0154	0.0174	0.0179	0.0194	0.0198	0.0201	0.0220
Minor Diam.	Min.	0.2125	0.2696	0.3250	0.3875	0.4400	0.5500	0.6500	0.7750	0.8800	1.0050	1.1300	1.2250
	Max.	0.2156	0.2732	0.3292	0.3917	0.4450	0.5562	0.6583	0.7833	0.8900	1.0150	1.1400	1.2375
	Tol.	0.0031	0.0036	0.0042	0.0042	0.0050	0.0062	0.0083	0.0083	0.0100	0.0100	0.0100	0.0125

TABLE 7 LIMITING DIMENSIONS AND TOLERANCES, STUB ACME SCREW THREADS, STANDARD SERIES (CONT'D)

Limiting Diameters and Tolerances		Nominal Diameter *D*										
		1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/2	4	4 1/2	5
		Threads/in.										
		4	4	4	3	3	3	2	2	2	2	2
External Threads												
Major Diam.	Max. *D*	1.5000	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.5000	4.0000	4.5000	5.0000
	Min.	1.4875	1.7375	1.9875	2.2333	2.4833	2.7333	2.9750	3.4750	3.9750	4.4750	4.9750
	Tol.	0.0125	0.0125	0.0125	0.0167	0.0167	0.0167	0.0250	0.0250	0.0250	0.0250	0.0250
Pitch Diam.	Max.	1.4152	1.6645	1.9137	2.1380	2.3874	2.6367	2.8360	3.3350	3.8340	4.3330	4.8319
	Min.	1.3929	1.6416	1.8902	2.1117	2.3606	2.6094	2.8044	3.3026	3.8008	4.2991	4.7973
	Tol.	0.0223	0.0229	0.0235	0.0263	0.0268	0.0273	0.0316	0.0324	0.0332	0.0339	0.0346
Major Diam.	Max.	1.3300	1.5800	1.8300	2.0300	2.2800	2.5300	2.6800	3.1800	3.6800	4.1800	4.6800
	Min.	1.3077	1.5571	1.8065	2.0037	2.2532	2.5027	2.6484	3.1476	3.6468	4.1461	4.6454
	Tol.	0.0223	0.0229	0.0235	0.0263	0.0268	0.0273	0.0316	0.0324	0.0332	0.0339	0.0346
Internal Threads												
Major Diam.	Min.	1.5200	1.7700	2.0200	2.2700	2.5200	2.7700	3.0200	3.5200	4.0200	4.5200	5.0200
	Max.	1.5423	1.7929	2.0435	2.2963	2.5468	2.7973	3.0516	3.5524	4.0532	4.5539	5.0546
	Tol.	0.0223	0.0229	0.0235	0.0263	0.0268	0.0273	0.0316	0.0324	0.0332	0.0339	0.0346
Pitch Diam.	Min.	1.4250	1.6750	1.9250	2.1500	2.4000	2.6500	2.8500	3.3500	3.8500	4.3500	4.8500
	Max.	1.4473	1.6979	1.9485	2.1763	2.4268	2.6773	2.8816	3.3824	3.8832	4.3839	4.8846
	Tol.	0.0223	0.0229	0.0235	0.0263	0.0268	0.0273	0.0316	0.0324	0.0332	0.0339	0.0346
Minor Diam.	Min.	1.3500	1.6000	1.8500	2.0500	2.3000	2.5500	2.7000	3.2000	3.7000	4.2000	4.7000
	Max.	1.3625	1.6125	1.8625	2.0667	2.3167	2.5667	2.7250	3.2250	3.7250	4.2250	4.7250
	Tol.	0.0125	0.0125	0.0125	0.0167	0.0167	0.0167	0.0250	0.0250	0.0250	0.0250	0.0250

TABLE 8 PLAIN GAGE TOLERANCES

Size Range		
Above	To and Including	Tolerances for Plain Gages
1	2	3
0.500	0.825	0.00010
0.825	1.510	0.00012
1.510	2.510	0.00016
2.510	4.510	0.00020
4.510	5.000	0.00025

TABLE 9 TOLERANCES FOR GO AND NOT GO THREAD WORKING AND SETTING GAGES, STUB ACME SCREW THREADS

Threads/in.	Tolerances on Pitch Diameters (1)	Tolerance on Major and Minor Diameters	Tolerance on Half Angle of Thread	
			deg.	min
1	2	3	4	
16	0.0006	0.001	0	10
14	0.0006	0.001	0	10
12	0.0006	0.001	0	10
10	0.0007	0.002	0	10
9	0.0008	0.002	0	10
8	0.0008	0.002	0	8
7	0.0009	0.002	0	8
6	0.0009	0.002	0	8
5	0.0010	0.002	0	8
4	0.0011	0.002	0	8
3½	0.0013	0.002	0	8
3	0.0013	0.002	0	6
2½	0.0014	0.002	0	6
2	0.0015	0.002	0	6
1½	0.0018	0.002	0	5
1⅓	0.0018	0.002	0	5
1	0.0021	0.002	0	5

GENERAL NOTE:
Intermediate pitches take the tolerance of the next coarser pitch listed in this Table.

NOTE:
(1) These pitch diameter tolerances for thread gages are not cumulative, that is, they do not include tolerances on lead and half-angle.

TABLE 10 PITCH DIAMETER COMPENSATION FOR ADJUSTED LENGTHS OF GO RING GAGES

Nominal Major Diameter of External Thread		Length of GO Ring Gage, in. (1)	Maximum Amount Two Diameters Length of Engagement Exceeds Length of Gage	Maximum Amount Pitch Diameter of GO Ring Shall Be Less Than Maximum Pitch (2) Diameter External Thread
Above	To and Including			
1	2	3	4	5
0	1.000	2 diameters	0	0
1.000	1.125	2.000	0.250	0.0012
1.125	1.250	2.000	0.500	0.0012
1.250	1.375	2.000	0.750	0.0015
1.375	1.500	2.000	1.000	0.0015
1.500	1.750	2.000	1.500	0.0015
1.750	2.000	2.000	2.000	0.0019
2.000	2.250	2.500	2.000	0.0019
2.250	2.500	2.500	2.500	0.0019
2.500	2.750	2.500	3.000	0.0019
2.750	3.000	3.000	3.000	0.0019
3.000	4.000	3.000	5.000	0.0027
4.000	5.000	3.000	7.000	0.0039

GENERAL NOTE:
Unless otherwise indicated, dimensions are in inches.

NOTES:

(1) This compensation is based on a length of engagement not exceeding two diameters and a lead variation in the product not exceeding the following, in inches:

0.0003 in length of 1/2 in. or less
0.0004 in length over 1/2 in. - 1 1/2 in.
0.0005 in length over 1 1/2 in. - 3 in.
0.0007 in length over 3 in. - 6 in.
0.0010 in length over 6 in. - 10 in.

(a) The principles have been established in the requirements of this Table that GO gages should approximate the length of engagement and NOT GO gages should be three pitches long. For reasons of economy or limitations in gage manufacture or use, it may be desirable to modify these principles as follows:
  (1) take advantage of the economies of using standard blanks, as listed in ASME/ANSI B47.1, wherever they may be utilized successfully;
  (2) avoid too cumbersome ring gages, as well as excessively expensive gages, by limiting the length of GO thread ring gages to maximum lengths given in column 3 of this Table;
  (3) avoid excessively cumbersome thread plug gages by limiting maximum length to two diameters wherever possible;
  (4) take full advantage of modern equipment for producing and checking accurate leads, particularly where long engagements are involved, thus permitting the use of standard or moderate length thread plug, thread ring, or thread snap gages. Alternatively, of course, instruments may be used for checking diameters and angles independently.

(b) Should a GO gage shorter than the length of engagement be chosen, independent means should be used to measure lead variation in the product. If the lead variation Δp in the length of engagement LE, so determined, exceeds 0.259*es* (where *es* is the product pitch diameter allowance), the maximum metal condition must be reduced to ensure free assembly of product. The required amount of change in pitch diameter Δd_2 of the product (minus on external thread, plus on internal thread) accordingly, is:

$$\Delta d_2 = 3.867 \left(1 - LG/LE\right) \Delta p$$

where
LG = gage length
LE = engagement length

(c) When instruments are used for checking diameter, it is a simple matter to make this allowance. When thread plug and ring gages are used, the allowance is sometimes increased by a fixed amount, as outlined in this Table. This arbitrarily changes the tolerance on pitch diameter.

(2) See para. 2.1.1(a)(4).

APPENDIX A

ALTERNATIVE STUB ACME THREADS, MODIFIED FORM 1 AND MODIFIED FORM 2

(This Appendix is not part of ASME/ANSI B1.8-1988, and is included for information purposes only.)

Recognizing the fact that one Stub Acme thread form may not provide a generally acceptable thread system to meet the requirements of all applications, basic data for two of the other commonly used forms (shown in Figs. A1 and A2) are tabulated in Tables A1 and A2. Wherever practicable, the standard Stub Acme thread form should be used.

In applying the foregoing data to special designs, the allowances and tolerances can be taken directly from Tables 4, 5, and 6 for standard Stub Acme threads. Therefore, the major diameter and basic thread thickness at pitch line for both external and internal threads will be the same as for the standard form, as shown in Tables 3 and 7. The pitch diameter and minor diameter will vary from the data shown in Tables 3 and 7. For the Modified Form 1 Stub Acme thread, the pitch and minor diameters will be smaller than similar values for the standard form; and for Modified Form 2 the pitch and minor diameters will be larger than those dimensions for the standard forms.

For gaging these modified Stub Acme threads, the principles of gaging outlined in Section 2 (para. 2.1.3) of this Standard will apply.

The dimensions of gages can be calculated from the data in Section 2 (paras. 2.1.1, 2.1.2, and 2.1.4).

The gage tolerances should be taken from para. 2.1 and Tables 8, 9, and 10.

These threads should be designated on drawings as described in para. 1.14 with the insertion after "Acme" of "M1" for the Modified Form 1 and "M2" for the Modified Form 2.

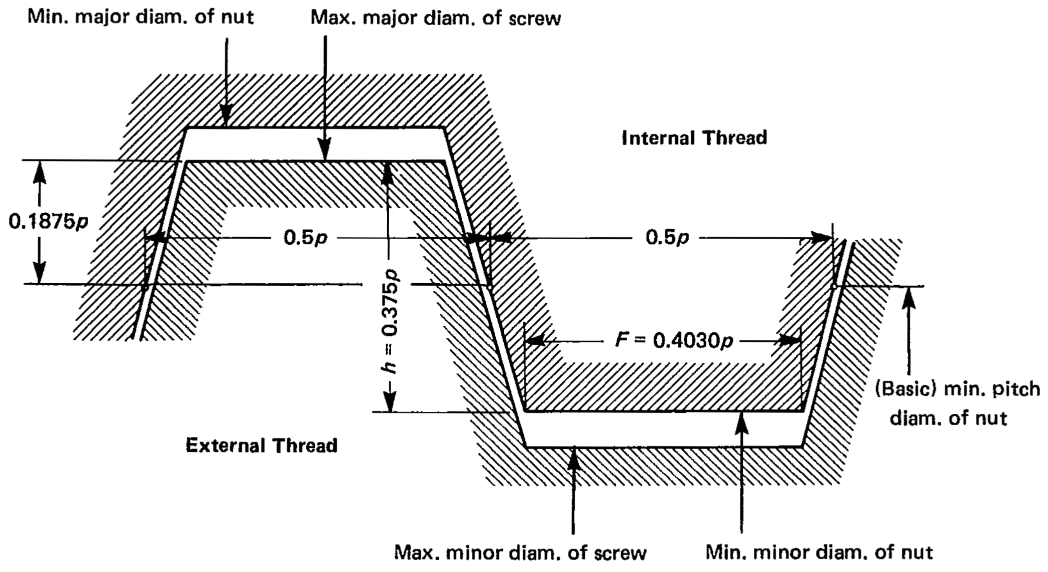


FIG. A1 MODIFIED STUB ACME THREAD WITH BASIC HEIGHT OF 0.375*p* (FORM 1)

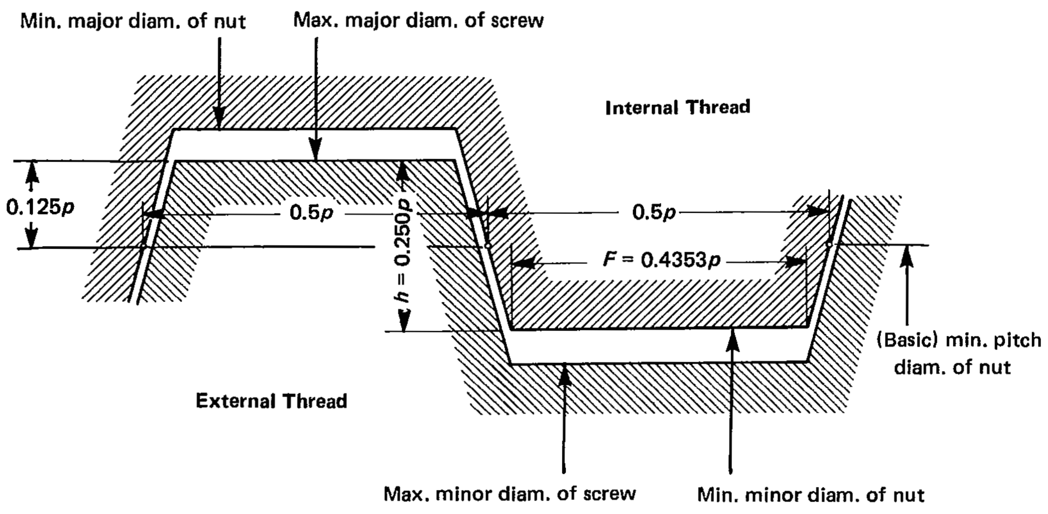


FIG. A2 MODIFIED STUB ACME THREAD WITH BASIC HEIGHT OF 0.250*p* (FORM 2)

TABLE A1 MODIFIED STUB ACME THREAD FORM, DESIGN DIMENSIONS (FORM 1)

Threads/in.	Pitch p	Height of Thread (Basic) $h = 0.375p$	Total Height of Thread $h_s = h +$ 1/2 Allowance (1)	Thread Thickness (Basic) $t = p/2$	Width of Flat at Crest of Internal Thread (Basic) $F = 0.4030p$
1	2	3	4	5	6
16	0.06250	0.02344	0.0284	0.03125	0.0252
14	0.07143	0.02679	0.0318	0.03572	0.0288
12	0.08333	0.03125	0.0363	0.04167	0.0336
10	0.10000	0.03750	0.0475	0.05000	0.0403
9	0.11111	0.04167	0.0517	0.05556	0.0448
8	0.12500	0.04688	0.0569	0.06250	0.0504
7	0.14286	0.05357	0.0636	0.07143	0.0576
6	0.16667	0.06250	0.0725	0.08333	0.0672
5	0.20000	0.07500	0.0850	0.10000	0.0806
4	0.25000	0.09375	0.1038	0.12500	0.1008
3 1/2	0.28571	0.10714	0.1171	0.14286	0.1151
3	0.33333	0.12500	0.1350	0.16667	0.1343
2 1/2	0.40000	0.15000	0.1600	0.20000	0.1612
2	0.50000	0.18750	0.1975	0.25000	0.2015
1 1/2	0.66667	0.25000	0.2600	0.33333	0.2687
1 1/3	0.75000	0.28125	0.2913	0.37500	0.3023
1	1.00000	0.37500	0.3850	0.50000	0.4030

NOTE:
(1) Allowance shown in Table 4, column 3.

TABLE A2 MODIFIED STUB ACME THREAD FORM, DESIGN DIMENSIONS (FORM 2)

Threads/in.	Pitch p	Height of Thread (Basic) $h = 0.250p$	Total Height of Thread $h_s = h +$ 1/2 Allowance (1)	Thread Thickness (Basic) $t = p/2$	Width of Flat at Crest of Internal Thread (Basic) $F = 0.4353p$
1	2	3	4	5	6
16	0.06250	0.01563	0.0206	0.03125	0.0272
14	0.07143	0.01786	0.0229	0.03571	0.0311
12	0.08333	0.02083	0.0258	0.04167	0.0363
10	0.10000	0.02500	0.0350	0.05000	0.0435
9	0.11111	0.02778	0.0378	0.05556	0.0484
8	0.12500	0.03125	0.0413	0.06250	0.0544
7	0.14286	0.03571	0.0457	0.07143	0.0622
6	0.16667	0.04167	0.0517	0.08333	0.0726
5	0.20000	0.05000	0.0600	0.10000	0.0871
4	0.25000	0.06250	0.0725	0.12500	0.1088
3 1/2	0.28571	0.07143	0.0814	0.14286	0.1244
3	0.33333	0.08333	0.0933	0.16667	0.1451
2 1/2	0.40000	0.10000	0.1100	0.20000	0.1741
2	0.50000	0.12500	0.1350	0.25000	0.2177
1 1/2	0.66667	0.16667	0.1767	0.33333	0.2902
1 1/3	0.75000	0.18750	0.1975	0.37500	0.3265
1	1.00000	0.25000	0.2600	0.50000	0.4353

NOTE:
(1) Allowance shown in Table 4, column 3.

APPENDIX B

THREE-WIRE METHOD OF MEASUREMENT OF PITCH DIAMETER OF 29 deg. STUB ACME THREADS

(This Appendix is not part of ASME/ANSI B1.8-1988, and is included for information purposes only.)

B1 THREAD WIRE SPECIFICATIONS, CALIBRATION, AND USE

The computed value for the pitch diameter of a screw thread gage obtained from readings over wires will depend upon the accuracy of the measuring instrument used, the contact load, and the value of the diameter of the wires used in the computations. In order to measure the pitch diameter of a screw thread gage to an accuracy of 0.0001 in. by means of wires, it is necessary to know the wire diameters to 0.00002 in. Accordingly, it is necessary to use a measuring instrument that reads accurately to 0.00001 in.

Variations in diameter around the wire should be determined by rotating the wire between a measuring contact and an anvil having the form of a V-groove cut on a cylinder and having the same flank angles, 14 deg. 30 min, as the thread to be measured. As thus measured, the limit on roundness deviation shall be 0.00005 in.

To avoid a permanent deformation of the material of the wires and gages it is necessary to limit the contact load, and for consistent results a standard practice as to contact load in making wire measurements of hardened screw thread gages is necessary.

In the case of Stub Acme threads, the wire presses against the sides of the thread with a pressure of approximately twice that of the measuring instrument. This would indicate that the diameter of the wires should be measured against a hardened cylinder having a radius equal to the radius of curvature of the helical surface of the thread at the point of contact, using approximately twice the load to be used in making pitch diameter readings. As with 60 deg. threads it is not practical to use such a variety of sizes, and it is recommended that the measurements of wire diameter be made between a flat contact and a 0.750 in. hardened and accurately finished steel cylinder. To limit the tendency of the wires to wedge in and deform the sides of a Stub Acme thread, it is recommended that pitch diameter measurements on 8 threads/in. and finer be made at 1 lb. For coarser pitches and larger wires the deformation of wires and threads is less than for finer pitches. Furthermore, the coarser pitches are used on larger and heavier products, on which the pitch diameter tolerance is greater and a larger measuring load may be required to make satisfactory measurements. It is, therefore, recommended that for threads/in. coarser than 8, the pitch diameter be measured at 2½ lb.

The standard specification for wires and standard practice in the measurement of 60 deg. wires stated in ANSI/ASME B1.2 are applicable to wires for Stub Acme threads, with the above-stated exceptions as to angle of V-groove and limit on roundness.

B2 FORMULAS FOR MEASURING THE PITCH DIAMETER OF STUB ACME THREADS (29 deg.)

B2.1 Lead Angle

The combination of small flank angle and large lead angle that is characteristic of Stub Acme threads results in a relatively large lead angle correction to be applied in wire measurements of pitch diameter of such threads. In the case of multiple-start threads, the geometry is such that it is no longer feasible to make the usual simplifying assumptions as to the positions of contact of the wire in the thread. Accordingly, measurement of single-start Stub Acme threads (with lead angles less than 5 deg.) is treated similar to the measurement of 60 deg. threads when the value for the term

$$\frac{\omega \tan^2 \lambda \cos \alpha \cot \alpha}{2}$$

is 0.00015 in. or smaller (see ANSI/ASME B1.2). For threads having lead angles greater than 5 deg., the necessary refinements in the calculations are presented.

B2.2 Single-Start External Threads

The general formula is

$$d_2 = M_w + \frac{\cot \alpha}{2n} - w(1 + \operatorname{cosec} \alpha') \qquad (1)$$

where

d_2 = pitch diameter
M_w = measurement over wires
α = half-angle of thread
n = threads/in. = 1/pitch
w = wire diameter
$\alpha' = \tan^{-1} (\tan \alpha \cos \lambda)$
λ = lead angle at pitch diameter

For a half-angle of 14 deg. 30 min, Eq. (1) takes the form

$$d_2 = M_w + \frac{1.933\ 357}{n} - w(1 + \operatorname{cosec} \alpha') \qquad (2)$$

The diameter w of the wires used should be as close as practicable to the size that will contact the flanks of the thread at the pitch line to minimize errors caused by deviations of the flank angle from nominal value. The best-size wire, to be applied only where the lead angle does not exceed approximately 5 deg., may be taken as

$$w_b = \frac{\sec \alpha}{2n} = \frac{0.516\ 450}{n} \qquad (3)$$

for which values are tabulated in Table B1.

For standard diameter-pitch combinations of Stub Acme threads, and where the best-size wire is used, the computations are simplified by the use of Table B2. Thus

$$d_2 = M_w - \text{column 7} \qquad (4)$$

or, if d_2 differs appreciably from the basic value given in column 3

$$d_2 = M_w - \text{column 7} - 100\ (\text{column 3} - d_{2_1}) \times \text{column 8} \qquad (5)$$

TABLE B1 WIRE SIZES AND CONSTANTS, SINGLE-START STUB ACME THREADS (29 deg.)

Threads/in.	Pitch $p = \frac{1}{n}$	Wire Sizes (1) Best 0.516450p	Maximum 0.650013p	Minimum 0.487263p
1	2	3	4	5
	in.	in.	in.	in.
16	0.06250	0.03228	0.04063	0.03045
14	0.07143	0.03689	0.04643	0.03480
12	0.08333	0.04304	0.05417	0.04061
10	0.10000	0.05164	0.06500	0.04873
9	0.11111	0.05738	0.07222	0.05414
8	0.12500	0.06456	0.08125	0.06091
7	0.14286	0.07378	0.09286	0.06961
6	0.16667	0.08608	0.10834	0.08121
5	0.20000	0.10329	0.13000	0.09745
4	0.25000	0.12911	0.16250	0.12182
3½	0.28571	0.14756	0.18572	0.13922
3	0.33333	0.17215	0.21667	0.16242
2½	0.40000	0.20658	0.26001	0.19491
2	0.50000	0.25822	0.32501	0.24363
1½	0.66667	0.34430	0.43334	0.32484
1⅓	0.75000	0.38734	0.48751	0.36545
1	1.00000	0.51645	0.65001	0.48726

NOTE:
(1) Based on zero lead angle.

where

$d_{2_1} = M_w - \text{column 7}$

If the measured wire diameter w' differs slightly (not more than 0.0003 in.) from the best size w shown in column 4, then

$$d_2 = M_w - \text{column 7} - 5\ (w' - w) - 100\ (\text{column 3} - d_{2_1})\ \text{column 8} \qquad (6)$$

However, the correction derived from column 8 is seldom significant in amount for standard diameter-pitch combinations.

Values of the term $(1 + \operatorname{cosec} \alpha')$ are given in Table B3 for use when threads of other than standard diameter-pitch combinations are to be measured. Values for intermediate lead angles may be determined by interpolation.

The three-wire measurement of Stub Acme threads corresponds to that of 29 deg. Acme threads. However, because of the shallower root on the Stub Acme

TABLE B2 VALUES FOR WIRE MEASUREMENTS OF SINGLE-START STANDARD STUB ACME THREADS (29 deg.)

Sizes	Threads/in.	Basic Pitch Diameter	Best-Size Wire $w = \frac{0.516450}{n}$	$\frac{\text{cot 14 deg. 30 min}}{2n}$	w (1 + cosec α')	Column 6 Minus Column 5 (1)	Change in Columns 6 and 7 per 0.01 in. Change in Pitch Diameter (Column 3)
1	2	3	4	5	6	7	8
in.		in.	in.		in.	in.	in.
0.250	16	0.2312	0.03228	0.120835	0.161422	0.040587	0.000044
0.3125	14	0.2911	0.03689	0.138097	0.184647	0.046550	0.000031
0.375	12	0.3500	0.04304	0.161113	0.215407	0.054294	0.000025
0.4375	12	0.4125	0.04304	0.161113	0.215477	0.054364	0.000018
0.500	10	0.4700	0.05164	0.193336	0.258329	0.064993	0.000021
0.625	8	0.5875	0.06456	0.241670	0.322961	0.018291	0.000021
0.750	6	0.7000	0.08608	0.322226	0.430800	0.108574	0.000030
0.875	6	0.8250	0.08608	0.322226	0.430542	0.108316	0.000019
1.000	5	0.9400	0.10329	0.386671	0.516707	0.130036	0.000021
1.125	5	1.0650	0.10329	0.386671	0.516620	0.219949	0.000014
1.250	5	1.1900	0.10329	0.386671	0.516356	0.129685	0.000014
1.375	4	1.3000	0.12911	0.483339	0.645669	0.162330	0.000014
1.500	4	1.4250	0.12911	0.483339	0.645518	0.162179	0.000012
1.750	4	1.6750	0.12911	0.483339	0.645310	0.161971	0.000007
2.000	4	1.9250	0.12911	0.483339	0.645178	0.161839	0.000005
2.250	3	2.1500	0.17215	0.644452	0.860533	0.216081	0.000004
2.500	3	2.4000	0.17215	0.644452	0.860332	0.215880	0.000005
2.750	3	2.6500	0.17215	0.644452	0.860218	0.215766	0.000004
3.000	2	2.8500	0.25822	0.966678	1.291035	0.324357	0.000011
3.500	2	3.3500	0.25822	0.966678	1.290620	0.323942	0.000007
4.000	2	3.8500	0.25822	0.966678	1.290356	0.323678	0.000004
4.500	2	4.3500	0.25822	0.966678	1.290176	0.323498	0.000003
5.000	2	4.8500	0.25822	0.966678	1.290049	0.323371	0.000003

NOTE:
(1) Given to six decimal places for purposes of computation. After subtracting from M_w the final result should be rounded to four places.

TABLE B3 VALUES OF (1 + cosec α') FOR α = 14 deg. 30 min AND LEAD ANGLES FROM 0 deg. TO 5 deg.

Lead Angle λ				Lead Angle λ			
deg.	min	1 + cosec α'	Difference	deg.	min	1 + cosec α'	Difference
1		2	3	1		2	3
0	0	4.99393		2	30	4.99748	
	5	393	0		35	772	24
	10	394	1		40	797	25
	15	396	2		45	823	26
	20	399	3		50	850	27
	25	403	4		55	877	27
			4				28
				3	0	905	
	30	407			5	934	29
	35	412	5		10	964	30
	40	418	6		15	995	31
	45	425	7		20	5.00026	31
	50	432	7		25	058	32
	55	440	8				33
			9		30	091	
					35	125	34
1	0	449			40	160	35
	5	459	10		45	195	35
	10	470	11		50	231	36
	15	481	11		55	268	37
	20	493	12				38
	25	506	13	4	0	306	
			14		5	345	39
	30	520			10	384	39
	35	535	15		15	424	40
	40	550	15		20	465	41
	45	566	16		25	507	42
	50	583	17				43
	55	601	18		30	550	
			19		35	593	43
					40	637	44
2	0	620			45	682	45
	5	639	19		50	728	46
	10	659	20		55	775	47
	15	680	21				48
	20	702	22	5	0	823	
	25	725	23		5	871	48
			23		10	920	49

threads, no smaller wire than the best-size wire given in Table B2 shall be used. There can be instances when the best-size wire will touch the thread root. Hence, a check should always be made to ensure that the wires do not touch the thread root.

B2.3 Multiple-Start External Threads

Multiple-start threads commonly have lead angles greater than 5 deg. In those exceptional cases that have smaller lead angles, the procedures described above may be applied. For larger lead angles there are two procedures available that give almost identical results; that is, the discrepancy between the values obtained for the lead angle correction c is well within the possible observational error in making the measurement of pitch diameter. The methods are those of Marriner and Wood [4], based on the analytical approach of Gary [3] and Vogel [2].

It is necessary to determine the best-size wire for the individual thread, as the size is dependent on the lead angle of the thread. This determination is simplified by extracting from Table B4 the wire diameter (interpolating if necessary) for a 1 in. axial pitch screw and dividing by the threads/in. Thus

$$w = w_1/n \tag{7}$$

The pitch diameter is given by formulas, as follows:

$$d_2 = M_w - (C + c) \tag{8}$$

where

d_2 = pitch diameter
M_w = measurement over wires
$C = w(1 + \operatorname{cosec}\alpha) - (\cot\alpha)/2n$ (9)
$= 4.993\,929w - 1.933\,357/n$
$c = 2(OP - OQ)$ of Fig. B1 (10)

Tabular values for $(C + c)_1$ for a 1 in. axial pitch screw, which should be divided by the threads/in. for a given case, are also given in Table B4 and [2].

In Fig. B1 the actual points of contact of the wire with the thread flanks are at A and B. Under certain conditions a wire may contact one flank at two points, in which case it is advisable to use a ball, equal in diameter to the wire. The value of c is the same for a ball as for a wire. The conditions determining single or double contact are dealt with below.

To evaluate c

$$OP = \gamma\cos\alpha\cos\beta + \frac{\frac{w}{2}\left(\frac{l}{2\pi}\sin\beta + \gamma\sin\alpha\cos\beta\right)}{\sqrt{\gamma^2 + \left(\frac{l}{2\pi}\right)^2}} \tag{11}$$

$$OQ = R + \frac{w}{2}\operatorname{cosec}\alpha \tag{12}$$

where

γ = distance from contact point A to a point L on the thread axis, measured parallel to an element of the thread flank, in the axial plane containing LA
β = (designated the "key angle" by Vogel) angle in a plane perpendicular to the thread axis between lines connecting the point O on the thread axis to the axis of the wire (or center of the ball) and to the point of contact of the wire and thread flank, respectively

The values of β and γ are determined by:

$$\sin\beta = \frac{\frac{w}{2}\left(\frac{l\cos\beta}{2\pi\gamma\cos\alpha} - \tan\alpha\sin\beta\right)}{\sqrt{\gamma^2 + \left(\frac{l}{2\pi}\right)^2}} \tag{13}$$

$$\gamma = \frac{R}{\cos\alpha} + \frac{\left(\frac{w}{2}\gamma\cot\alpha\right)}{\sqrt{\gamma^2 + \left(\frac{l}{2\pi}\right)^2}} + \frac{l\beta}{2\pi\sin\alpha} \tag{14}$$

These are simultaneous equations in β and γ which cannot be solved directly but can be solved by iteration. Letting $\beta = 0$, the first approximation for γ is

$$\gamma_0 = R\sec\alpha + \frac{w}{2}\cot\alpha \tag{15}$$

This approximate value of γ is entered in the right-hand side of Eq. (13) to obtain a new value $\beta = \beta_1$. Then this new value of β is entered in the right-hand side of Eq. (14), together with the first approximation of γ, to obtain a new value of $\gamma = \gamma_1$. Then γ_1 and β_1 are entered in Eq. (13) to obtain a new $\beta = \beta_2$. This process is repeated until the values of β and γ repeat themselves to the required degree of accuracy. Their final values are then entered in Eqs. (11) and (12) to obtain the lead angle correction given by Eq. (10).

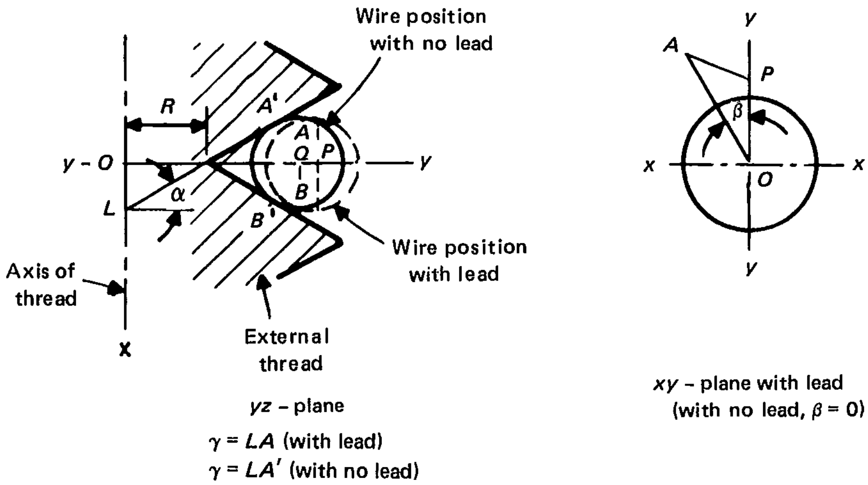
TABLE B4 BEST-WIRE DIAMETERS AND CONSTANTS FOR LARGE LEAD ANGLES, 1 in. AXIAL PITCH STUB ACME THREADS (29 deg.)

Lead Angle λ, deg.	1-Start Threads, in.		2-Start Threads, in.		Lead Angle λ, deg.	2-Start Threads, in.		3-Start Threads, in.	
	w_1	$(C + c)_1$	w_1	$(C + c)_1$		w_1	$(C + c)_1$	w_1	$(C + c)_1$
1	2	3	4	5	1	4	5	6	7
5.0	0.51450	0.64311	0.51443	0.64290	10.0	0.50864	0.63518	0.50847	0.63463
5.1	0.51442	0.64301	0.51435	0.64279	10.1	0.50849	0.63498	0.50831	0.63442
5.2	0.51435	0.64291	0.51427	0.64268	10.2	0.50834	0.63478	0.50815	0.63420
5.3	0.51427	0.64282	0.51418	0.64256	10.3	0.50818	0.63457	0.50800	0.63399
5.4	0.51419	0.64272	0.51410	0.64245	10.4	0.50802	0.63436	0.50784	0.63378
5.5	0.51411	0.64261	0.51401	0.64233	10.5	0.50786	0.63416	0.50768	0.63356
5.6	0.51403	0.64251	0.51393	0.64221	10.6	0.50771	0.63395	0.50751	0.63333
5.7	0.51395	0.64240	0.51384	0.64209	10.7	0.50755	0.63375	0.50735	0.63311
5.8	0.51386	0.64229	0.51375	0.64196	10.8	0.50739	0.63354	0.50718	0.63288
5.9	0.51377	0.64218	0.51366	0.64184	10.9	0.50723	0.63333	0.50701	0.63265
6.0	0.51368	0.64207	0.51356	0.64171	11.0	0.50707	0.63313	0.50684	0.63242
6.1	0.51359	0.64195	0.51346	0.64157	11.1	0.50691	0.63292	0.50667	0.63219
6.2	0.51350	0.64184	0.51336	0.64144	11.2	0.50674	0.63271	0.50649	0.63195
6.3	0.51340	0.64172	0.51327	0.64131	11.3	0.50658	0.63250	0.50632	0.63172
6.4	0.51330	0.64160	0.51317	0.64117	11.4	0.50641	0.63228	0.50615	0.63149
6.5	0.51320	0.64147	0.51306	0.64103	11.5	0.50623	0.63206	0.50597	0.63126
6.6	0.51310	0.64134	0.51296	0.64089	11.6	0.50606	0.63184	0.50579	0.63102
6.7	0.51300	0.64122	0.51285	0.64075	11.7	0.50589	0.63162	0.50561	0.63078
6.8	0.51290	0.64110	0.51275	0.64061	11.8	0.50571	0.63140	0.50544	0.63055
6.9	0.51280	0.64097	0.51264	0.64046	11.9	0.50553	0.63117	0.50526	0.63031
7.0	0.51270	0.64085	0.51254	0.64032	12.0	0.50535	0.63095	0.50507	0.63006
7.1	0.51259	0.64072	0.51243	0.64017	12.1	0.50517	0.63072	0.50488	0.62981
7.2	0.51249	0.64060	0.51232	0.64002	12.2	0.50500	0.63050	0.50470	0.62956
7.3	0.51238	0.64047	0.51221	0.63987	12.3	0.50482	0.63027	0.50451	0.62931
7.4	0.51227	0.64034	0.51209	0.63972	12.4	0.50464	0.63004	0.50432	0.62906
7.5	0.51217	0.64021	0.51198	0.63957	12.5	0.50445	0.62981	0.50413	0.62881
7.6	0.51206	0.64008	0.51186	0.63941	12.6	0.50427	0.62958	0.50394	0.62856
7.7	0.51196	0.63996	0.51174	0.63925	12.7	0.50408	0.62934	0.50375	0.62830
7.8	0.51186	0.63983	0.51162	0.63909	12.8	0.50389	0.62911	0.50356	0.62805
7.9	0.51175	0.63970	0.51150	0.63892	12.9	0.50371	0.62888	0.50336	0.62779
8.0	0.51164	0.63957	0.51138	0.63876	13.0	0.50352	0.62865	0.50316	0.62752
8.1	0.51153	0.63944	0.51125	0.63859	13.1	0.50333	0.62841	0.50295	0.62725
8.2	0.51142	0.63930	0.51113	0.63843	13.2	0.50313	0.62817	0.50275	0.62699
8.3	0.51130	0.63916	0.51101	0.63827	13.3	0.50293	0.62792	0.50255	0.62672
8.4	0.51118	0.63902	0.51088	0.63810	13.4	0.50274	0.62768	0.50235	0.62646
8.5	0.51105	0.63887	0.51075	0.63793	13.5	0.50254	0.62743	0.50214	0.62619
8.6	0.51093	0.63873	0.51062	0.63775	13.6	0.50234	0.62718	0.50194	0.62592
8.7	0.51081	0.63859	0.51049	0.63758	13.7	0.50215	0.62694	0.50173	0.62564
8.8	0.51069	0.63845	0.51035	0.63740	13.8	0.50195	0.62670	0.50152	0.62537
8.9	0.51057	0.63831	0.51022	0.63722	13.9	0.50175	0.62645	0.50131	0.62509
9.0	0.51044	0.63817	0.51008	0.63704	14.0	0.50155	0.62621	0.50110	0.62481
9.1	0.51032	0.63802	0.50993	0.63685	14.1	0.50135	0.62596	0.50089	0.62453
9.2	0.51019	0.63788	0.50979	0.63667	14.2	0.50115	0.62571	0.50068	0.62425
9.3	0.51006	0.63774	0.50965	0.63649	14.3	0.50094	0.62546	0.50046	0.62397
9.4	0.50993	0.63759	0.50951	0.63630	14.4	0.50073	0.62520	0.50024	0.62368
9.5	0.50981	0.63744	0.50937	0.63612	14.5	0.50051	0.62494	0.50003	0.62340
9.6	0.50968	0.63730	0.50922	0.63593	14.6	0.50030	0.62468	0.49981	0.62312
9.7	0.50955	0.63715	0.50908	0.63574	14.7	0.50009	0.62442	0.49959	0.62283
9.8	0.50941	0.63700	0.50893	0.63555	14.8	0.49988	0.62417	0.49936	0.62253
9.9	0.50927	0.63685	0.50879	0.63537	14.9	0.49966	0.62391	0.49914	0.62224
10.0	0.50913	0.63670	0.50864	0.63518	15.0	0.49945	0.62365	0.49891	0.62195

TABLE B4 BEST-WIRE DIAMETERS AND CONSTANTS FOR LARGE LEAD ANGLES, 1 in. AXIAL PITCH STUB ACME THREADS (29 deg.) (CONT'D)

Lead Angle λ, deg.	3-Start Threads, in.		4-Start Threads, in.		Lead Angle λ, deg.	3-Start Threads, in.		4-Start Threads, in.	
	w_1	$(C + c)_1$	w_1	$(C + c)_1$		w_1	$(C + c)_1$	w_1	$(C + c)_1$
1	6	7	8	9	1	6	7	8	9
13.0	0.50316	0.62752	0.50297	0.62694	18.0	0.49154	0.61250	0.49109	0.61109
13.1	0.50295	0.62725	0.50277	0.62667	18.1	0.49127	0.61216	0.49082	0.61073
13.2	0.50275	0.62699	0.50256	0.62639	18.2	0.49101	0.61182	0.49054	0.61037
13.3	0.50255	0.62672	0.50235	0.62611	18.3	0.49074	0.61148	0.49027	0.61001
13.4	0.50235	0.62646	0.50215	0.62583	18.4	0.49047	0.61114	0.48999	0.60964
13.5	0.50214	0.62619	0.50194	0.62555	18.5	0.49020	0.61080	0.48971	0.60928
13.6	0.50194	0.62592	0.50173	0.62526	18.6	0.48992	0.61045	0.48943	0.60891
13.7	0.50173	0.62564	0.50152	0.62498	18.7	0.48965	0.61011	0.48915	0.60854
13.8	0.50152	0.62537	0.50131	0.62469	18.8	0.48938	0.60976	0.48887	0.60817
13.9	0.50131	0.62509	0.50109	0.62440	18.9	0.48910	0.60941	0.48859	0.60780
14.0	0.50110	0.62481	0.50087	0.62411	19.0	0.48882	0.60906	0.48830	0.60742
14.1	0.50089	0.62453	0.50065	0.62381	19.1	0.48854	0.60871	0.48800	0.60704
14.2	0.50068	0.62425	0.50043	0.62351	19.2	0.48825	0.60835	0.48771	0.60666
14.3	0.50046	0.62397	0.50021	0.62321	19.3	0.48797	0.60799	0.48742	0.60628
14.4	0.50024	0.62368	0.49999	0.62291	19.4	0.48769	0.60764	0.48713	0.60590
14.5	0.50003	0.62340	0.49977	0.62262	19.5	0.48741	0.60729	0.48684	0.60552
14.6	0.49981	0.62312	0.49955	0.62232	19.6	0.48712	0.60693	0.48655	0.60514
14.7	0.49959	0.62283	0.49932	0.62202	19.7	0.48683	0.60657	0.48625	0.60475
14.8	0.49936	0.62253	0.49910	0.62172	19.8	0.48655	0.60621	0.48596	0.60437
14.9	0.49914	0.62224	0.49887	0.62141	19.9	0.48626	0.60585	0.48566	0.60398
15.0	0.49891	0.62195	0.49864	0.62110	20.0	0.48597	0.60549	0.48536	0.60359
15.1	0.49869	0.62166	0.49842	0.62080	20.1	...	...	0.48506	0.60320
15.2	0.49846	0.62137	0.49819	0.62049	20.2	...	...	0.48476	0.60281
15.3	0.49824	0.62108	0.49795	0.62017	20.3	...	...	0.48445	0.60241
15.4	0.49801	0.62078	0.49771	0.61985	20.4	...	...	0.48415	0.60202
15.5	0.49778	0.62048	0.49747	0.61953	20.5	...	...	0.48384	0.60162
15.6	0.49754	0.62017	0.49723	0.61921	20.6	...	...	0.48354	0.60123
15.7	0.49731	0.61987	0.49699	0.61889	20.7	...	...	0.48323	0.60083
15.8	0.49707	0.61956	0.49675	0.61857	20.8	...	...	0.48292	0.60042
15.9	0.49683	0.61926	0.49651	0.61825	20.9	...	...	0.48261	0.60002
16.0	0.49659	0.61895	0.49627	0.61793	21.0	...	...	0.48230	0.59961
16.1	0.49635	0.61864	0.49602	0.61760	21.1	...	...	0.48198	0.59920
16.2	0.49611	0.61833	0.49577	0.61727	21.2	...	...	0.48166	0.59879
16.3	0.49586	0.61801	0.49552	0.61694	21.3	...	...	0.48134	0.59838
16.4	0.49562	0.61770	0.49527	0.61661	21.4	...	...	0.48103	0.59797
16.5	0.49537	0.61738	0.49502	0.61628	21.5	...	...	0.48701	0.59756
16.6	0.49512	0.61706	0.49476	0.61594	21.6	...	...	0.48040	0.59715
16.7	0.49488	0.61675	0.49451	0.61560	21.7	...	...	0.48008	0.59674
16.8	0.49463	0.61643	0.49425	0.61526	21.8	...	...	0.47975	0.59632
16.9	0.49438	0.61611	0.49400	0.61492	21.9	...	...	0.47943	0.59590
17.0	0.49414	0.61580	0.49375	0.61458	22.0	...	...	0.47910	0.59548
17.1	0.49389	0.61548	0.49349	0.61424	22.1	...	...	0.47878	0.59507
17.2	0.49363	0.61515	0.49322	0.61389	22.2	...	...	0.47845	0.59465
17.3	0.49337	0.61482	0.49296	0.61354	22.3	...	...	0.47812	0.59422
17.4	0.49311	0.61449	0.49269	0.61319	22.4	...	...	0.47778	0.59379
17.5	0.49285	0.61416	0.49243	0.61284	22.5	...	...	0.47745	0.59336
17.6	0.49259	0.61383	0.49217	0.61250	22.6	...	...	0.47711	0.59293
17.7	0.49233	0.61350	0.49191	0.61215	22.7	...	...	0.47677	0.59250
17.8	0.49206	0.61316	0.49164	0.61180	22.8	...	...	0.47643	0.59207
17.9	0.49180	0.61283	0.49137	0.61144	22.9	...	...	0.47610	0.59164
...	...	...	...	...	23.0	...	...	0.47577	0.59121

GENERAL NOTE: This Table is courtesy of the Van Keuren Co.



$\sqrt{\gamma^2 + \left(\frac{l}{2\pi}\right)^2}$	sin β	β (radian)	cos β	γ
0.54486 847	0.02337 088	0.02337 301	0.99972 686	0.52978 325
0.54444 355	0.02226 331	0.02226 515	0.99975 214	0.52934 621
0.54446 650	0.02232 617	0.02232 833	0.99975 073	0.52936 984
0.54446 524	0.02232 298	0.02332 483	0.99975 081	0.52936 853
0.54446 530	0.02232 317	0.02232 502	0.99975 081	0.52936 860
0.54446 530	0.02232 316	0.02232 501	0.99975 081	0.52936 860

OP = 0.52843 3962
OQ = 0.51926 0196
c = 0.01114 8
$2OP$ = 1.04966 79 = nominal measurement between centers of wires
M_w = $2OP + w$ = 1.149 868 in. = nominal measurement over wires
M_w = 1.149 868 = actual measurement over wires
d_2 = 1.149 868 − ($C + c$) [see Eqs. (8) and (9)]
C = 4.993 929 × 0.100 20 − 1.933 375/5 = 0.113 720
$C + c$ = 0.113 720 + 0.011 148 = 0.124 868
d_2 = 1.149 868 − 0.124 868 = 1.025 000 (as measured)

FIG. B1 BASIS OF LEAD ANGLE CORRECTION FOR EXTERNAL THREAD

The following calculation exemplifies the process, and the result may be compared with that obtained for the same example by the Vogel method [2] or the Van Keuren method [1, 2].

1⅛ in. – 5, 4 start 29 deg. Acme screw thread

d_2 = 1.025 basic
l = 0.800
p = 0.200
λ = 13.95 1927 deg.
ω = 0.10020 (from Table B4) [1, 2]
α = 14.5 deg.
$\sin \alpha$ = 0.25038 00041
$\cos \alpha$ = 0.96814 76404
$\tan \alpha$ = 0.25861 75844
$\cot \alpha$ = 3.86671 30949
$\sec \alpha$ = 1.03290 03122
$\operatorname{cosec} \alpha$ = 3.99392 91629
l/π = 0.31830 98862
R = 0.31916 43455
$l/2\pi$ = 0.12732 39545
$(l/2\pi)^2$ = 0.01621 13939
$l/(2\pi \sin \alpha)$ = 0.50852 28550
$l/(2\pi \cos \alpha)$ = 0.13151 29523
$R/\cos \alpha$ = 0.32966 49520
γ_0 = 0.27393 42429

If the Marriner and Wood equations are applied instead of those of Vogel, we have

$$\sigma - \beta = \frac{\cot^2 \lambda}{\cot \beta - \dfrac{\tan \alpha}{\tan \lambda}} \qquad (16)$$

where

$\sigma = \dfrac{\pi}{2N_s}$
N_s = number of starts
λ = lead angle at pitch line
α = half-angle of thread in axial plane

This equation may likewise be solved for β by iteration, but various shortcuts are presented in [2], including a short, highly accurate, and nontranscendent formula for β. The value of β in the above example, which satisfies this equation, is 0.02232 480 radian, as compared with 0.02232 501 obtained with the Marriner and Wood formulas. The measurement to the center of the wires is given by the Vogel formula

$$2OP = d_2 \tan^2 \lambda \, (\sigma - \beta) \operatorname{cosec} \beta = 1.0496\,522 \text{ in.} \qquad (17)$$

which is 0.0000 157 smaller than the value (1.0496 679) obtained by the Marriner and Wood formulas. As this discrepancy is small compared with the possible error in measurement of M_w, either set of formulas is applicable. Also, the discrepancy between the value of $(C + c)$ by the Marriner and Wood formulas is only 0.000 018 in.

B2.4 Limitations on Three-Wire Measurement of External Threads

When the lead angle and diameter of a thread are such that double contact of the measuring wires occurs, it will be necessary to check the pitch diameter by means of balls rather than wires.

For accurate measurement with wires, single contact on each flank must occur. Measuring wires can be used if the following formula from [4] is satisfied for a specific thread.

$$\tan \alpha > \frac{l}{\pi}\sqrt{1/(R + \frac{w}{2}\cos \alpha \cot \alpha)^2 - 4/D^2} \qquad (18)$$

where

α = half-angle of thread in an axial plane
l = lead
R = distance from thread axis to sharp root (see Fig. B1)
w = diameter for measuring wires
D = major diameter of thread

If best-size wires are used so that contact is near the pitch line, the condition for single contact simplifies to

$$\tan \alpha > \frac{2l}{\pi}\sqrt{\frac{1}{d_2^2} - \frac{1}{D^2}} \qquad (19)$$

Due to the approximate nature of the above formulas, double contact does not necessarily occur when these formulas are not satisfied. If this is not satisfactory, the following formula can be used for a more precise determination.

$$\frac{D}{2}\tan \alpha - \gamma_A \sin \alpha + \frac{l}{2\pi}(\beta_A - \beta_P) + \left(\gamma_A \sin \alpha \sin \beta_A - \frac{l}{2\pi}\cos \beta_A\right) \times \sec \beta_P \sin(\beta_A - \beta_P) > 0 \qquad (20)$$

where

γ_A = final value for γ in the correction calculation (0.52936 8598) would be the γ_A for sample calculation, the results of which are shown above

β_A = final value for β in the correction calculation

β_P = $\cos^{-1}$ $(2\gamma_A \cos \alpha \cos \beta_A/D)$ and is a negative angle

If the formula is satisfied, double contact does not occur.

B2.5 References

[1] H. L. Van Keuren, Tables for Precise Measurement of Screws, Catalog and Handbook No. 34, The Van Keuren Co. (1948).

[2] Werner F. Vogel, New Thread Measuring Formulas, Catalog and Handbook No. 36, Appendix D, The Van Keuren Co. (1955).

[3] M. Gary, Die Berechnung der Gewinde-Anlagekorrekturen. Physikalisch-Technischen Bundesanstalt, Braunschweig, 21, No. 4 (1955).

[4] R. S. Marriner and Mrs. J. G. Wood, Rake Correction in the Measurement of Parallel External and Internal Screw Threads, Institute of Mechanical Engineers, London (July 1958).

AMERICAN NATIONAL STANDARDS FOR SCREW THREADS

(Published by The American Society of Mechanical Engineers)

TITLE OF STANDARD

The ASME Publications Catalog shows a complete list of all the Standards published by the Society.

The catalog and binders for holding these Standards are available upon request.