ASME B1.10M-2004
(Revision of ASME B1.10M-1997)

UNIFIED MINIATURE SCREW THREADS

AN AMERICAN NATIONAL STANDARD



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Date of Issuance: March 5, 2004

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CONTENTS

Foreword iv
Committee Roster vi
Correspondence With the B1 Committee vii

1 General 1

2 Screw Thread Profile 2

Figures
1 Basic Profile for the UNM Screw Threads 4
2 Design (Maximum Material) Thread Forms 5
3 Disposition of Tolerances and Crest Clearances 8

Tables
1 Thread Size Dimensions, Basic and Design 2
2 Limits of Size and Tolerances 3
3 Thread Form Formulas 6
4 Thread Form Dimensions, Basic and Design 6
5 Thread Size Formulas, Basic and Design 7
6 Tolerance Formulas for Limits of Size 7

Nonmandatory Appendices
A Gages and Gaging for Unified Miniature Screw Threads 9
B Inch Conversion of Table 1 10
C Inch Conversion of Table 2 11
D Inch Conversion of Table 4 13

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FOREWORD

The standardization of threads for miniature fastening screws and similar purposes has been under study since 1927, when the National Screw Thread commission prepared a compilation of the practices of American manufacturers and various foreign standards. The latter included the Swiss standard NHS 56100, which first appeared in 1923. However, for want of sufficient interest, no further action was taken in the United States until 1943, when the demands of modern warfare awakened both the need for domestic standardization and the desirability of international standardization, particularly among the inch-using countries. For the consideration of this dual problem, together with other thread matters confined principally to the instrument industry, the American Standards Association established, in 1944, ASA War Committee B1.7 on Instrument Screw Threads.

The first significant progress toward standardization and unification of miniature threads was achieved at the American-British-Canadian Conference on the Unification of Engineering Standards held in Ottawa in 1945, when the delegations of these three countries joined in recommending the adoption of the NHS thread series in the size range of 0.30 mm to 0.90 mm having a 50 deg thread angle, and the development of a series closely following the NHS series for sizes larger than 0.90 mm with a 60 deg thread angle.

In June 1946, the War Committee was converted to Subcommittee No. 4 on Instrument Screw Threads of ASME Sectional Committee B1. Shortly thereafter it was learned that Swiss manufacturers were not adhering entirely to NHS 56100, but that the 60 deg thread angle made essentially in accordance with the Unified Thread Form was being widely used for the sizes below 1 mm. From this information and the results of subsequent experimental work by watch and instrument manufacturers both here and abroad, there developed a consensus favoring the 60 deg thread angle for all sizes.

At a meeting in June 1952 of Technical Committee No. 1, Screw Threads, of the International Organization for Standardization, a diameter-pitch series covering the range from 0.25 mm to 1.40 mm was adopted for recommendation to all national standardizing bodies. The Committee also agreed that further studies should be made regarding the use of the ISO Basic Profile (or Unified Thread Form) in this range.

In the United States, where subsequent studies revealed no need, either current or anticipated, for sizes below 0.30 mm, it was established that the 60 deg angle for all sizes was feasible. It was also determined that the minor diameter of internal threads must be, and invariably is, kept above the minimum value established by the Unified Thread Form to avoid excessive tapping difficulties. From this conclusion and the calculation problems presented by the need for dimensioning this Standard in both metric and inch units, a simple plan evolved based on the coefficient of 0.52 in place of 0.54127 for basic thread height. These findings resulted in the formulation of the following recommendations by Subcommittee No. 4 for the American standard:

(a) that the series consist of all sizes from 0.30 mm to 1.400 mm in the ISO recommendation

(b) that the 60 deg thread angle be adopted over the entire range

(c) that the design thread forms be based on the simplified value of 0.52*P*, instead of 0.54127*P*, for the basic thread height

The American views were presented at both the American-British-Canadian Conference in April 1955 and the plenary session of ISO in June 1955. The latter session developed Draft ISO recommendation No. 84 covering a metric series from 0.25 mm to 5.00 mm, with the ISO Basic Thread Profile, having a 60 deg angle and a thread height of 0.54127*P*, applied over the entire range.

American sentiment was strongly in favor of the simplified coefficients for the thread sizes 1.400 mm and below, and the previous issue of this Standard was formulated to incorporate the original American recommendation on thread height. Despite this deviation, complete interchangeability with product made to ISO recommendation No. 84 was regarded as a certainty in view of common practice on internal threads.

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Tolerances given in this Standard were entirely of national origin, as recommendations on this phase had not yet been formulated by other bodies.

A preliminary draft of this Standard, approved by Subcommittee No. 4 on June 12, 1956, was distributed to industry for comment and criticism in October 1956. This draft was then revised and submitted to the Sectional Committee B1 for letter ballot in April 1957. In response to comments received with the letter ballot, the draft was further modified at a meeting of Subcommittee No. 4 on March 6, 1958. Following the acceptance of these modifications by the Sectional Committee, the proposal was submitted to and approved by the sponsor organizations and ASA, and was formally designated as an American Standard on August 18, 1958.

This Standard remained virtually unchanged from 1958 to 1995, while the use of miniature threads diminished considerably due to electronic components, replacing many of the mechanical devices used in watches and instrumentation. There still remains, however, an active use of miniature screw threads in spacecrafts and aircrafts, as components are miniaturized for weight considerations. Attempts were made to revise the Standard between 1979 and 1983, but unresolved negative votes defeated the proposed revisions. Efforts to revise the Standard were undertaken again in 1989.

The current Standard now has a thread height of $0.554H$ ($0.48P$), which is in agreement with FED-STD-H28/5 and ISO/R1501, and which allows for interchangeability with threads produced to the previous standard ASA B1.10-1958. The dimensions and symbology are in line with current screw thread practices. This revision of Unified Miniature Screw Threads lists all dimensions in metric units. Inch conversions of these values have been placed in the Appendix Section of this Standard.

ASME B1.10M-1997 was approved by the American National Standards Institute on July 11, 1997.

ASME B1.10M-1997 was revised again in 2003 to correct printing errors and update symbology to be in line with current screw thread practice. Many of the values that are expressed with P have been expanded to seven decimal places. This has been done to improve calculation accuracy in accordance with ASME B1.30. In addition thread values that were derived from a function of H have been changed to a function of P.

ASME B1.10M-2004 was approved by the American National Standards Institute on January 14, 2004.

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Standardization and Unification of Screw Threads

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

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

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

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UNIFIED MINIATURE SCREW THREADS

1 GENERAL

1.1 Scope

This Standard specifies the thread form, series, tolerance, and designation for the Unified Miniature Screw Threads. The series covers a diameter range of 0.30 mm to 1.40 mm, extending the metric M-Profile and unified thread series that begin at 1.6 mm.

1.2 Unified Miniature Screw Thread Standards

The fourteen sizes published in this Standard were endorsed by the American-British-Canadian conference of April 1955 as the basis of the unified standard among inch-using countries, and to correspond with the range of sizes in the ISO. The sizes are shown in Table 1. In interest of standardization and where design permits, selection of size should be confined to those indicated in bold type in Table 1. For more restrictive conditions, those sizes indicated in regular type in Table 1 may be used.

1.3 Designation

Unified Miniature Thread sizes of this series shall be designated on engineering drawings, in specifications, and on tools and gages (space permitting) by their nominal diameter in hundredths of a millimeter followed by the symbol "UNM" (e.g., 0.80 UNM).

On internal threads, the full limits of minor diameter, as given in Table 2, shall normally be considered applicable. Where this is not permissible, the designation shall be supplemented by the minor diameter limits.

1.4 Reference Documents[1]

The following is a list of publications referenced in this Standard.

ASME B1.7, Nomenclature, Definitions, and Letter Symbols for Screw Threads

ASME B1.30M, Screw Threads—Standard Practice for Calculating and Rounding Dimensions

Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ISO/R1501[2], ISO Miniature Screw Threads

Publisher: International Organization for Standardization, 3 rue de Varembé, 1211 Genève 20, Switzerland/Suisse

1.5 Acceptability

Additional recommended methods for determining the acceptability of miniature screw threads will be included as further experience with this thread standard is reported. Until such time, agreements must be reached between purchaser and vendor regarding the basis for determining acceptance, since practices are likely to differ considerably, particularly for external threads. Where a free choice is possible, the procedures given below, which are being used with considerable success by some producers, are suggested.

1.5.1 External Threads. The major diameter of the external thread is measured by either contact gaging, optical projection, or laser inspection equipment. All other dimensions, such as pitch diameter, lead, thread form, and minor diameter may be inspected by optical projection methods, with a magnification of 100X recommended. A suggested chart for this method is shown in Appendix A. The thread plug gages and the tap are inspected in a similar manner to externally threaded parts. Contact gaging, such as the use of "GO" and "NOT GO" ring gages, measuring wires, and set plug gages may be used for sizes 0.70 UNM and above.

1.5.2 Internal Threads. The minor diameter of the internal thread is gaged with "GO" and "NOT GO" plain cylindrical plug gages. All other elements are checked only for assemble-ability limits by means of a "GO" thread plug gage, taking extreme care not to damage the thread. For the minimum material limits of the internal threads, the accuracy and performance of the tap is relied upon. This implies that the major and pitch diameters of the tap do not exceed the maximum internal thread limits for these elements, and disregards over cutting, which is rarely incurred because of the flexibility of these small taps and the manner in which they are generally fluted.

It is recommended that the minor diameter of the internal thread be gaged with one insertion of the "NOT GO" plain cylindrical plug gage first. The "NOT GO"

[1] When the American National Standards referred to in this Standard are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

[2] May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

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Table 1 Thread Size Dimensions, Basic and Design

Size Designation	Pitch, P, mm	Nominal and Basic Major Diameter, D, d, mm	Basic Pitch Diameter, D_2, d_2, mm	Design Minor Diameter External Threads, $d - 1.145185P = d_3$, mm	Design Minor Diameter Internal Threads, $D - 0.96P$, mm	Design Major Diameter Internal Threads, $D + 0.0721688P$, mm	Lead Angle at Basic Pitch Diameter, λ deg	Lead Angle at Basic Pitch Diameter, λ min	Sectional Area at Minor Diameter, d_3, sq mm
0.30 UNM	**0.080**	**0.300**	**0.248**	**0.208**	**0.223**	**0.306**	**5**	**52**	**0.034**
0.35 UNM	0.090	0.350	0.292	0.247	0.264	0.356	5	37	0.048
0.40 UNM	**0.100**	**0.400**	**0.335**	**0.285**	**0.304**	**0.407**	**5**	**26**	**0.064**
0.45 UNM	0.100	0.450	0.385	0.335	0.354	0.457	4	44	0.088
0.50 UNM	**0.125**	**0.500**	**0.419**	**0.357**	**0.380**	**0.509**	**5**	**26**	**0.100**
0.55 UNM	0.125	0.550	0.469	0.407	0.430	0.559	4	51	0.130
0.60 UNM	**0.150**	**0.600**	**0.503**	**0.428**	**0.456**	**0.611**	**5**	**26**	**0.144**
0.70 UNM	0.175	0.700	0.586	0.500	0.532	0.713	5	26	0.196
0.80 UNM	**0.200**	**0.800**	**0.670**	**0.571**	**0.608**	**0.814**	**5**	**26**	**0.256**
0.90 UNM	0.225	0.900	0.754	0.642	0.684	0.916	5	26	0.324
1.00 UNM	**0.250**	**1.000**	**0.838**	**0.714**	**0.760**	**1.018**	**5**	**26**	**0.400**
1.10 UNM	0.250	1.100	0.938	0.814	0.860	1.118	4	51	0.520
1.20 UNM	**0.250**	**1.200**	**1.038**	**0.914**	**0.960**	**1.218**	**4**	**23**	**0.656**
1.40 UNM	0.300	1.400	1.205	1.056	1.112	1.422	4	32	0.877

GENERAL NOTES:

(a) Sizes shown in bold type are preferred. It is recommended that selection be confined to these sizes insofar as possible.

(b) For inch conversion of Table 1, see Table B1.

plain cylindrical plug gage shall be inserted only until it meets some resistance. The minor diameter is then gaged with only one insertion of the plain cylindrical plug gage per thread, as the act of gaging can wear the thread oversize. At this point, the minor diameter is considered to be acceptable. The thread is gaged with only one insertion of the "GO" thread plug gage. The thread is accepted or rejected on the basis of this one insertion. Repeat insertions can wear out/damage the thread.

1.5.3 Reference Temperature. The reference temperature is 20°C for the dimensions defined by this system.

1.5.4 Units of Measure. All dimensions in this Standard, including all tables, are in millimeters unless otherwise specified. Inch conversions may be found in Nonmandatory Appendices B, C, and D.

1.5.5 Federal Government Use. When this Standard is approved by the Department of Defense (DOD) and federal agencies, and is incorporated into FED-STD-H28/5, Screw-Thread Standards for Federal Services, Section 5, the use of this Standard by federal government will be subject to all requirements and limitations of FED-STD-H28/5.

2 SCREW THREAD PROFILE

2.1 Scope

The basic profile and design profiles defined in this Section are the basis of all thread dimensions given in this Standard.

2.2 Basic Profile

The basic profile for the UNM screw threads is shown in Fig. 1 (profile applies to the axial plane), and except for one element is the Unified Basic Thread Form. The exception is the height of thread engagement for which the basic value is $0.4800P$. The basic thread height of $0.4800P$ ($0.554H$) will not affect interchangeability with products made to the 1958 revision of this Standard showing $0.5200P$. As the resulting difference is negligible and completely offset by practical considerations in tapping, full internal thread heights are avoided in these small sizes to escape excessive tap breakage.

For reference, the basic profile for UNM screw threads is identical to that for ISO metric threads in ISO/R1501.

2.3 Design Profiles

The design profiles define the maximum material conditions for the external and internal unified miniature

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Table 2 Limits of Size and Tolerances

Size Designation	Pitch, P, mm	External Threads, mm								Internal Threads, mm							
		Major Diameter			Pitch Diameter			Minor Diameter		Minor Diameter			Pitch Diameter			Major Diameter	
		Max.	Min.	Tol.	Max.	Min.	Tol.	Max.	Min. [Note (1)]	Min.	Max.	Tol.	Min.	Max.	Tol.	Min.	Max. [Note (1)]
0.30 UNM	**0.080**	**0.300**	**0.284**	**0.016**	**0.248**	**0.234**	**0.014**	**0.208**	**0.187**	**0.223**	**0.261**	**0.038**	**0.248**	**0.262**	**0.014**	**0.306**	**0.327**
0.35 UNM	0.090	0.350	0.333	0.017	0.292	0.277	0.015	0.247	0.225	0.264	0.305	0.041	0.292	0.307	0.015	0.356	0.379
0.40 UNM	**0.100**	**0.400**	**0.382**	**0.018**	**0.335**	**0.319**	**0.016**	**0.285**	**0.261**	**0.304**	**0.348**	**0.044**	**0.335**	**0.351**	**0.016**	**0.407**	**0.432**
0.45 UNM	0.100	0.450	0.432	0.018	0.385	0.369	0.016	0.335	0.311	0.354	0.398	0.044	0.385	0.401	0.016	0.457	0.482
0.50 UNM	**0.125**	**0.500**	**0.479**	**0.021**	**0.419**	**0.401**	**0.018**	**0.357**	**0.329**	**0.380**	**0.432**	**0.052**	**0.419**	**0.437**	**0.018**	**0.509**	**0.538**
0.55 UNM	0.125	0.550	0.529	0.021	0.469	0.451	0.018	0.407	0.379	0.430	0.482	0.052	0.469	0.487	0.018	0.559	0.588
0.60 UNM	**0.150**	**0.600**	**0.576**	**0.024**	**0.503**	**0.483**	**0.020**	**0.428**	**0.396**	**0.456**	**0.516**	**0.060**	**0.503**	**0.523**	**0.020**	**0.611**	**0.644**
0.70 UNM	0.175	0.700	0.673	0.027	0.586	0.564	0.022	0.500	0.464	0.532	0.600	0.068	0.586	0.608	0.022	0.713	0.750
0.80 UNM	**0.200**	**0.800**	**0.770**	**0.030**	**0.670**	**0.646**	**0.024**	**0.571**	**0.531**	**0.608**	**0.684**	**0.076**	**0.670**	**0.694**	**0.024**	**0.814**	**0.856**
0.90 UNM	0.225	0.900	0.867	0.033	0.754	0.728	0.026	0.642	0.598	0.684	0.768	0.084	0.754	0.780	0.026	0.916	0.962
1.00 UNM	**0.250**	**1.000**	**0.964**	**0.036**	**0.838**	**0.810**	**0.028**	**0.714**	**0.666**	**0.760**	**0.852**	**0.092**	**0.838**	**0.866**	**0.028**	**1.018**	**1.068**
1.10 UNM	0.250	1.100	1.064	0.036	0.938	0.910	0.028	0.814	0.766	0.860	0.952	0.092	0.938	0.966	0.028	1.118	1.168
1.20 UNM	**0.250**	**1.200**	**1.164**	**0.036**	**1.038**	**1.010**	**0.028**	**0.914**	**0.866**	**0.960**	**1.052**	**0.092**	**1.038**	**1.066**	**0.028**	**1.218**	**1.268**
1.40 UNM	0.300	1.400	1.358	0.042	1.205	1.173	0.032	1.056	1.000	1.112	1.220	0.108	1.205	1.237	0.032	1.422	1.480

GENERAL NOTES:

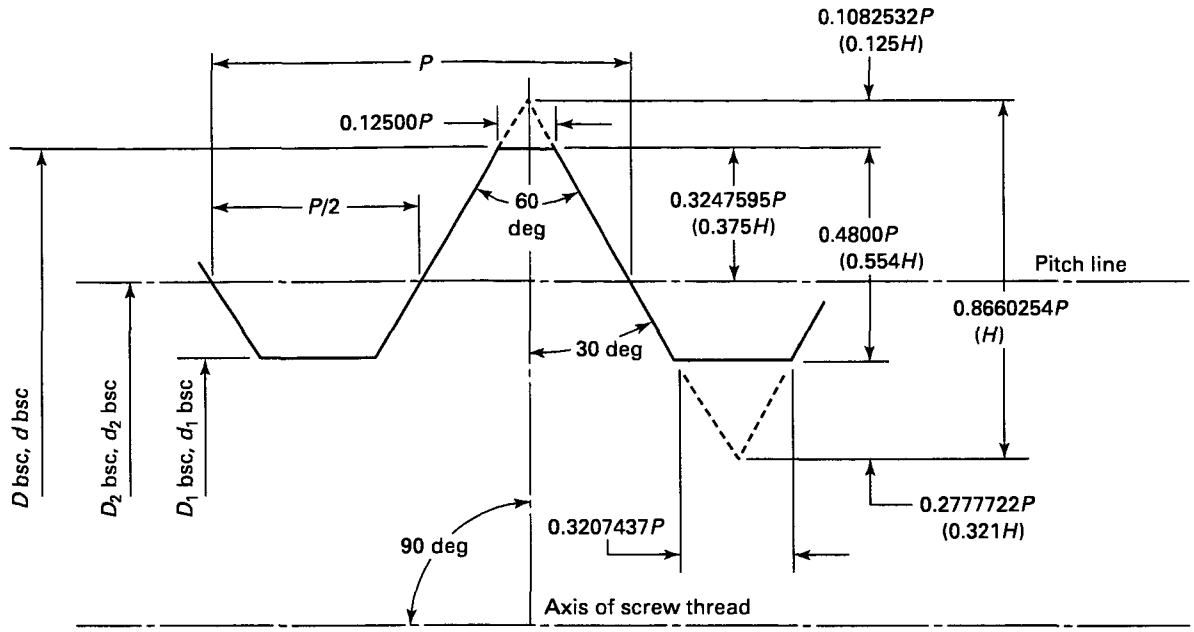
(a) Sizes shown in bold type are preferred. It is recommended that selection be confined to these sizes insofar as possible.

(b) For inch conversion of Table 2, see Table C1.

NOTE:

(1) Dimension is used in the design of tools. Generally, diameter acceptance is based upon maximum material condition gaging.

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GENERAL NOTE: For standardization, the tabulated listing of thread values has been established based on a function of pitch, *P*. The thread values based on a functional height, *H*, are used as reference only.

Fig. 1 Basic Profile for the UNM Screw Threads

thread as shown in Fig. 2. These forms are derived from the basic profile shown in Fig. 1 by the application of clearances for the crests of the addendum at the roots of the mating dedendum forms, and thereby satisfy the practical consideration that the contact between the mating pair be limited to functional surfaces of the fasteners.

2.3.1 Practically speaking, product made to the requirements of this Standard will be interchangeable with product made to any other standards allowing a maximum depth of engagement (or combined addendum height) of $0.4800P$. Internal thread heights exceeding $0.4800P$ should be avoided in the small thread sizes in order to avoid excessive tap breakage.

2.3.2 Formulas for the various dimensions are given in both Fig. 2 and Table 3. Values of the various dimensions for all pitches are given in Table 4.

2.4 Lead

All threads are of the single (single start) type.

2.5 Nominal Size

The thread sizes comprising this series and their respective pitches are shown in the third and second columns, respectively, of Table 1. Formulas for the dimensions are listed in Table 5. Corresponding values for all sizes are given in Table 1.

2.6 Classifications

This Standard establishes only one class of thread, with zero allowance on all diameters, in view of the manufacturing difficulties which any differentiations in tolerance would impose and because there is no demonstrated need for additional classes.

2.7 Tolerance

2.7.1 All tolerance governing limits of size are based on functions of the pitch only and apply to lengths of engagement from $\frac{2}{3}$ to $1\frac{1}{2}$ times the nominal diameter. Lengths of engagement and nominal diameter are not incorporated in any of the tolerance formulas in view of the following.

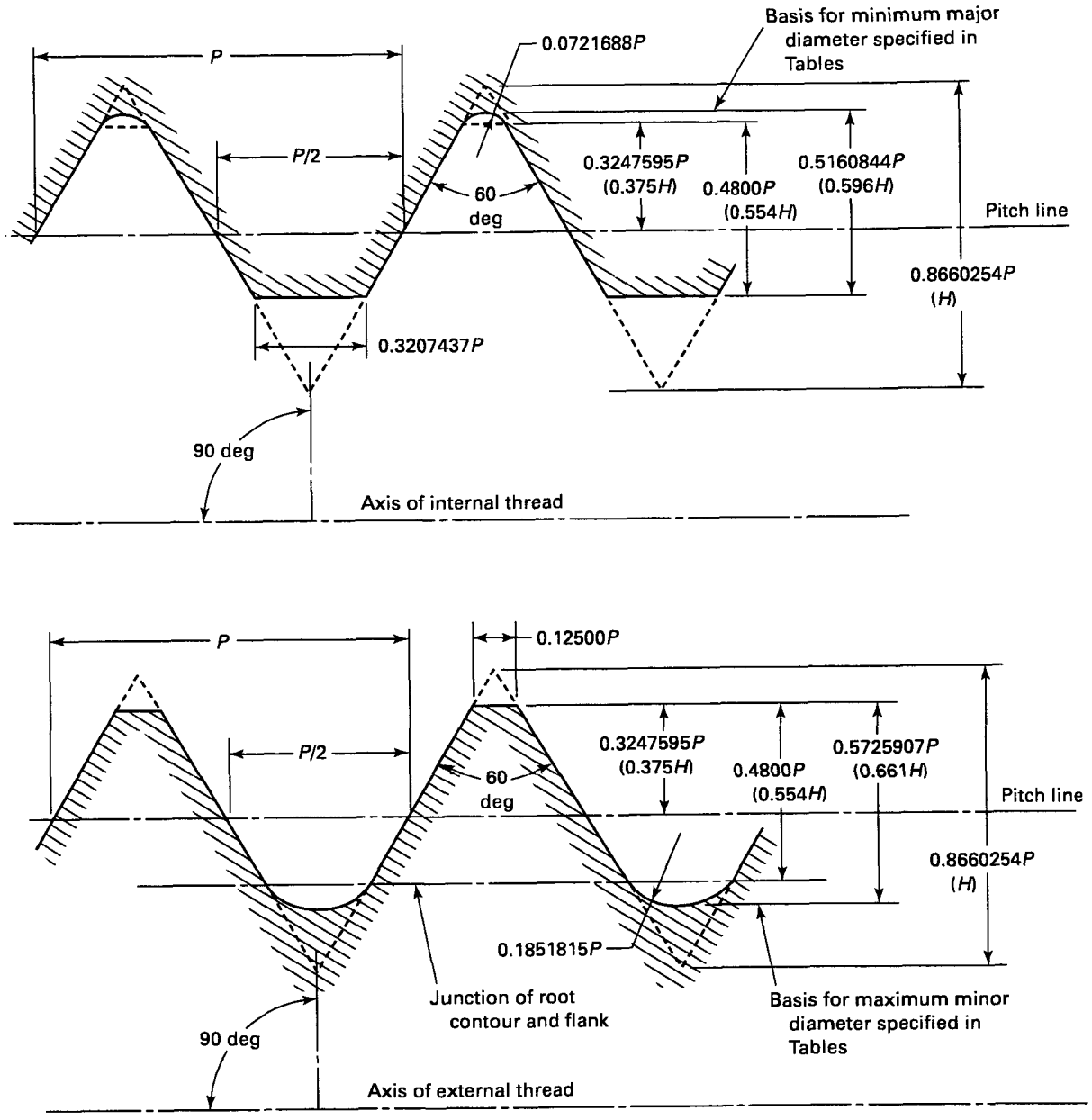
(a) In the small thread sizes covered by this Standard, lengths of engagement significantly below or above the range covered by the formulas are not frequently employed.

(b) Functional fitness in these small sizes is dependent principally upon the properties of the thread rather than the size of the threaded member.

(c) Total tolerance is too small to permit the imposition of minor modifications.

2.7.2 On external threads, tolerance is applied to the design sizes in the minus direction. On internal threads,

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GENERAL NOTE: For standardization, the tabulated listing of thread values has been established based on a function of pitch, *P*. The thread values based on a functional height, *H*, are used as reference only.

Fig. 2 Design (Maximum Material) Thread Forms

tolerance is applied to the design size in the plus direction. Tolerance formulas are given in Table 6. Their values are given in Table 2.

2.8 Coated Threads

It is not within the scope of this Standard to make recommendations for thickness of, or specify limits for, coatings.

2.9 Limits of Size

The limits of size resulting from the application of the specified tolerance are illustrated in Fig. 3. Their values are given in Table 2.

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Table 3 Thread Form Formulas

Element	Symbol	Formula
Basic Thread Form		
Angle of thread	2α	60 deg
Half angle of thread	α	30 deg
Pitch of thread	P	...
Height of sharp V thread	H	$0.8660254P$
Addendum of basic thread	h_{ab}	$0.3247595P$ ($0.375H$)
Height of basic thread	h_b	$0.4800P$ ($0.554H$)
Design Form — External Thread		
Addendum	h_{as}	$0.3247595P$ ($0.375H$)
Height	h_s	$0.5725907P$ ($0.661H$)
Flat at crest	F_{cs}	$0.12500P$
Radius at root	r_{rs}	$0.1851815P$
Design Form — Internal Thread		
Height of engagement	h_e	$0.4800P$ ($0.554H$)
Height of thread	h_n	$0.4800P$ ($0.554H$)
Flat at crest	F_{cn}	$0.3207437P$
Radius at root	r_{rn}	$0.0721688P$

GENERAL NOTE: For standardization, this tabular listing of thread values has been established based on a function of pitch, P. The thread values based on a functional height, H, are used as reference only.

Table 4 Thread Form Dimensions, Basic and Design

	Basic Thread Form, mm			External Thread Design Form, mm			Internal Thread Design Form, mm		
Pitch, P	Height of Sharp V, H = $0.8660254P$	Height of Internal Thread and Depth of Thread Engagement, h_b = ($0.554H$) = $0.4800P$	Dedendum of Internal Thread and Addendum of External Thread, h_{as} = ($0.375H$) = $0.3247595P$	Height, h_s = ($0.661H$) = $0.5725907P$	Flat at Crest, F_{cs} = $0.12500P$	Radius at Root, r_{rs} = $0.1851815P$	Rounded Root Height, ($0.596H$) = $0.5160844P$	Flat at Crest, F_{cn} = $0.3207437P$	Radius at Root, r_m = $0.0721688P$
0.080	0.06928	0.03840	0.02598	0.04581	0.0100	0.015	0.04129	0.0257	0.006
0.090	0.07794	0.04320	0.02923	0.05153	0.0113	0.017	0.04645	0.0289	0.006
0.100	0.08660	0.04800	0.03248	0.05726	0.0125	0.019	0.05161	0.0321	0.007
0.125	0.10825	0.06000	0.04059	0.07157	0.0156	0.023	0.06451	0.0401	0.009
0.150	0.12990	0.07200	0.04871	0.08589	0.0188	0.028	0.07741	0.0481	0.011
0.175	0.15155	0.08400	0.05683	0.10020	0.0219	0.032	0.09031	0.0561	0.013
0.200	0.17321	0.09600	0.06495	0.11452	0.0250	0.037	0.10322	0.0641	0.014
0.225	0.19486	0.10800	0.07307	0.12883	0.0281	0.042	0.11612	0.0722	0.016
0.250	0.21651	0.12000	0.08119	0.14315	0.0313	0.046	0.12902	0.0802	0.018
0.300	0.25981	0.14400	0.09743	0.17178	0.0375	0.056	0.15483	0.0962	0.022

GENERAL NOTES:

(a) For standardization, this listing of tabulated thread values has been established based on a function of pitch, P. The thread values based on a functional height, H, are used as reference only.

(b) For inch conversion of Table 4, see Table D1.

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Table 5 Thread Size Formulas, Basic and Design

Dimensions	Symbol	Formula [Note (1)]
Major diameter, design and basic	*D*bsc, *d*bsc	...
Major diameter of external thread, design	*d*	*d*bsc
Major diameter of internal thread, design	*D*	$D\text{bsc} + r_m = D\text{bsc} + 0.0721688P$
Pitch diameter, basic	D_2bsc, $d_2$bsc	$D_2\text{bsc} = D\text{bsc} - 2h_{ab} = D\text{bsc} - 0.6495191P$ $d_2\text{bsc} = d\text{bsc} - 2h_{ab} = d\text{bsc} - 0.6495191P$
Pitch diameter of external thread, design [Note (2)]	d_2	$d_2$bsc
Pitch diameter of internal thread, design	D_2	D_2bsc
Minor diameter, basic	D_1bsc, $d_1$bsc	$D_1\text{bsc} = D\text{bsc} - 2h_b = D\text{bsc} - 0.9600P$ $d_1\text{bsc} = d\text{bsc} - 2h_b = d\text{bsc} - 0.9600P$
Minor diameter of external thread, design	d_1	$d\text{bsc} - 2h_s = d\text{bsc} - 1.1451815P$
Minor diameter of internal thread, design	D_1	$D\text{bsc} - 2h_n = d\text{bsc} - 0.9600P$

NOTES:
(1) Metric units (millimeters) apply in all formulas.
(2) Only one class of thread, with no allowance on the pitch diameter, is provided.

Table 6 Tolerance Formulas for Limits of Size

Dimension	Formula
External thread, major diameter	$0.1200P + 0.006$
External thread, pitch diameter	$0.0800P + 0.008$
External thread, minor diameter [Note (1)]	$0.1600P + 0.008$
Internal thread, major diameter [Note (1)]	$0.1680P + 0.008$
Internal thread, pitch diameter	$0.0800P + 0.008$
Internal thread, minor diameter	$0.3200P + 0.012$

NOTE:
(1) Tolerance is used in the design of tools.

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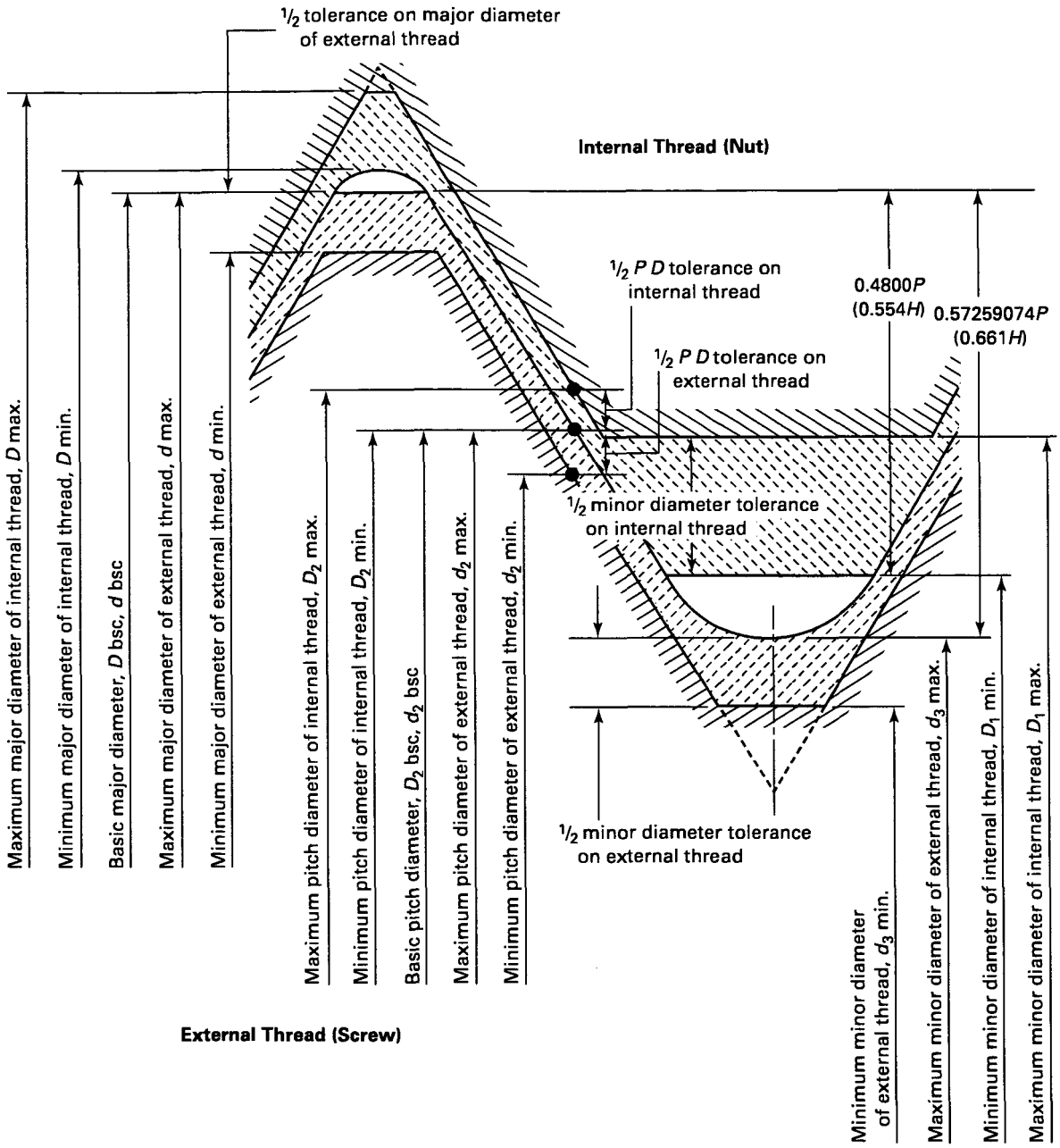


Fig. 3 Disposition of Tolerances and Crest Clearances

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NONMANDATORY APPENDIX A
GAGES AND GAGING FOR UNIFIED MINIATURE SCREW THREADS

The establishment of specifications for gages for Unified Miniature Screw Threads is not within the scope of this document. However, in the absence of a gage standard, the development of which is awaiting the accumulation of more experience with this thread standard, there is presented below, in Fig. A1, an illustration of a chart which has been found very satisfactory for the optical projection method of inspection of external threads. Inspection at a magnification of 100X is recommended and at this scale the charts should be accurate to within ±0.01 in. on all diameters and on pitches cumulatively up to five pitches.

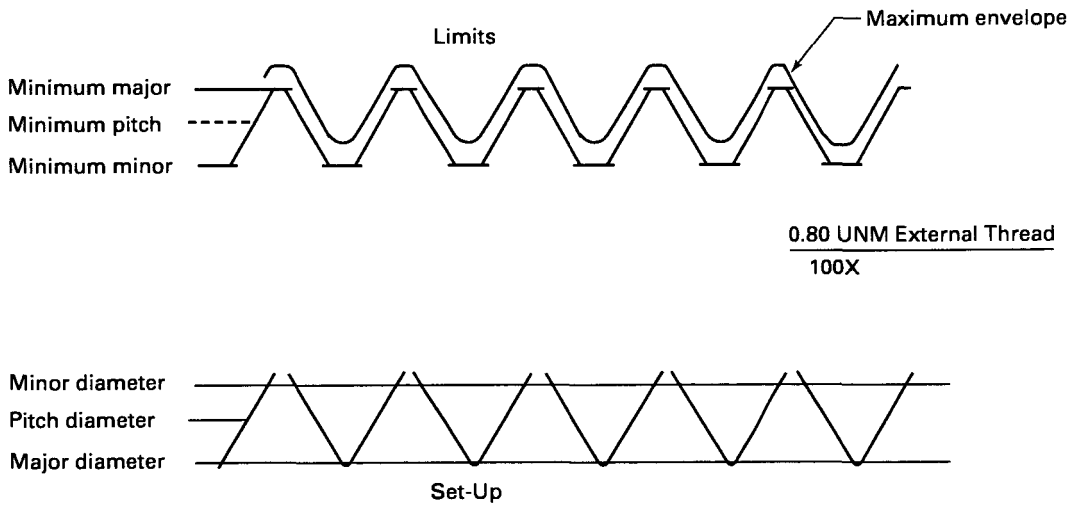


Fig. A1 Example of Projection Comparator Chart for External Thread

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NONMANDATORY APPENDIX B
INCH CONVERSION OF TABLE 1

Table B1 Thread Size Dimensions, Basic and Design

Size Designation	Threads/in., n	Nominal and Basic Major Diameter, D, d, in.	Basic Pitch Diameter, D_2, d_2, in.	Design Minor Diameter External Threads, d_3, in.	Design Minor Diameter Internal Threads, in.	Design Major Diameter Internal Threads, in.	Lead Angle at Basic Pitch Diameter, λ deg	min	Sectional Area at Minor Diameter, sq in.
0.30 UNM	**317.5**	**0.0118**	**0.0098**	**0.0082**	**0.0088**	**0.0120**	**5**	**52**	**0.0000527**
0.35 UNM	282.2	0.0138	0.0115	0.0097	0.0104	0.0140	5	37	0.0000744
0.40 UNM	**254**	**0.0157**	**0.0132**	**0.0112**	**0.0120**	**0.0160**	**5**	**26**	**0.0000992**
0.45 UNM	254	0.0177	0.0152	0.0132	0.0139	0.0180	4	44	0.0001364
0.50 UNM	**203.2**	**0.0197**	**0.0165**	**0.0141**	**0.0150**	**0.0200**	**5**	**26**	**0.0001550**
0.55 UNM	203.2	0.0217	0.0185	0.0160	0.0169	0.0220	4	51	0.0002015
0.60 UNM	**169.3**	**0.0236**	**0.0198**	**0.0169**	**0.0180**	**0.0241**	**5**	**26**	**0.0002232**
0.70 UNM	145.1	0.0276	0.0231	0.0197	0.0209	0.0281	5	26	0.0003038
0.80 UNM	**127**	**0.0315**	**0.0264**	**0.0225**	**0.0239**	**0.0320**	**5**	**26**	**0.0003968**
0.90 UNM	112.9	0.0354	0.0297	0.0253	0.0269	0.0361	5	26	0.0005022
1.00 UNM	**101.6**	**0.0394**	**0.0330**	**0.0281**	**0.0299**	**0.0401**	**5**	**26**	**0.0006200**
1.10 UNM	101.6	0.0433	0.0369	0.0320	0.0339	0.0440	4	51	0.0008060
1.20 UNM	**101.6**	**0.0472**	**0.0409**	**0.0360**	**0.0378**	**0.0480**	**4**	**23**	**0.0010168**
1.40 UNM	84.7	0.0551	0.0474	0.0416	0.0438	0.0560	4	32	0.0013594

GENERAL NOTES:

(a) Sizes shown in bold type are preferred. It is recommended that selection be confined to these sizes insofar as possible.

(b) Dimensions shown are a soft inch conversion of Table 1.

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NONMANDATORY APPENDIX C
INCH CONVERSION OF TABLE 2

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Table C1 Limits of Size and Tolerances

Size Designation	Threads/in. *n*	External Threads, in.								Internal Threads, in.							
		Major Diameter			Pitch Diameter			Minor Diameter		Minor Diameter			Pitch Diameter			Major Diameter	
		Max.	Min.	Tol.	Max.	Min.	Tol.	Max.	Min. [Note (1)]	Min.	Max.	Tol.	Min.	Max.	Tol.	Min.	Max. [Note (1)]
0.30 UNM	**317.5**	**0.0118**	**0.0112**	**0.0006**	**0.0098**	**0.0092**	**0.0006**	**0.0082**	**0.0074**	**0.0088**	**0.0103**	**0.0015**	**0.0098**	**0.0103**	**0.0006**	**0.0120**	**0.0129**
0.35 UNM	282.2	0.0138	0.0131	0.0007	0.0115	0.0109	0.0006	0.0097	0.0089	0.0104	0.0120	0.0016	0.0115	0.0121	0.0006	0.0140	0.0149
0.40 UNM	**254**	**0.0157**	**0.0150**	**0.0007**	**0.0132**	**0.0126**	**0.0006**	**0.0112**	**0.0103**	**0.0120**	**0.0137**	**0.0017**	**0.0132**	**0.0138**	**0.0006**	**0.0160**	**0.0170**
0.45 UNM	254	0.0177	0.0170	0.0007	0.0152	0.0145	0.0006	0.0132	0.0122	0.0139	0.0157	0.0017	0.0152	0.0158	0.0006	0.0180	0.0190
0.50 UNM	**203.2**	**0.0197**	**0.0189**	**0.0008**	**0.0165**	**0.0158**	**0.0007**	**0.0141**	**0.0130**	**0.0150**	**0.0170**	**0.0020**	**0.0165**	**0.0172**	**0.0007**	**0.0200**	**0.0212**
0.55 UNM	203.2	0.0217	0.0208	0.0008	0.0185	0.0178	0.0007	0.0160	0.0149	0.0169	0.0190	0.0020	0.0185	0.0192	0.0007	0.0220	0.0231
0.60 UNM	**169.3**	**0.0236**	**0.0227**	**0.0009**	**0.0198**	**0.0190**	**0.0008**	**0.0169**	**0.0156**	**0.0180**	**0.0203**	**0.0024**	**0.0198**	**0.0206**	**0.0008**	**0.0241**	**0.0254**
0.70 UNM	145.1	0.0276	0.0265	0.0011	0.0231	0.0222	0.0009	0.0197	0.0183	0.0209	0.0236	0.0027	0.0231	0.0239 [Note (2)]	0.0009	0.0281	0.0295
0.80 UNM	**127**	**0.0315**	**0.0303**	**0.0012**	**0.0264**	**0.0254**	**0.0009**	**0.0225**	**0.0209**	**0.0239**	**0.0269**	**0.0030**	**0.0264**	**0.0273**	**0.0009**	**0.0320**	**0.0337**
0.90 UNM	112.9	0.0354	0.0341	0.0013	0.0297	0.0287	0.0010	0.0253	0.0235	0.0269	0.0302	0.0033	0.0297	0.0307	0.0010	0.0361	0.0379
1.00 UNM	**101.6**	**0.0394**	**0.0380**	**0.0014**	**0.0330**	**0.0319**	**0.0011**	**0.0281**	**0.0262**	**0.0299**	**0.0335**	**0.0036**	**0.0330**	**0.0341**	**0.0011**	**0.0401**	**0.0420**
1.10 UNM	101.6	0.0433	0.0419	0.0014	0.0369	0.0358	0.0011	0.0320	0.0302	0.0339	0.0375	0.0036	0.0369	0.0380	0.0011	0.0440	0.0460
1.20 UNM	**101.6**	**0.0472**	**0.0458**	**0.0014**	**0.0409**	**0.0397**	**0.0011**	**0.0360**	**0.0341**	**0.0378**	**0.0414**	**0.0036**	**0.0409**	**0.0420**	**0.0011**	**0.0480**	**0.0499**
1.40 UNM	84.7	0.0551	0.0535	0.0017	0.0474	0.0462	0.0013	0.0416	0.0394	0.0438	0.0480	0.0043	0.0474	0.0487	0.0013	0.0560	0.0583

GENERAL NOTES:

(a) Sizes shown in bold type are preferred. It is recommended that selection be confined to these sizes insofar as possible.

(b) Dimensions shown are a soft inch conversion of Table 2.

NOTES:

(1) Dimension is used in the design of tools. Generally, diameter acceptance is based upon maximum material condition gaging.

(2) The value 0.0239 is derived by soft conversion and does not mathematicly agree with the Min. value of 0.0231 + tolerance of 0.0009.

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NONMANDATORY APPENDIX D
INCH CONVERSION OF TABLE 4

Table D1 Thread Form Dimensions, Basic and Design

Basic Thread Form, in.					External Thread Design Form, in.			Internal Thread Design Form, in.		
Threads/in., n	Pitch, P	Height of Sharp V, H	Height of Internal Thread and Depth of Thread Engagement, h_b	Dedendum of Internal Thread and Addendum of External Thread, h_{as}	Height, h_s	Flat at Crest, F_{cs}	Radius at Root, r_{rs}	Rounded Root Height	Flat at Crest, F_{cn}	Radius at Root, r_m
317.5	0.003150	0.002728	0.001512	0.001023	0.001804	0.00039	0.0006	0.001626	0.00101	0.0002
282.2	0.003543	0.003069	0.001701	0.001151	0.002029	0.00044	0.0007	0.001829	0.00114	0.0002
254	0.003937	0.003409	0.001890	0.001279	0.002254	0.00049	0.0007	0.002032	0.00126	0.0003
203.2	0.004921	0.004262	0.002362	0.001598	0.002818	0.00061	0.0009	0.002540	0.00158	0.0004
169.3	0.005906	0.005114	0.002835	0.001918	0.003381	0.00074	0.0011	0.003048	0.00189	0.0004
145.1	0.006890	0.005967	0.003307	0.002237	0.003945	0.00086	0.0013	0.003556	0.00221	0.0005
127	0.007874	0.006819	0.003780	0.002557	0.004509	0.00098	0.0015	0.004064	0.00252	0.0006
112.9	0.008858	0.007672	0.004252	0.002877	0.005072	0.00111	0.0017	0.004572	0.00284	0.0006
101.6	0.009843	0.008524	0.004724	0.003196	0.005636	0.00123	0.0018	0.005080	0.00316	0.0007
84.7	0.011811	0.010229	0.005669	0.003836	0.006763	0.00148	0.0022	0.006096	0.00379	0.0009

GENERAL NOTES:

(a) For standardization, this listing of tabulated thread values has been established based on a function of pitch, P. The thread values based on a functional height, H, are used as reference only.

(b) Dimensions are soft inch conversions of Table 4.

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OTHER STANDARDS FOR SCREW THREADS

Unified Inch Screw Threads (UN and UNR Thread Form) B1.1-1989
Gages and Gaging for Unified Inch Screw Threads ..... B1.2-1983(R2001)
Screw Thread Gaging Systems for Dimensional Acceptability — Inch and Metric Screw Threads
(UN, UNR, UNJ, M, and MJ) ..... B1.3M-1992(R2001)
Acme Screw Threads B1.5-1997
Nomenclature, Definitions, and Letter Symbols for Screw Threads ..... B1.7M-1984(R2001)
Stub Acme Screw Threads ..... B1.8-1988(R2001)
Buttress Inch Screw Threads 7°/45° Form With 0.6 Pitch Basic Height of Thread Engagement ..... B1.9-1973(R2001)
Unified Miniature Screw Threads B1.10M-2004
Microscope Objective Thread ..... B1.11-1958(R2001)
Class 5 Interference-Fit Thread ..... B1.12-1987(R1998)
Metric Screw Threads — M Profile B1.13M-2001
Unified Inch Screw Threads (UNJ Thread Form) B1.15-1995
Gages and Gaging for Metric M Screw Threads ..... B1.16M-1984(R2001)
Pipe Threads, General Purpose (Inch) ..... B1.20.1-1983(R2001)
Dryseal Pipe Threads (Inch) ..... B1.20.3-1976(R1998)
Gaging for Dryseal Pipe Threads (Inch) ..... B1.20.5-1991(R1998)
Hose Coupling Screw Threads (Inch) ..... B1.20.7-1991(R1988)
Metric Screw Threads: MJ Profile B1.21M-1997
Gages and Gaging for MJ Series Metric Screw Threads ..... B1.22M-1985(R2001)
Screw Threads — Standard Practice for Calculating and Rounding Dimensions B1.30-2002

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