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FED-STD-H28/2A
20 April 1984
SUPERSEDING
FED-STD-H28/2
FED-STD-H28/3
31 March 1978
(See Note)

FEDERAL STANDARD
SCREW - THREAD STANDARDS FOR FEDERAL SERVICES
SECTION 2
UNIFIED INCH SCREW THREADS-
UN AND UNR THREAD FORMS

This standard was approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for the use of all Federal Agencies.

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New and revised pages will be issued under Change Notices which will be numbered consecutively and will bear the date of issuance. Change Notices should be retained and filed in front of the standard until such time as they are superseded by a reissue of the entire standard.

FOREWORD

This section was developed to provide Unified Inch Screw Threads for the Federal Services. It was formerly known as "Unified Thread Form and Thread Series for Bolts, Screws, Nuts, Tapped Holes and General Applications". The present issue is a complete revision of FED-STD-H28/2 dated 31 March 1978. It also includes the material previously identified as FED-STD-H28/3 dated 31 March 1978, which was known as "Unified Threads of Special Diameters, Pitches, and Lengths of Engagement". Material from Appendices A3 and A5 of FED-STD-H28 dated 31 March 1978 has been revised and is now in Appendices A and B, respectively, of FED-STD-H28/2A.

FED-STD-H28/2A was prepared by the Defense Industrial Supply Center (DLA-IS) and incorporates the American National Standard for Unified Inch Screw Threads, ANSI B1.1-1982. Significant changes from the previous issues include the following:

(1) Added UNR, external thread form with mandatory rounded root.

(2) Revised tolerance requirements for lead and flank angles.

(3) Added requirements for control of surface texture, chamfers, and rolled thread lead-ins and run-outs.

(4) Added requirement that inspection methods for acceptability are in accordance with FED-STD-H28/20.

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SECTION 2 - Unified Inch Screw Threads - UN and UNR Thread Forms

1. Scope. This section provides the standard for unified inch screw threads to be used by the Federal Services.

1.1 Limitations. Only UN and UNR screw threads are covered in this section. For UNJ threads (controlled external thread root with rounded form and increased form minor diameter) see FED-STD-H28/4 (MIL-S-8879). For UNM threads (miniature threads) see FED-STD-H28/5.

1.2 Application.

1.2.1 UN form screw threads. The UN thread is intended for general purpose fastening applications. Its external thread root may be either flat or rounded.

1.2.2 UNR form screw threads. The UNR form applies only to external threads. Its design form is the same as that of the external UN thread except that the root is required to be rounded. UNR threads are applied most often to high volume commercial fastener threads produced by rolling.

NOTE: The mandatory rounded root of the UNR thread greatly reduces the concentration of stress, hence increases the fatigue life of threaded parts.

2. Referenced documents.

2.1 Government publications. The issues of the following documents in effect on the date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

Federal standards.

FED-STD-H28/1 Nomenclature, Definitions and Letter Symbols for Screw Threads

FED-STD-H28/6 Gages and Gaging for Unified Screw Threads

FED-STD-H28/20 Inspection Methods for Acceptability of UN, UNR, UNJ, M and MJ Screw-Threads

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bi-monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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(Federal Government activities may obtain copies of Federal standardization documents, and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

2.2 Other publications. The following documents form a part of this standard to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standards.

ANSI B1.1-1982 Unified Inch Screw Threads (UN and UNR Thread Form)

ANSI B46.1 Surface Texture - Surface Roughness, Waviness and Lay

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017 or the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

3. Definitions. The terms applicable to this standard are defined in FED-STD-H28/1.

4. General requirements.

4.1 Screw threads. Unified inch screw threads shall be in accordance with ANSI B1.1-1982 and this Federal Standard. Only Standard Series Unified Screw Threads, listed in Table 3A of ANSI B1.1-1982, shall be used for new design for the Federal Services unless prior approval has been granted by the procurement authority to deviate from them. Coarse and fine thread series are preferred.

4.2 Acceptability. Screw thread inspection methods for acceptability shall be in accordance with FED-STD-H28/20. The required gaging system shall be specified in accordance with that standard.

4.3 Gages and gaging. Gages and gaging shall be in accordance with FED-STD-H28/6.

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5. Detailed requirements.

5.1 Diameter-pitch combinations. When standard size screw threads referred to in 4.1 cannot be used, the designer should choose preferred sizes of special threads listed in Table 3B of ANSI B1.1-1982. If this is not possible, consideration should be given to the following sub-paragraphs in the choice of thread.

5.1.1 Preferred non-standard diameters. Whenever possible, the nominal diameter should be selected from series of diameter increments as follows:

Diameter range	First choice increment	Second choice increment
inch	inch	inch
0.25 to 0.6	0.05	—
above 0.6 to 1.5	0.1	0.05
above 1.5 to 6.0	0.25	0.1
above 6 to 16	0.5	0.25
above 16 to 24	1.0	0.5

It is recommended that diameters less than 0.25 inch conform to the standard sizes as there is virtually no necessity for the selection of a diameter not included in those sizes. Also, the coarse and fine thread series provide ample choice of diameter-pitch combinations.

5.1.2 Preferred non-standard pitches. Whenever possible, the pitch should be selected from one of the following; 40, 36, 32, 28, 24, 20, 16, 12, 10, 8, 6 and 4 threads per inch. Intermediate pitches should be used only when absolutely necessary. Pitches coarser than 4 threads per inch are not recommended. The curves shown in Figure 2.B.2 of Appendix B cover the practical diameter limits suggested for each pitch.

5.2 Thread Class Selection. Standard Unified thread classes and their applications are described in Section 4 of ANSI B1.1-1982. When selecting a thread class, consideration should first be given to the use of a class 2A external thread with a class 2B internal thread since these classes are designed for general use. Before specifying class 3A/3B series, it must be considered whether the additional production cost, necessary for the tighter fit and tolerance is justified. If a fit looser than the standard class 1A/1B is required, the non-preferred class 1AR may be specified for an external thread of 16 threads per inch and coarser. This special class combines the larger allowance of the old American National class 1 thread with the Unified class 1A thread tolerance. See 5.2.2 for class 1AR allowance.

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5.2.1 Replacements for obsolete American National thread classes. When threads specified with the obsolete American National thread classes are to be replaced by unified threads, the following guidelines are provided:

a. American National class 1 coarse thread series (NC-1) is approximately equivalent to Unified class 1A/1B series. Class 1 fine thread series (NF-1) is approximately equivalent dimensionally to Unified class 2A/2B series. Standard Unified series threads should be considered prior to approval of replacement by non-standard threads

b. American National class 2 coarse thread series (NC-2), 8 thread series (8N-2), 12 thread series (12N-2), 16 thread series (16N-2), and extra fine thread series (NEF-2) are most nearly equivalent to Unified series UNC-2A/2B, 8UN-2A/2B, 12UN-2A/2B, 16UN-2A/2B and UNEF-2A/2B respectively. Class 2 fine thread series (NF-2) is approximately equivalent dimensionally to Unified class 3A/3B series, but the use of class 2A/2B series should be considered prior to approval of replacement by class 3A/3B.

c. American National class 3 series NC-3, NF-3, NEF-3, 8N-3, 12N-3 and 16N-3 are most nearly equivalent to Unified class 3 series UNC-3A/3B, UNF-3A/3B, UNEF-3A/3B, 8UN-3A/3B, 12UN-3A/3B and 16UN-3A/3B, respectively.

d. There is no Unified thread class equivalent to the old American National class 4 which required selective fit of parts due to the possibility of interference.

5.2.2 Thread allowance and tolerance. Allowances and tolerances specified for standard Unified thread classes are described in Section 5 of ANSI B1.1-1982. For the special external thread class 1AR, tolerances are the same as for class 1A and allowances are as follows:

Threads per inch	Class 1AR allowance
	inch
16	0.0018
14	0.0021
12	0.0024
10	0.0028
8	0.0034
6	0.0044
4	0.0064

To complement paragraph 5.6 of ANSI B1.1-1982, recommended tap drill sizes and hole size limits before threading, for different lengths of engagement, are included in Appendix A.

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5.3 Designation. Designation of Unified screw threads is in accordance with section 6 of ANSI B1.1-1982. Nominal size shall be stated in decimals. The symbol UNS is applicable to any thread:

(1) having the basic Unified thread form

(2) with limits based upon Unified formulations, and

(3) which is not in the standard series listed in Table 3A of ANSI B1.1-1982.

5.4 Limits of size. See section 8 of ANSI B1.1-1982 for limits of size of standard and preferred non-standard threads and for information used for calculation of non-standard thread size limits which are not tabulated. For class 1AR, calculate as for class 1A except allowance is tabulated in 5.2.2. The following example illustrates the procedure necessary to calculate the limits of size of a non-standard thread; this follows the outlines in tables 1A and 1B of ANSI B1.1-1982:

External thread, 2.500 - 28UNS-2A
Length of engagement, 1 inch

Maximum major diameter = Nominal size - allowance
(section 13 of ANSI B1.1-1982)
= 2.5000 - 0.0014 (from table 32 of ANSI B1.1-1982)
= 2.4986

Minimum major diameter = Maximum major diameter - tolerance
(Section 13 of ANSI B1.1-1982)
= 2.4986 - 0.0065 (from table 31 of ANSI B1.1-1982)
= 2.4921

Maximum pitch diameter = Maximum major diameter - h_p
(table 6, col. 13 of ANSI B1.1-1982)
= 2.4986 - 0.0232 (rounded from 0.023197)
= 2.4754

Minimum pitch diameter = Maximum pitch diameter - tolerance
(section 13 of ANSI B1.1-1982)
= 2.4754 - 0.0056 (from table 34 of ANSI B1.1-1982)
= 2.4698

Nominal (maximum) minor diameter = Maximum major diameter - $2h_n$
(table 6, col. 15 of ANSI B1.1-1982)
= 2.4986 - 0.0387 (rounded from 0.03866)
= 2.4599

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Internal thread 2.500 - 28UNS-2B
(to mate with the above thread)

Minimum minor diameter = Nominal size - $2h_n$
(table 6, col. 15 of ANSI B1.1-1982)
= 2.5000 - 0.0387 (rounded from 0.03866)
= 2.4613 which is rounded to 2.461

Maximum minor diameter = Minimum minor diameter + tolerance
(section 13 of ANSI B1.1-1982)
= 2.4613 + 0.0063 (from table 39 of ANSI B1.1-1982 for length of engagement of 0.4D)
= 2.4676 which is rounded to 2.468

Minimum pitch diameter = Nominal size - h_b
(table 6, col. 13 of ANSI B1.1-1982)
= 2.5000 - 0.0232 (rounded from 0.023197)
= 2.4768

Maximum pitch diameter = Minimum pitch diameter + tolerance
(section 13 of ANSI B1.1-1982)
= 2.4768 + 0.0073 (from table 37 of ANSI B1.1-1982)
= 2.4841

Nominal (minimum) major diameter = Nominal size
= 2.5000

Factors used in the design of threads, particularly special threads, are presented in Appendix B. It is to be noted that deviations from standard tolerances for major diameter of the external thread and for minor diameter of internal thread may be necessary in order to arrive at the optimum design.

5.5 Surface texture.

5.5.1 The threads shall have a smooth finish and be free from flaws and other defects, such as fins, nicks and burrs, that would make them unsuitable for the purpose intended.

5.5.2 Workmanship shall be consistent with the tolerances specified herein. Surface texture of threads produced to this standard shall not exceed 100 microinch arithmetical average roughness (R_a) for cut threads and 63 microinch (R_a) for rolled and ground threads in accordance with ANSI B46.1.

NOTE: Coarse and fine pitch threads with rough surface texture are more likely to cross-thread. Threads with chamfered entering ends have the least tendency to cross-thread when assembled with power tools.

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5.6 Chamfer.

5.6.1 All entering ends of fasteners and threaded components shall have 45° chamfers (approximately) from minor diameter of external threads and major diameter of internal threads, unless otherwise specified.

5.7 Rolled threads.

5.7.1 Completely formed threads. A completely formed thread follows the thread profile, within the tolerance zone over an axial distance of one pitch. See figure 2.1.

5.7.2 Incomplete formed threads.

5.7.2.1 The lead-in thread is measured from the end of the product to the start of the first complete thread where the major diameter is equal to the minimum allowable major diameter and the thread root is equal to the maximum minor diameter. This should not exceed 2P. See figure 2.2.

5.7.2.2 The run-out thread is measured between the transition point of the product and the first thread root which is completely formed, where the minor diameter equals the maximum permissible minor diameter and the major diameter of the last fully formed thread equals the minimum permissible major diameter. When root radius is specified, the last completely formed root at the minor diameter must meet the requirement. See figure 2.3 for full shank fastener, figure 2.4 for pitch diameter shank fastener, figure 2.5 for shoulder bolt, figure 2.6 for oversize diameter shank fastener and figures 2.7 and 2.8 for threaded to head fasteners.

6. Notes.

6.1 Supersession note. In addition to superseding FED-STD-H28/2 dated 31 March 1978 and FED-STD-H28/3 dated 31 March 1978, this document also supersedes Appendices A3 and A5 of FED-STD-H28 dated 31 March 1978.

MILITARY INTERESTS:

Custodians

Army - AR
Navy - AS
Air Force - 11

Review Activities

Army - CR,FA,ER,MF
Air Force - 15,99

User Activities

Army - AT,MI

CIVIL AGENCY COORDINATING ACTIVITY:

GSA-FSS

PREPARING ACTIVITY:

DLA-IS

(DoD Project THDS-0044)

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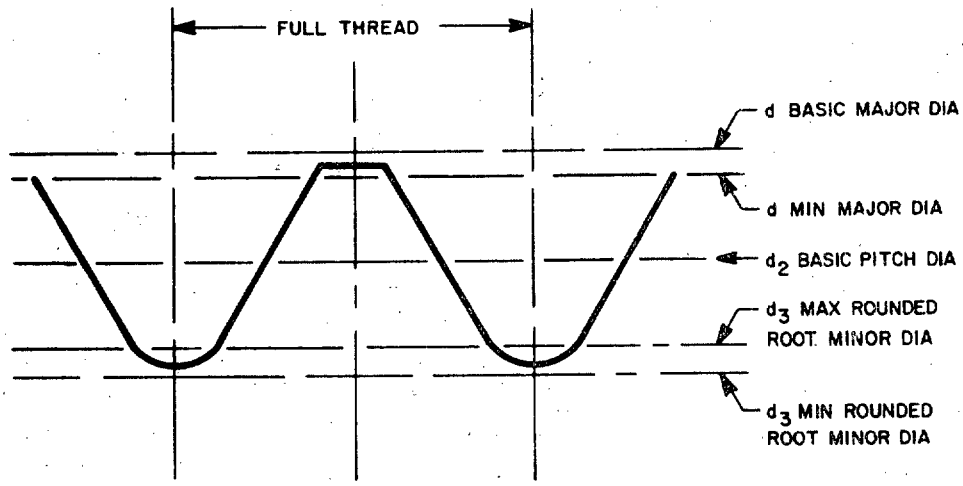

FIGURE 2.1 COMPLETELY FORMED EXTERNAL THREAD

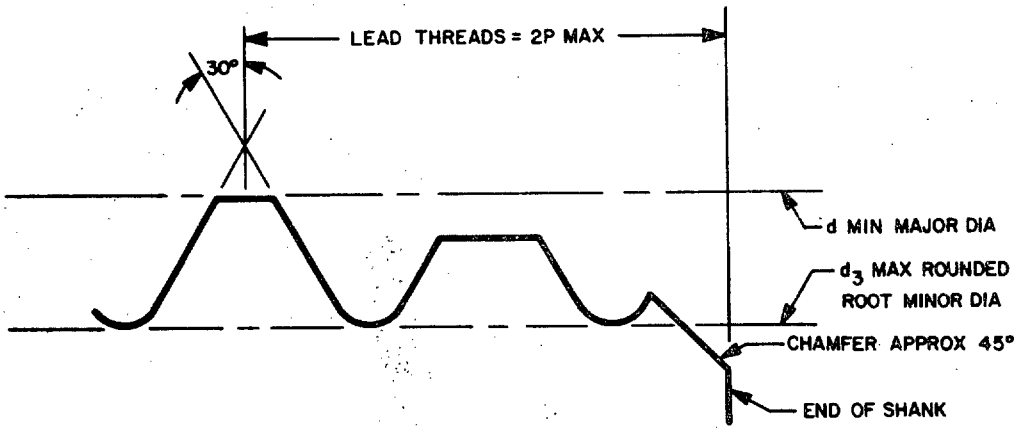

FIGURE 2.2 INCOMPLETE FORMED EXTERNAL THREADS, LEAD-IN THREADS

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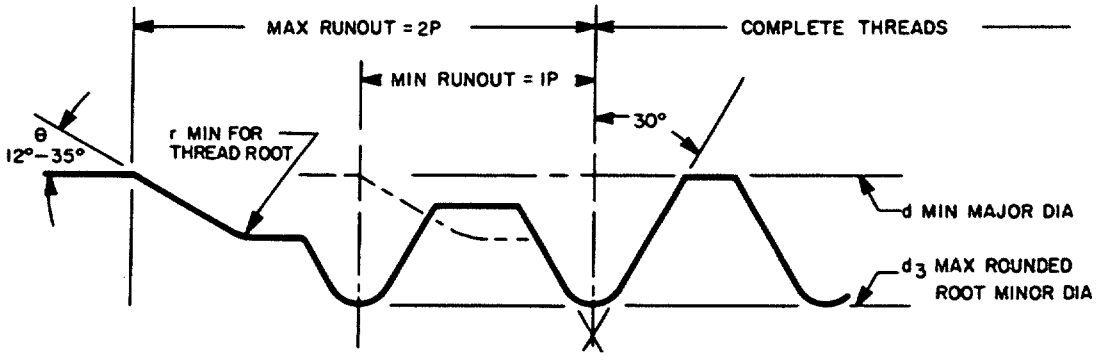

FIGURE 2.3 INCOMPLETE FORMED THREADS, FULL SHANK FASTENER-STANDARD DIAMETER

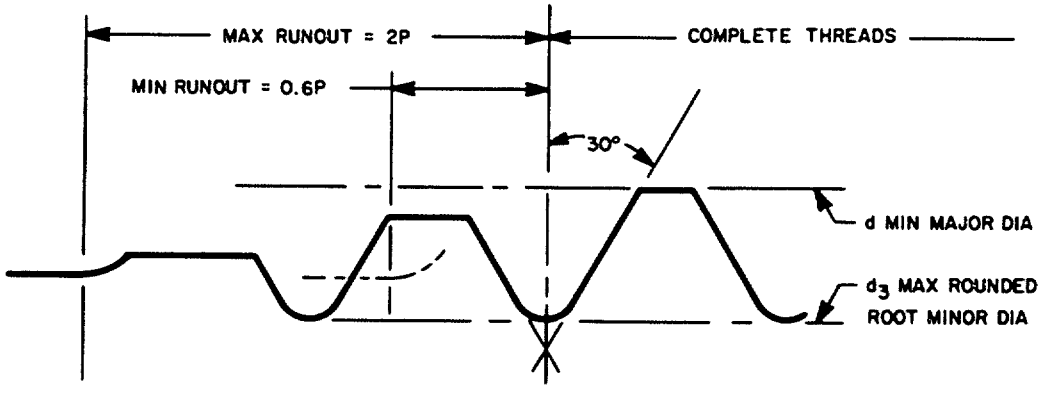

FIGURE 2.4 INCOMPLETE FORMED THREADS, PITCH DIAMETER SHANK FASTENER

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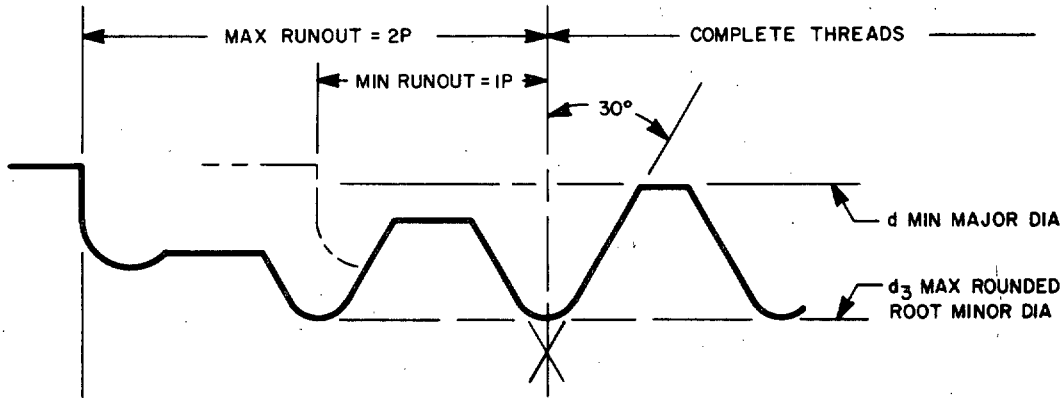

FIGURE 2.5 FULL SHANK FASTENER-STANDARD DIAMETER, OPTIONAL CONFIGURATION (SHOULDER BOLT)

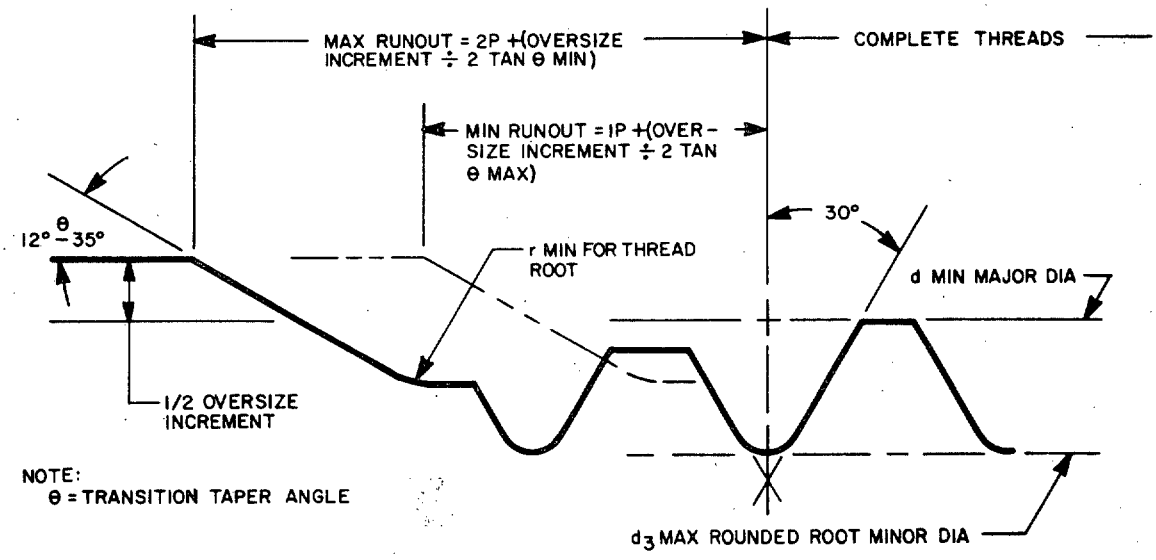

FIGURE 2.6 FULL SHANK FASTENER-OVERSIZE DIAMETER

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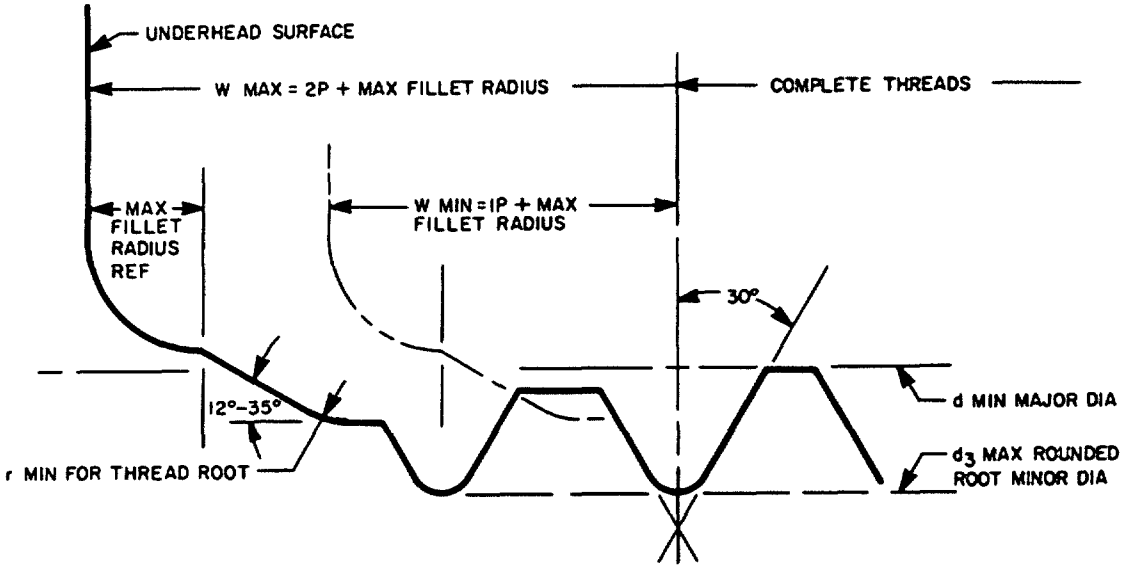

FIGURE 2.7 FULL SHANK FASTENER - THREADED TO HEAD

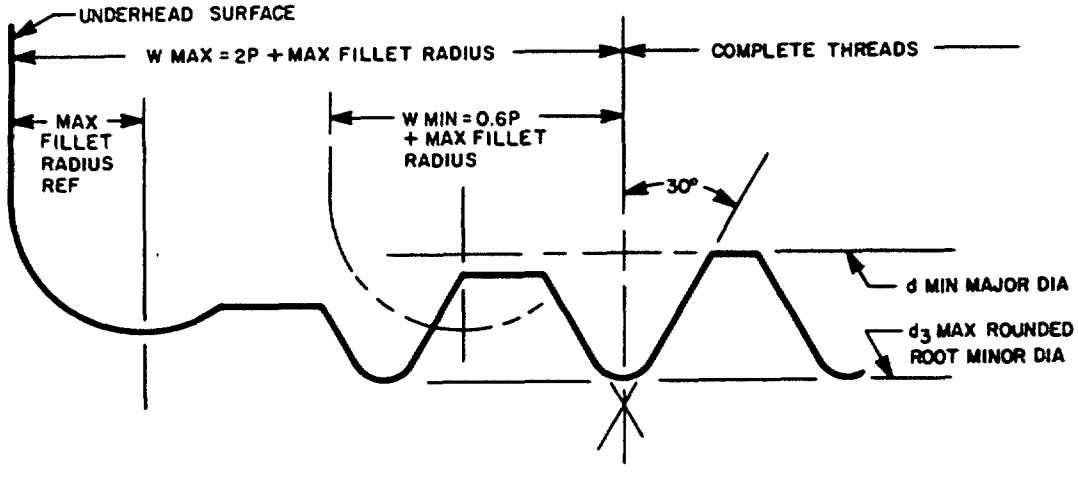

FIGURE 2.8 PITCH DIAMETER SHANK FASTENER - THREADED TO HEAD

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APPENDIX A

TAP DRILL SIZES AND RECOMMENDED HOLE SIZE LIMITS BEFORE THREADING

10. Scope. This appendix provides suggested tap drill sizes and recommended hole size limits applicable prior to forming internal Unified screw threads. It is not a mandatory part of the standard. The information contained herein is intended for guidance only.

20. Tap drill sizes.

20.1 General. To assure that the minor diameter of an internal thread is held within specified limits, it may be necessary to use a reamer to finish the hole. A variety of factors enters into the production of a clean, round, straight hole of the correct diameter. For a discussion of these and other data on drilling and tapping, reference may be made to "Drilled Holes for Tapping", a publication of the Metal Cutting Tool Institute, 1230 Keith Building, Cleveland, OH 44115.

20.2 Tabulated data.

20.2.1 Table II.A.1 gives minor diameter limits and corresponding percentages of thread for all standard series threads up to and including 3.75 inch diameter for classes 1B and 2B. Table II.A.2 is a similar table for class 3B. These tables also list sizes of drills that may be expected to drill holes within or near the specified minor diameter limits. The diameter of the drill, the probable hole size, and the corresponding percentages of thread are tabulated.

20.2.2 As a drill may normally be expected to cut oversize, probable hole sizes are tabulated that are derived from probable mean oversizes, also tabulated. The following is quoted from the above-mentioned report: "... a series of tests was conducted by drill manufacturers. Using six sizes of drills ranging from 1/16" to 1" in diameter, a total of 2,808 holes were drilled in cast iron and steel. Regular high speed steel drills were used with drilling equipment of the type normally found in metal working shops.... The average depth of hole drilled was equal to 1 1/2 times the drill diameter. Measurement of the hole was made at midpoint of the depth drilled....The average of the...amounts oversize...shows a marked increase in amount oversize for drills larger than 3/4". For this size range reaming is recommended."

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20.2.3 Percent of thread listed in tables is the ratio in percent of the actual height of thread to the value 0.75H; this value is the basic thread height of the obsolete American National Thread Profile. Since the basic height of a Unified Thread Profile is 0.625H, the maximum percent thread permissible is 83.3%. Due to allowances for drills to cut oversize or due to lack of availability of drills within specified minor diameter limits, tap drills listed in tables II.A.1 and II.A.2 may show greater than 83.3% threads. This indicates that the drill size is smaller than the minimum thread minor diameter and additional machining of the hole may be necessary in order to permit economical tapping.

30. Recommended hole size limits before threading.

30.1 General. For short length of engagement, the hole diameter required prior to threading should be held near the minimum limit to maximize thread height for maximum joint strength. As length of engagement increases, it is advantageous to increase the hole diameter for more economical tapping with less risk of tap breakage. Therefore, the following recommendations were developed (also see 30.2 below):

Length of Engagement	Minimum Hole Size	Maximum Hole Size
Up to and including 0.33D	Minimum minor dia	Min minor dia plus 1/2 minor dia tolerance
Above 0.33D thru 0.67D	Min minor dia plus 1/4 minor dia tolerance	Min minor dia plus 3/4 minor dia tolerance
Above 0.67D thru 1.5D	Min minor dia plus 1/2 Minor dia tolerance	Max minor dia (min minor dia plus tolerance)
Above 1.5D thru 3.0D	Min minor dia plus 3/4 minor dia tolerance	Max minor dia plus 1/4 minor dia tolerance (See 30.2)

From the foregoing it will be seen that the difference between limits in each range is the same and equal to half of the minor diameter tolerance. This is a general rule. However, the minimum differences for sizes below 0.25 in are equal to the minor diameter tolerances given in tables 39 and 40 in ANSI B1.1-1982 for lengths of engagement to and including 0.33D. For lengths of engagement greater than 0.33D for sizes 0.25 in and larger, the minimum values are adjusted so that the difference between limits is never less than 0.0040 in.

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30.2 Tabulated data. Recommended hole size limits for standard Unified threads and some special (UNS) threads are given in tables II.A.3 and II.A.4. For other special threads, calculate in accordance with 30.1 above; use minimum minor diameter and tolerance from table 3B of ANSI B1.1-1982, or calculate in accordance with section 8 of ANSI B1.1-1982 using appropriate tolerance from table 39 or 40 of ANSI B1.1-1982 for tolerance ratio of 1 or from formulas in paragraph 5.8.2 of ANSI B1.1-1982. Tabulated hole sizes and hole sizes calculated in accordance with 30.1 are not mandatory unless the thread designation states the modified minor diameter limits and the designation MOD in accordance with paragraph 6.7 in ANSI B1.1-1982. If modified minor diameter limits are not specified, acceptance will be in accordance with standard minor diameter limits.

NOTE: Recommended maximum hole sizes in 30.1, for lengths of engagement greater than 1.5D are outside standard minor diameter limits. They are not included in tables II.A.3 and II.A.4. Use of a minor diameter larger than standard will result in a reduction in shear area of the external threads of the mating part. If manufacturing process permits, maximum hole size before threading should be maintained at the high end of the standard minor diameter limits.

30.3 Other considerations. When tapping relatively soft materials, especially with fine pitch threads, there is a tendency for the material to be squeezed down towards the root of the tap so that the minor diameter of the tapped hole may become smaller than the diameter of the drilled hole. It may be necessary to try a different size drill or different style tap to assure a satisfactory thread.

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TABLE II.A.1 — Tap drill sizes, Unified screw threads, classes 1B and 2B

Thread size	Threads per inch	Designation	Classes 1B and 2B minor diameter, internal threads				Tap drills and percent of thread					
			Minimum	Percent of thread [1/]	Maximum	Percent of thread [1/]	Drill size		Percent of thread [1/]	Probable oversize, mean	Probable hole size	Percent of thread [1/]
in			in		in		in			in	in	
.060	80	UNF	0.0465	83.1	0.0514	53.0	#56	0.0465	83	0.0015	0.0480	74
							3/64	.0469	81	.0015	.0484	71
.073	64	UNC	.0561	83.3	.0623	52.7	#54	.0550	89	.0015	.0565	81
							#53	.0595	67	.0015	.0610	59
.073	72	UNF	.0580	83.1	.0635	52.7	#53	.0595	75	.0015	.0610	67
							1/16	.0625	58	.0015	.0640	50
.086	56	UNC	.0667	83.2	.0737	53.0	#51	.0670	82	.0017	.0687	75
							#50	.0700	69	.0017	.0717	62
							#49	.0730	56	.0017	.0747	49
.086	64	UNF	.0691	83.3	.0753	52.7	#50	.0700	79	.0017	.0717	70
							#49	.0730	64	.0017	.0747	56
							#48	.0760	85	.0019	.0779	78
.099	48	UNC	.0764	83.5	.0845	53.6	5/64	.0781	77	.0019	.0800	70
							#47	.0785	76	.0019	.0804	69
							#46	.0810	67	.0019	.0829	60
							#45	.0820	63	.0019	.0839	56
.099	56	UNF	.0797	83.2	.0865	53.9	#46	.0810	78	.0019	.0829	69
							#45	.0820	73	.0019	.0839	65
							#44	.0860	56	.0019	.0879	48
.112	40	UNC	.0849	83.4	.0939	55.7	#44	.0860	80	.0019	.0879	74
							#43	.0890	71	.0020	.0910	65
							#42	.0935	57	.0020	.0955	51
							3/32	.0938	56	.0020	.0958	50
.112	48	UNF	.0894	83.5	.0968	56.2	#43	.0890	85	.0020	.0910	78
							#42	.0935	68	.0020	.0955	61
							3/32	.0938	67	.0020	.0958	60
							#41	.0960	59	.0020	.0980	52
.125	40	UNC	.0979	83.4	.1062	57.9	#40	.0980	83	.0023	.1003	76
							#39	.0995	79	.0023	.1018	71
							#38	.1015	72	.0023	.1038	65
							#37	.1040	65	.0023	.1063	58
.125	44	UNF	.1004	83.3	.1079	57.9	#38	.1015	80	.0023	.1038	72
							#37	.1040	71	.0023	.1063	63
							#36	.1065	63	.0023	.1088	55
							#37	.1040	84	.0023	.1063	78
							#36	.1065	78	.0023	.1088	72
.138	32	UNC	.104	83.8	.114	59.1	7/64	.1094	70	.0026	.1120	64
							#35	.1100	69	.0026	.1126	63
							#34	.1110	67	.0026	.1136	60
							#33	.1130	62	.0026	.1156	55
.138	40	UNF	.111	83.1	.119	58.5	#34	.1110	83	.0026	.1136	75
							#33	.1130	77	.0026	.1156	69
							#32	.1160	68	.0026	.1186	60
.164	32	UNC	.130	83.8	.139	61.6	#29	.1360	69	.0029	.1389	62
.164	36	UNF	.134	83.1	.142	61.0	#29	.1360	78	.0029	.1389	70
							#28	.1405	65	.0029	.1434	57
							9/64	.1406	65	.0029	.1435	57
							#27	.1440	85	.0032	.1472	79
							#26	.1470	79	.0032	.1502	74
.190	24	UNC	.145	83.1	.156	62.8	#25	.1495	75	.0032	.1527	69
							#24	.1520	70	.0032	.1552	64
							#23	.1540	66	.0032	.1572	61
							5/32	.1562	83	.0032	.1594	75
.190	32	UNF	.156	83.8	.164	64.0	#22	.1570	81	.0032	.1602	73
							#21	.1590	76	.0032	.1622	68
							#20	.1610	71	.0032	.1642	64
							11/64	.1719	82	.0035	.1754	75
							#17	.1730	79	.0035	.1765	73
.216	24	UNC	.171	83.1	.181	64.7	#16	.1770	72	.0035	.1805	66
							#15	.1800	67	.0035	.1835	60
							#16	.1770	84	.0035	.1805	77
.216	28	UNF	.177	84.1	.186	64.7	#15	.1800	78	.0035	.1835	70
							#14	.1820	73	.0035	.1855	66
							#13	.1850	67	.0035	.1885	59
							#14	.1820	84	.0035	.1855	75
.216	32	UNEF	.182	83.8	.190	64.0	#13	.1850	76	.0035	.1885	68
							3/16	.1875	70	.0035	.1910	62
							#12	.1890	67	.0035	.1925	58

See footnotes at end of table.

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TABLE II.A.1 — Tap drill sizes, Unified screw threads, classes 1B and 2B —Continued

Thread size	Threads per inch	Designation	Classes 1B and 2B minor diameter, internal threads				Tap drills and percent of thread					
			Minimum	Percent 1/ of thread	Maximum	Percent 1/ of thread	Drill size		Percent 1/ of thread	Probable oversize, mean	Probable hole size	Percent 1/ of thread
in			in		in		in	in		in	in	
.250	20	UNC	.196	83.1	.207	66.2	#9	.1960	83	.0038	.1998	77
							#8	.1990	79	.0038	.2028	73
							#7	.2010	75	.0038	.2048	70
							13/64	.2031	72	.0038	.2069	66
							#6	.2040	71	.0038	.2078	65
							#5	.2055	69	.0038	.2093	63
.250	28	UNF	.211	84.1	.220	64.7	#3	.2130	80	.0038	.2168	72
							7/32	.2188	67	.0038	.2226	59
.250	32	UNEF	.216	83.8	.224	64.0	7/32	.2188	77	.0038	.2226	67
							#2	.2210	71	.0038	.2248	62
.250	36	UNS	.220	83.1	.226	66.5	#2	.2210	80	.0038	.2248	70
.3125	18	UNC	.252	83.8	.265	65.8	F	.2570	77	.0038	.2608	72
							G	.2610	71	.0041	.2651	66
.3125	20	UN	.258	83.9	.270	65.4	F	.2570	85	.0038	.2608	80
							G	.2610	79	.0041	.2651	73
							H	.2660	72	.0041	.2701	65
.3125	24	UNF	.267	84.1	.277	65.6	H	.2660	86	.0041	.2701	78
							I	.2720	75	.0041	.2761	67
							J	.2770	66	.0041	.2811	58
.3125	28	UN	.274	83.0	.282	65.7	J	.2770	77	.0041	.2811	68
							K	.2810	68	.0042	.2852	59
							9/32	.2812	67	.0042	.2854	58
.3125	32	UNEF	.279	82.5	.286	65.3	K	.2810	78	.0042	.2852	67
							9/32	.2812	77	.0042	.2854	67
.3125	36	UNS	.282	84.5	.289	65.1	7.25 mm	.2854	75	.0042	.2896	63
.375	16	UNC	.307	83.8	.321	66.5	5/16	.3125	77	.0044	.3169	72
							O	.3160	73	.0044	.3204	67
.375	20	UN	.321	83.1	.332	66.2	P	.3230	80	.0044	.3274	73
							Q	.3320	66	.0044	.3364	59
.375	24	UNF	.330	83.1	.340	64.7	Q	.3320	79	.0044	.3364	71
							R	.3390	67	.0044	.3434	58
.375	28	UN	.336	84.1	.345	64.7	R	.3390	78	.0044	.3434	68
							11/32	.3438	67	.0045	.3483	58
.375	32	UNEF	.341	83.8	.349	64.0	11/32	.3438	77	.0045	.3483	66
.375	36	UNS	.345	83.1	.352	63.7	S	.3480	67	.0045	.3525	55
							S	.3480	75	.0045	.3525	62
.4375	14	UNC	.360	83.5	.376	66.3	T	.3580	86	.0046	.3626	81
							23/64	.3594	84	.0046	.3640	79
.4375	16	UN	.370	83.1	.384	65.9	3/8	.3750	77	.0046	.3796	71
							V	.3770	75	.0046	.3816	69
.4375	20	UNF	.383	83.9	.395	65.4	W	.3860	79	.0046	.3906	72
							25/64	.3906	72	.0046	.3952	65
.4375	28	UNEF	.399	83.0	.407	65.7	Y	.4040	72	.0046	.4086	62
.4375	32	UN	.404	82.5	.411	65.3	Y	.4040	83	.0046	.4086	71
							13/32	.4062	77	.0046	.4108	66
.500	12	UNS	.416	83.1	.428	66.5	Z	.4130	80	.0047	.4177	76
							27/64	.4219	72	.0047	.4266	68
.500	13	UNC	.417	83.1	.434	66.0	27/64	.4219	78	.0047	.4266	73
.500	16	UN	.432	83.8	.446	66.5	7/16	.4375	77	.0047	.4422	71
.500	20	UNF	.446	83.1	.457	66.2	29/64	.4531	72	.0047	.4578	65
.500	28	UNEF	.461	84.1	.470	64.7	15/32	.4688	67	.0048	.4736	57
.500	32	UN	.466	83.8	.474	64.0	15/32	.4688	77	.0048	.4736	65
.5625	12	UNC	.472	83.6	.490	67.0	15/32	.4688	87	.0048	.4736	82
							31/64	.4844	72	.0048	.4892	68
.5625	16	UN	.495	83.1	.509	65.9	1/2	.5000	77	.0048	.5048	71
							0.5062	.5062	69	.0048	.5110	63
.5625	18	UNF	.502	83.8	.515	65.8	1/2	.5000	87	.0048	.5048	80
							0.5062	.5062	78	.0048	.5110	71
.5625	20	UN	.508	83.9	.520	65.4	33/64	.5156	72	.0048	.5204	65
.5625	24	UNEF	.517	84.1	.527	65.6	33/64	.5156	87	.0048	.5204	78
							0.5203	.5203	78	.0048	.5251	69
.5625	28	UN	.524	83.0	.532	65.7	17/32	.5312	67	.0049	.5361	57
							0.5263	.5263	78	.0049	.5312	67
.5625	32	UN	.529	82.5	.536	65.3	17/32	.5312	77	.0049	.5361	65
.625	11	UNC	.527	83.0	.546	66.9	17/32	.5312	79	.0049	.5361	75
.625	12	UN	.535	83.1	.553	66.5	35/64	.5469	72	.0049	.5518	68
							9/16	.5625	77	.0049	.5674	71
.625	16	UN	.557	83.8	.571	66.5	0.5687	.5687	69	.0049	.5736	63
							9/16	.5625	87	.0049	.5674	80
.625	18	UNF	.565	83.1	.578	65.1	0.5687	.5687	78	.0049	.5736	71
.625	20	UN	.571	83.1	.582	66.2	37/64	.5781	72	.0049	.5830	65
							37/64	.5781	87	.0049	.5830	78
.625	24	UNEF	.580	83.1	.590	64.7	0.5828	.5828	78	.0049	.5877	69
.625	28	UN	.586	84.1	.595	64.7	19/32	.5938	67	.0049	.5987	57
.625	32	UN	.591	83.8	.599	64.0	19/32	.5938	77	.0049	.5987	65

See footnotes at end of table.

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TABLE II. A.1 — Tap drill sizes, Unified screw threads, classes 1B and 2B — Continued

Thread size	Threads per inch	Designation	Classes 1B and 2B minor diameter, internal threads				Tap drills and percent of thread					
			Minimum	Percent of thread 1/	Maximum	Percent of thread 1/	Drill size		Percent of thread 1/	Probable oversize, mean	Probable hole size	Percent of thread 1/
in			in		in		in	in		in	in	
.6875	12	UN	.597	83.6	.615	67.0	19/64	.5938	87	.0049	.5987	82
							39/64	.6094	72	.0049	.6143	68
.6875	16	UN	.620	83.1	.634	65.9	1/4	.6250	77	.0050	.6300	71
.6875	20	UN	.633	83.9	.645	65.4	41/64	.6406	72	.0050	.6456	65
.6875	24	UNEF	.642	84.1	.652	65.6	41/64	.6406	87	.0050	.6456	77
.6875	28	UN	.649	83.0	.657	65.7	21/32	.6562	67	.0050	.6612	57
.6875	32	UN	.654	82.5	.661	65.3	21/32	.6562	77	.0050	.6612	65
.750	10	UNC	.642	83.1	.663	67.0	41/64	.6406	84	.0050	.6456	80
							21/32	.6562	72	.0050	.6612	68
.750	12	UN	.660	83.1	.678	66.5	21/32	.6562	87	.0050	.6612	82
							43/64	.6719	72	.0050	.6769	68
.750	16	UNF	.682	83.8	.696	66.5	11/16	.6875	77	.0050	.6925	71
.750	20	UNEF	.696	83.1	.707	66.2	45/64	.7031	72	.0051	.7082	64
.750	28	UN	.711	84.1	.720	64.7	23/32	.7188	67	.0051	.7239	56
.750	32	UN	.716	83.8	.724	64.0	23/32	.7188	77	.0051	.7239	64
.8125	12	UN	.722	83.6	.740	67.0	47/64	.7344	72	.0051	.7395	67
.8125	16	UN	.745	83.1	.759	65.9	3/4	.7500	77	.0052	.7552	71
.8125	20	UNEF	.758	83.9	.770	65.4	49/64	.7656	72	.0052	.7708	64
.8125	28	UN	.774	83.0	.782	65.7	25/32	.7812	67	.0052	.7864	56
.8125	32	UN	.779	82.5	.786	65.3	25/32	.7812	77	.0052	.7864	64
.875	9	UNC	.755	83.1	.778	67.2	49/64	.7656	78	.0052	.7708	72
.875	12	UN	.785	83.1	.803	66.5	25/32	.7812	87	.0052	.7864	82
							51/64	.7969	72	.0052	.8021	67
							51/64	.7969	84	.0052	.8021	79
.875	14	UNF	.798	83.0	.814	65.7	0.8024	.8024	78	.0052	.8076	73
							13/16	.8125	67	.0052	.8177	62
.875	16	UN	.807	83.8	.821	66.5	13/16	.8125	77	.0053	.8178	70
.875	20	UNEF	.821	83.1	.832	66.2	53/64	.8281	72	.0054	.8335	64
.875	28	UN	.836	84.1	.845	64.7	27/32	.8438	67	.0055	.8493	55
.875	32	UN	.841	83.8	.849	64.0	27/32	.8438	77	.0055	.8493	63
.9375	12	UN	.847	83.6	.865	67.0	27/32	.8438	87	.0055	.8493	81
							55/64	.8594	72	.0056	.8650	67
.9375	16	UN	.870	83.1	.884	65.9	7/8	.8750	77	.0057	.8807	70
.9375	20	UNEF	.883	83.9	.895	65.4	57/64	.8906	72	.0059	.8965	63
.9375	28	UN	.899	83 C	.907	65.7	29/32	.9062	67	.0060	.9122	55
.9375	32	UN	.904	82.5	.911	65.3	29/32	.9062	77	.0060	.9122	62
1.000	8	UNC	.865	83.1	.890	67.7	55/64	.8594	87	.0059	.8653	83
							7/8	.8750	77	.0059	.8809	73
1.000	12	UNF	.910	83.1	.928	66.5	29/32	.9062	87	.0060	.9122	81
							59/64	.9219	72	.0060	.9279	67
1.000	14	UNS	.923	83.0	.938	66.8	59/64	.9219	84	.0060	.9279	78
							0.9274	.9274	78	.0061	.9335	72
1.000	16	UN	.932	83.8	.946	66.5	15/16	.9375	77	.0062	.9437	69
1.000	20	UNEF	.946	83.1	.957	66.2	61/64	.9531	72	.0063	.9594	63
1.000	28	UN	.961	84.1	.970	64.7	31/32	.9688	67	.0065	.9753	53
1.000	32	UN	.966	83.8	.974	64.0	31/32	.9688	77	.0065	.9753	61
1.0625	8	UN	.927	83.4	.952	68.0	59/64	.9219	87	.0060	.9279	83
							0.9274	.9274	83	.0061	.9335	79
							15/16	.9375	77	.0062	.9437	73
1.0625	12	UN	.972	83.6	.990	67.0	31/32	.9688	87	.0065	.9753	81
1.0625	16	UN	.995	83.1	1.009	65.9	63/64	.9844	72	.0067	.9911	66
1.0625	18	UNEF	1.002	83.8	1.015	65.8	1	1.0000	77	.0069	1.0069	68
1.0625	20	UN	1.008	83.9	1.020	65.4	1	1.0000	87	.0069	1.0069	77
1.0625	28	UN	1.024	83.0	1.032	65.7	1 1/64	1.0156	72	.0070	1.0226	61
							1 1/32	1.0312	67	.0071	1.0383	52
1.125	7	UNC	.970	83.5	.998	68.4	31/32	.9688	84	.0062	.9750	81
1.125	8	UN	.990	83.1	1.015	67.7	63/64	.9844	76	.0067	.9911	72
							1	1.0000	77	.0069	1.0069	73
1.125	12	UNF	1.035	83.1	1.053	66.5	1 1/32	1.0312	87	.0071	1.0383	80
							1 1/64	1.0469	72	.0072	1.0541	65
1.125	16	UN	1.057	83.8	1.071	66.5	1 1/16	1.0625	77	.0074	1.0399	68
1.125	18	UNEF	1.065	83.1	1.078	65.1	1 1/16	1.0625	87	----------	----------	----------
							1 1/64	1.0781	65	----------	----------	----------
1.125	20	UN	1.071	83.1	1.082	66.2	1 1/64	1.0781	72	----------	----------	----------
1.125	28	UN	1.086	84.1	1.095	64.7	1 1/32	1.0938	67	----------	----------	----------
1.1875	8	UN	1.052	83.4	1.077	68.0	1 1/16	1.0625	77	----------	----------	----------
1.1875	12	UN	1.097	83.6	1.115	67.0	1 1/32	1.0938	87	----------	----------	----------
1.1875	16	UN	1.120	83.1	1.134	65.9	1 1/8	1.1250	77	----------	----------	----------
1.1875	18	UNEF	1.127	83.8	1.140	65.8	1 1/8	1.1250	87	----------	----------	----------
							1 9/64	1.1406	65	----------	----------	----------
1.1875	20	UN	1.133	83.9	1.145	65.4	1 9/64	1.1406	72	----------	----------	----------
1.1875	28	UN	1.149	83.0	1.157	65.7	1 5/32	1.1562	67	----------	----------	----------
1.250	7	UNC	1.095	83.5	1.123	68.4	1 1/16	1.0938	84	----------	----------	----------
1.250	8	UN	1.115	83.1	1.140	67.7	1 1/8	1.1250	77	----------	----------	----------
1.250	12	UNF	1.160	83.1	1.178	66.5	1 5/32	1.1562	87	----------	----------	----------
							1 11/64	1.1719	72	----------	----------	----------
1.250	16	UN	1.182	83.8	1.198	66.5	1 3/16	1.1875	77	----------	----------	----------
1.250	18	UNEF	1.190	83.1	1.203	65.1	1 3/16	1.1875	87	----------	----------	----------
							1 13/64	1.2031	65	----------	----------	----------
1.250	20	UN	1.196	83.1	1.207	66.2	1 13/64	1.2031	72	----------	----------	----------
1.250	28	UN	1.211	84.1	1.220	64.7	1 1/8	1.2188	67	----------	----------	----------

See footnotes at end of table.

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TABLE II.A.1 – Tap drill sizes, Unified screw threads, classes 1B and 2B – Continued

Thread size	Threads per inch	Designation	Classes 1B and 2B minor diameter, internal threads				Tap drills and percent of thread					
			Minimum	Percent of thread 1/	Maximum	Percent of thread 1/	Drill size		Percent of thread 1/	Probable oversize, mean	Probable hole size	Percent of thread 1/
in			in		in		in	in		in	in	
1.3125	8	UN	1.177	83.4	1.202	68.0	1 11/64	1.1719	87			
							1 3/16	1.1875	77			
1.3125	12	UN	1.222	83.6	1.240	67.0	1 7/32	1.2188	87			
1.3125	16	UN	1.245	83.1	1.259	65.9	1 15/64	1.2344	72			
1.3125	18	UNEF	1.252	83.8	1.265	65.8	1 1/4	1.2500	77			
1.3125	20	UN	1.258	83.9	1.270	65.4	1 1/4	1.2500	87			
1.3125	28	UN	1.274	83.0	1.282	65.7	1 17/64	1.2656	65			
							1 17/64	1.2656	72			
							1 9/32	1.2812	67			
1.375	6	UNC	1.195	83.1	1.225	69.3	1 3/16	1.1875	87			
							1 13/64	1.2031	79			
							1 15/64	1.2188	72			
1.375	8	UN	1.240	83.1	1.265	67.7	1 15/64	1.2344	87			
							1 1/4	1.2500	77			
1.375	12	UNF	1.285	83.1	1.303	66.5	1 9/32	1.2812	87			
							1 19/64	1.2969	72			
1.375	16	UN	1.307	83.8	1.321	66.5	1 5/16	1.3125	77			
1.375	18	UNEF	1.315	83.1	1.328	65.1	1 5/16	1.3125	87			
							1 21/64	1.3281	65			
1.375	20	UN	1.321	83.1	1.332	66.2	1 21/64	1.3281	72			
1.375	28	UN	1.336	84.1	1.345	64.7	1 11/32	1.3438	67			
1.4375	6	UN	1.257	83.4	1.288	69.1	1 17/64	1.2656	79			
							1 9/32	1.2812	72			
1.4375	8	UN	1.302	83.4	1.327	68.0	1 19/64	1.2969	87			
							1 5/16	1.3125	77			
1.4375	12	UN	1.347	83.6	1.365	67.0	1 11/32	1.3438	87			
							1 23/64	1.3594	72			
1.4375	16	UN	1.370	83.1	1.384	65.9	1 3/8	1.3750	77			
1.4375	18	UNEF	1.377	83.8	1.390	65.8	1 3/8	1.3750	87			
1.4375	20	UN	1.383	83.9	1.395	65.4	1 25/64	1.3906	72			
1.4375	28	UN	1.399	83.0	1.407	65.7	1 13/32	1.4062	67			
1.500	6	UNC	1.320	83.1	1.350	69.3	1 5/16	1.3125	87			
							1 21/64	1.3281	79			
1.500	8	UN	1.365	83.1	1.390	67.7	1 23/64	1.3594	87			
							1 3/8	1.3750	77			
1.500	12	UNF	1.410	83.1	1.428	66.5	1 13/32	1.4062	87			
							1 27/64	1.4219	72			
1.500	16	UN	1.432	83.8	1.446	66.5	1 7/16	1.4375	77			
1.500	18	UNEF	1.440	83.1	1.452	66.5	1 7/16	1.4375	87			
1.500	20	UN	1.446	83.1	1.457	66.2	1 29/64	1.4531	72			
1.500	28	UN	1.461	84.1	1.470	64.7	1 15/32	1.4688	67			
1.5625	6	UN	1.382	83.4	1.413	69.1	1 25/64	1.3906	79			
							1 13/32	1.4062	72			
1.5625	8	UN	1.427	83.4	1.452	68.0	1 27/64	1.4219	87			
							1 7/16	1.4375	77			
1.5625	12	UN	1.472	83.6	1.490	67.0	1 15/32	1.4688	87			
							1 31/64	1.4844	72			
1.5625	16	UN	1.495	83.1	1.509	65.9	1 1/2	1.5000	77			
1.5625	18	UNEF	1.502	83.8	1.515	65.8	1 1/2	1.5000	87			
							1 33/64	1.5156	65			
1.5625	20	UN	1.508	83.9	1.520	65.4	1 33/64	1.5156	72			
1.625	6	UN	1.445	83.1	1.475	69.3	1 29/64	1.4531	79			
							1 15/32	1.4688	72			
1.625	8	UN	1.490	83.1	1.515	67.7	1 31/64	1.4844	87			
							1 1/2	1.5000	77			
1.625	12	UN	1.535	83.1	1.553	66.5	1 17/32	1.5312	87			
							1 35/64	1.5469	72			
1.625	16	UN	1.557	83.8	1.571	66.5	1 9/16	1.5625	77			
1.625	18	UNEF	1.565	83.1	1.578	65.1	1 9/16	1.5625	87			
							1 37/64	1.5781	65			
1.625	20	UN	1.571	83.1	1.582	66.2	1 37/64	1.5781	72			
1.6875	6	UN	1.507	83.4	1.538	69.1	1 1/2	1.5000	87			
							1 33/64	1.5156	79			
							1 17/32	1.5312	72			
1.6875	8	UN	1.552	83.4	1.577	68.0	1 9/16	1.5625	77			
1.6875	12	UN	1.597	83.6	1.615	67.0	1 19/32	1.5938	87			
							1 39/64	1.6094	72			
1.6875	16	UN	1.620	83.1	1.634	65.9	1 5/8	1.6250	77			
1.6875	18	UNEF	1.627	83.8	1.640	65.8	1 5/8	1.6250	87			
							1 41/64	1.6406	65			
1.6875	20	UN	1.633	83.9	1.645	65.4	1 41/64	1.6406	72			
1.750	5	UNC	1.534	83.1	1.568	70.1	1 17/32	1.5312	84			
							1 35/64	1.5469	78			
							1 9/16	1.5625	87			
1.750	6	UN	1.570	83.1	1.600	69.3	1 37/64	1.5781	79			
							1 19/32	1.5938	72			
							1 39/64	1.6094	87			
1.750	8	UN	1.615	83.1	1.640	67.7	1 5/8	1.6250	77			
							1 41/64	1.6406	67			
							1 21/32	1.6562	87			
1.750	12	UN	1.660	83.1	1.678	66.5	1 43/64	1.6719	72			
1.750	16	UN	1.682	83.8	1.696	66.5	1 11/16	1.6875	77			
1.750	20	UN	1.696	83.1	1.707	66.2	1 45/64	1.7031	72			

See footnotes at end of table.

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TABLE II.A.1 — Tap drill sizes, Unified screw threads, classes 1B and 2B — Continued

Thread size	Threads per inch	Designation	Classes 1B and 2B minor diameter, internal threads				Tap drill and percent of thread					
			Minimum	Percent[1] of thread	Maximum	Percent[1] of thread	Drill size		Percent[1] of thread	Probable oversize, mean	Probable hole size	Percent[1] of thread
in			in		in		in	in				
1.8125	6	UN	1.632	83.4	1.663	69.1	1 5/8	1.6250	87			
							1 41/64	1.6406	79			
							1 21/32	1.6562	72			
1.8125	8	UN	1.677	83.4	1.702	68.0	1 43/64	1.6719	87			
							1 11/16	1.6875	77			
1.8125	12	UN	1.722	83.6	1.740	67.0	1 33/64	1.7188	87			
							1 47/64	1.7344	72			
1.8125	16	UN	1.745	83.1	1.759	65.9	1 3/4	1.7500	77			
1.8125	20	UN	1.758	83.9	1.770	65.4	1 49/64	1.7656	72			
1.875	6	UN	1.695	83.1	1.725	69.3	1 13/16	1.7031	79			
							1 23/32	1.7188	72			
1.875	8	UN	1.740	83.1	1.765	67.7	1 3/4	1.7500	77			
1.875	12	UN	1.785	83.1	1.803	66.5	1 25/32	1.7812	87			
							1 51/64	1.7969	72			
1.875	16	UN	1.807	83.8	1.821	66.5	1 25/32	1.8125	77			
1.875	20	UN	1.821	83.1	1.832	66.2	1 53/64	1.8281	72			
1.9375	6	UN	1.757	83.4	1.788	69.1	1 49/64	1.7656	79			
							1 23/32	1.7812	72			
1.9375	8	UN	1.802	83.4	1.827	68.0	1 51/64	1.7969	87			
							1 13/16	1.8125	77			
1.9375	12	UN	1.847	83.6	1.865	67.0	1 27/32	1.8438	87			
							1 59/64	1.8594	72			
1.9375	16	UN	1.870	83.1	1.884	65.9	1 7/8	1.8750	77			
1.9375	20	UN	1.883	83.9	1.895	65.4	1 57/64	1.8906	72			
2.000	4.5	UNC	1.759	83.5	1.795	71.0	1 25/32	1.7812	76			
2.000	6	UN	1.820	83.1	1.850	69.3	1 53/64	1.8281	79			
							1 27/32	1.8438	72			
2.000	8	UN	1.865	83.1	1.890	67.7	1 7/8	1.8750	77			
2.000	12	UN	1.910	83.1	1.928	66.5	1 29/32	1.9062	87			
							1 61/64	1.9219	72			
2.000	16	UN	1.932	83.8	1.946	66.5	1 15/16	1.9375	77			
2.000	20	UN	1.946	83.1	1.957	66.2	1 61/64	1.9531	72			
2.0625	16	UNS	1.995	83.1	2.009	65.9	2	2.0000	77			
2.125	6	UN	1.945	83.1	1.975	69.3	1 61/64	1.9531	79			
							1 31/32	1.9688	72			
2.125	8	UN	1.990	83.1	2.015	67.7	2	2.0000	77			
2.125	12	UN	2.035	83.1	2.053	66.5	2 1/32	2.0312	87			
2.125	16	UN	2.057	83.8	2.071	66.5	2 1/16	2.0625	77			
2.125	20	UN	2.071	83.1	2.082	66.2	2 1/16	2.0625	96			
2.1875	16	UNS	2.120	83.1	2.134	65.9	2 3/16	2.1250	77			
2.250	4.5	UNC	2.090	83.5	2.045	71.0	2	2.0000	87			
							2 1/32	2.0312	76			
2.250	6	UN	2.070	83.1	2.100	69.3	2 1/16	2.0625	87			
2.250	8	UN	2.115	83.1	2.140	67.7	2 3/16	2.1250	77			
2.250	12	UN	2.160	83.1	2.178	66.5	2 9/32	2.1562	87			
2.250	16	UN	2.182	83.8	2.196	66.5	2 1/4	2.1875	77			
2.250	20	UN	2.196	83.1	2.207	66.2	2 1/4	2.1875	96			
2.3125	16	UNS	2.245	83.1	2.259	65.9	2 1/4	2.2500	77			
2.375	6	UN	2.195	83.1	2.226	68.8	2 3/16	2.1875	87			
2.375	8	UN	2.240	83.1	2.265	67.7	2 1/4	2.2500	77			
2.375	12	UN	2.285	83.1	2.303	66.5	58 mm	2.2835	85			
2.375	16	UN	2.307	83.8	2.321	66.5	2 5/16	2.3125	77			
2.375	20	UN	2.321	83.1	2.332	66.2	2 5/16	2.3125	96			
2.4375	16	UNS	2.370	83.1	2.384	65.9	2 3/8	2.3750	77			
2.500	4	UNC	2.229	83.4	2.267	71.7	2 13/16	2.2188	87			
							2 1/4	2.2500	77			
2.500	6	UN	2.320	83.1	2.350	69.3	2 5/16	2.3125	87			
2.500	8	UN	2.365	83.1	2.390	67.7	2 3/8	2.3750	77			
2.500	12	UN	2.410	83.1	2.428	66.5	2 13/32	2.4062	87			
2.500	16	UN	2.432	83.8	2.446	66.5	2 7/16	2.4375	77			
2.500	20	UN	2.446	83.1	2.457	66.2	2 7/16	2.4375	96			
2.625	4	UN	2.354	83.4	2.392	71.7	2 11/16	2.3438	87			
							2 3/4	2.3750	77			
2.625	6	UN	2.445	83.1	2.475	69.3	2 7/16	2.4375	87			
2.625	8	UN	2.490	83.1	2.515	67.7	2 1/2	2.5000	77			
2.625	12	UN	2.535	83.1	2.553	66.5	2 17/32	2.5312	87			
2.625	16	UN	2.557	83.8	2.571	66.5	2 9/16	2.5625	77			
2.625	20	UN	2.571	83.1	2.582	66.2	2 9/16	2.5625	96			
2.750	4	UNC	2.479	83.4	2.517	71.7	2 1/2	2.5000	77			
2.750	6	UN	2.570	83.1	2.600	69.3	2 9/16	2.5625	87			
2.750	8	UN	2.615	83.1	2.640	67.7	2 5/8	2.6250	77			
2.750	12	UN	2.660	83.1	2.678	66.5	2 21/32	2.6562	87			
2.750	16	UN	2.682	83.8	2.696	66.5	2 11/16	2.6875	77			
2.750	20	UN	2.696	83.1	2.707	66.2	2 11/16	2.6875	96			

See footnotes at end of table.

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TABLE II.A.1 – Tap drill sizes, Unified screw threads, classes 1B and 2B – Continued

Thread size	Threads per inch	Desig-nation	Classes 1B and 2B minor diameter, internal threads				Tap drill and percent of thread				
			Minimum	Percent of Thread 1/	Maximum	Percent of Thread 1/	Drill size	Percent of Thread 1/	Probable oversize, mean	Probable hole size	Percent of Thread 1/
in			in		in		in	in				
2.875	4	UN	2.604	83.4	2.642	71.7	2 5/8	2.6250	77			
2.875	6	UN	2.695	83.1	2.725	69.3	2 11/16	2.6875	87			
2.875	8	UN	2.740	83.1	2.765	67.7	2 3/4	2.7500	77			
2.875	12	UN	2.785	83.1	2.803	66.5	2 25/32	2.7812	87			
2.875	16	UN	2.807	83.8	2.821	66.5	2 13/16	2.8125	77			
2.875	20	UN	2.821	83.1	2.832	66.2	2 13/16	2.8125	96			
3.000	4	UNC	2.729	83.4	2.767	71.7	2 3/4	2.7500	77			
3.000	6	UN	2.820	83.1	2.850	69.3	2 13/16	2.8125	87			
3.000	8	UN	2.865	83.1	2.890	67.7	2 7/8	2.8750	77			
3.000	12	UN	2.910	83.1	2.928	66.5	74 mm	2.9134	80			
3.000	16	UN	2.932	83.8	2.946	66.5	2 15/16	2.9375	77			
3.000	20	UN	2.946	83.1	2.957	66.2	2 15/16	2.9375	96			
3.250	4	UNC	2.979	83.4	3.017	71.7	3	3.0000	77			
3.500	4	UNC	3.229	83.4	3.267	71.7	3 1/4	3.2500	77			
3.750	4	UNC	3.479	83.4	3.517	71.7	3 1/2	3.5000	77			

1/ 100% of thread = 0.75H (see 20.2.3).

TABLE II.A.2 – Tap drill sizes, Unified screw threads, class 3B

Thread size	Threads per inch	Desig-nation	Class 3B minor diameter, internal threads				Tap drill and percent of thread				
			Minimum	Percent of Thread 1/	Maximum	Percent of Thread 1/	Drill size	Percent of Thread 1/	Probable oversize, mean	Probable hole size	Percent of Thread 1/
in			in		in		in	in			
.060	80	UNF	0.0465	83.1	0.0514	52.9	#56	0.0465	83	0.0015	0.0480	74
							3/64	.0469	81	.0015	.0484	71
.073	64	UNC	.0561	83.3	.0623	52.7	#54	.0550	89	.0015	.0565	81
							#53	.0595	67	.0015	.0610	59
.073	72	UNF	.0580	83.1	.0635	52.7	#53	.0595	75	.0015	.0610	67
							1/16	.0625	58	.0015	.0640	50
.086	56	UNC	.0667	83.2	.0737	53.0	#51	.0670	82	.0017	.0687	75
							#50	.0700	69	.0017	.0717	62
							#49	.0730	56	.0017	.0747	49
.086	64	UNF	.0691	83.3	.0753	52.7	#50	.0700	79	.0017	.0717	70
							#49	.0730	64	.0017	.0747	56
.099	48	UNC	.0764	83.5	.0845	53.6	#48	.0760	85	.0019	.0779	78
							5/64	.0781	77	.0019	.0800	70
							#47	.0785	76	.0019	.0804	69
							#46	.0810	67	.0019	.0829	60
							#45	.0820	63	.0019	.0839	56
.099	56	UNF	.0797	83.2	.0865	53.9	#46	.0810	78	.0019	.0829	69
							#45	.0820	73	.0019	.0839	65
							#44	.0860	56	.0019	.0879	48
.112	40	UNC	.0849	83.4	.0939	55.7	#44	.0860	80	.0019	.0879	74
							#43	.0890	71	.0020	.0910	65
							#42	.0935	57	.0020	.0955	51
							3/32	.0938	56	.0020	.0958	50
.112	48	UNF	.0894	83.5	.0968	56.2	#43	.0890	85	.0020	.0910	78
							#42	.0935	68	.0020	.0955	61
							3/32	.0938	67	.0020	.0958	60
							#41	.0960	59	.0020	.0980	52
.125	40	UNC	.0979	83.4	.1062	57.9	#40	.0980	83	.0023	.1003	76
							#39	.0995	79	.0023	.1018	71
							#38	.1015	72	.0023	.1038	65
							#37	.1040	65	.0023	.1063	58
.125	44	UNF	.1004	83.3	.1079	57.9	#38	.1015	80	.0023	.1038	72
							#37	.1049	71	.0023	.1063	63
							#36	.1065	63	.0023	.1088	55
.138	32	UNC	.1040	83.8	.1140	59.1	#37	.1040	84	.0023	.1063	78
							#36	.1065	78	.0023	.1088	72
							7/64	.1094	70	.0026	.1120	64
							#35	.1100	69	.0026	.1126	63
							#34	.1110	67	.0026	.1136	60
							#33	.1130	62	.0026	.1156	55
.138	40	UNF	.1110	83.1	.1186	59.7	#34	.1110	83	.0026	.1136	75
							#33	.1130	77	.0026	.1156	69
							#32	.1160	68	.0026	.1186	60

See footnotes at end of table.

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TABLE II.A.2 – Tap drill sizes, Unified screw threads, class 3B – continued

Thread size	Threads per inch	Desig-nation	Class 3B minor diameter, internal threads				Tap drill and percent of thread					
			Minimum	Percent [1] of Thread	Maximum	Percent [1] of Thread	Drill size		Percent [1] of Thread	Probable oversize, mean	Probable hole size	Percent [1] of Thread
in			in		in		in	in		in	in	
.164	32	UNC	.1300	83.8	.1389	61.8	#29	.1360	69	.0029	.1389	62
							#29	.1360	78	.0029	.1389	70
.164	36	UNF	.1340	83.1	.1416	62.1	#28	.1405	65	.0029	.1434	57
							9/64	.1406	65	.0029	.1435	57
							#27	.1440	85	.0032	.1472	79
							#26	.1470	79	.0032	.1502	74
.190	24	UNC	.1450	83.1	.1555	63.7	#25	.1495	75	.0032	.1527	69
							#24	.1520	70	.0032	.1552	64
							#23	.1540	66	.0032	.1572	61
							5/32	.1562	83	.0032	.1594	75
.190	32	UNF	.1560	83.8	.1641	63.8	#22	.1570	81	.0032	.1602	73
							#21	.1590	76	.0032	.1622	68
							#20	.1610	71	.0032	.1642	64
							11/64	.1719	82	.0035	.1754	75
							#17	.1730	79	.0035	.1765	73
.216	24	UNC	.1710	83.1	.1807	65.2	#16	.1770	72	.0035	.1805	66
							#15	.1800	67	.0035	.1835	60
							#16	.1770	84	.0035	.1805	77
.216	28	UNF	.1770	84.1	.1857	65.3	#15	.1800	78	.0035	.1835	70
							#14	.1820	73	.0035	.1855	66
							#13	.1850	67	.0035	.1885	59
							#14	.1820	84	.0035	.1855	75
.216	32	UNEF	.1820	83.8	.1895	65.3	#13	.1850	76	.0035	.1885	68
							3/16	.1875	70	.0035	.1910	62
							#12	.1890	67	.0035	.1925	58
							#9	.1960	83	.0038	.1998	77
							#8	.1990	79	.0038	.2028	73
.250	20	UNC	.1960	83.1	.2067	66.7	#7	.2010	75	.0038	.2048	70
							13/64	.2031	72	.0038	.2069	66
							#6	.2040	71	.0038	.2078	65
							#5	.2055	69	.0038	.2093	63
.250	28	UNF	.2110	84.1	.2190	66.8	#3	.2130	80	.0038	.2168	72
							7/32	.2188	67	.0038	.2226	59
.250	32	UNEF	.2160	83.8	.2229	66.8	7/32	.2188	77	.0038	.2226	67
							#2	.2210	71	.0038	.2248	62
							F	.2570	77	.0038	.2608	72
							G	.2610	71	.0041	.2651	66
							F	.2570	85	.0038	.2608	80
.3125	20	UN	.2580	83.9	.2680	68.5	G	.2610	79	.0041	.2651	73
							H	.2660	72	.0041	.2701	65
.3125	24	UNF	.2670	84.1	.2754	68.5	H	.2660	86	.0041	.2701	78
.3125	28	UN	.2740	83.0	.2807	68.5	I	.2720	75	.0041	.2761	67
.3125	32	UNEF	.2790	82.5	.2847	68.5	J	.2770	77	.0041	.2811	68
							K	.2810	78	.0042	.2852	67
							9/32	.2812	77	.0042	.2854	67
.375	16	UNC	.3070	83.8	.3182	70.0	5/16	.3125	77	.0044	.3169	72
							O	.3160	73	.0044	.3204	67
.375	20	UN	.3210	83.1	.3297	69.7	P	.3230	80	.0044	.3274	73
.375	24	UNF	.3300	83.1	.3372	69.8	Q	.3320	79	.0044	.3364	71
.375	28	UN	.3360	84.1	.3428	69.8	R	.3390	78	.0044	.3434	68
.375	32	UNEF	.3410	83.8	.3469	69.2	11/32	.3438	77	.0045	.3483	66
							T	.3580	86	.0046	.3626	81
.4375	14	UNC	.3600	83.5	.3717	70.9	23/64	.3594	84	.0046	.3640	79
.4375	16	UN	.3700	83.1	.3800	70.8	3/8	.3750	77	.0046	.3796	71
							V	.3770	75	.0046	.3816	69
.4375	20	UNF	.3830	83.9	.3916	70.7	W	.3860	79	.0046	.3906	72
							25/64	.3906	72	.0046	.3952	65
.4375	28	UNEF	.3990	83.0	.4051	69.8	Y	.4040	72	.0046	.4086	62
.4375	32	UN	.4040	82.5	.4094	69.2	Y	.4040	83	.0046	.4086	71
							13/32	.4062	77	.0046	.4108	66
.500	12	UNS	.4100	83.1	.4223	71.8	Z	.4130	80	.0047	.4177	76
.500	13	UNC	.4170	83.1	.4284	71.7	27/64	.4219	72	.0047	.4266	68
.500	16	UN	.4320	83.8	.4419	71.6	27/64	.4219	78	.0047	.4266	73
.500	20	UNF	.4460	83.1	.4537	71.3	7/16	.4375	77	.0047	.4422	71
.500	28	UNEF	.4610	84.1	.4676	69.8	29/64	.4531	72	.0047	.4578	65
.500	32	UN	.4660	83.8	.4719	69.2	11.8 mm	.4646	76	.0047	.4693	66
							15/32	.4688	77	.0048	.4736	65
.5625	12	UNC	.4720	83.6	.4843	72.2	15/32	.4688	87	.0048	.4736	82
.5625	16	UN	.4950	83.1	.5040	72.1	31/64	.4844	72	.0048	.4892	68
							1/2	.5000	77	.0048	.5048	71
.5625	18	UNF	.5020	83.8	.5106	71.9	1/2	.5000	87	.0048	.5048	80
							0.5062	.5062	78	.0048	.5110	71
.5625	20	UN	.5080	83.9	.5162	71.3	33/64	.5156	72	.0048	.5204	65
.5625	24	UNEF	.5170	84.1	.5244	70.4	33/64	.5156	87	.0048	.5204	78
							0.5203	.5203	78	.0048	.5251	69
.5625	28	UN	.5240	83.0	.5301	69.8	0.5263	.5263	78	.0049	.5312	67
.5625	32	UN	.5290	82.5	.5344	69.2	17/32	.5312	77	.0049	.5361	65

See footnotes at end of table.

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TABLE II.A.2 — Tap drill sizes, Unified screw threads, class 3B – continued

Thread size	Threads per inch	Designation	Class 3B minor diameter, internal threads				Tap drill and percent of thread					
			Minimum	Percent[1/] of Thread	Maximum	Percent[1/] of Thread	Drill size		Percent[1/] of Thread	Probable oversize, mean	Probable hole size	Percent[1/] of Thread
in			in		in		in	in		in	in	
.625	11	UNC	.5270	83.0	.5391	72.7	17/32	.5312	79	.0049	.5361	75
.625	12	UN	.5350	83.1	.5463	72.7	35/64	.5469	72	.0049	.5518	68
.625	16	UN	.5570	83.8	.5662	72.4	9/16	.5625	77	.0049	.5674	71
.625	18	UNF	.5650	83.1	.5730	72.1	9/16	.5625	87	.0049	.5674	80
							0.5687	.5687	78	.0049	.5736	71
.625	20	UN	.5710	83.1	.5787	71.3	37/64	.5781	72	.0049	.5830	65
							37/64	.5781	87	.0049	.5830	78
.625	24	UNEF	.5800	83.1	.5869	70.4	0.5828	.5828	78	.0049	.5877	69
							0.5828	.5828	91	.0049	.5877	80
.625	28	UN	.5860	84.1	.5926	69.8	19/32	.5938	77	.0049	.5987	65
.625	32	UN	.5910	83.8	.5969	69.2						
.6875	12	UN	.5970	83.6	.6085	73.0	19/32	.5938	87	.0049	.5987	82
.6875	16	UN	.6200	83.1	.6284	72.8	5/8	.6250	77	.0050	.6300	71
.6875	20	UN	.6330	83.9	.6412	71.3	41/64	.6406	72	.0050	.6456	65
.6875	24	UNEF	.6420	84.1	.6494	70.4	41/64	.6406	87	.0050	.6456	77
.6875	28	UN	.6490	83.0	.6551	69.8	16.5 mm	.6496	82	.0050	.6546	71
.6875	32	UN	.6540	82.5	.6594	69.2	21/32	.6562	77	.0050	.6612	65
.750	10	UNC	.6420	83.1	.6545	73.5	41/64	.6406	84	.0050	.6456	80
.750	12	UN	.6600	83.1	.6707	73.3	21/32	.6562	87	.0050	.6612	82
.750	16	UNF	.6820	83.8	.6908	72.9	11/16	.6875	77	.0050	.6925	71
.750	20	UNEF	.6960	83.1	.7037	71.3	45/64	.7031	72	.0051	.7082	64
.750	28	UN	.7110	84.1	.7176	69.8	18 mm	.7087	89	.0051	.7138	78
.750	32	UN	.7160	83.8	.7219	69.2	23/32	.7188	77	.0051	.7239	64
.8125	12	UN	.7220	83.6	.7329	73.5	18.5 mm	.7283	78	.0051	.7334	73
.8125	16	UN	.7450	83.1	.7533	72.9	3/4	.7500	77	.0052	.7552	71
.8125	20	UNEF	.7580	83.9	.7662	71.3	49/64	.7656	72	.0052	.7708	64
.8125	28	UN	.7740	83.0	.7801	69.8	19.75 mm	.7776	75	.0052	.7828	64
.8125	32	UN	.7790	82.5	.7844	69.2	25/32	.7812	77	.0052	.7864	64
.875	9	UNC	.7550	83.1	.7681	74.1	49/64	.7656	76	.0052	.7708	72
.875	12	UN	.7850	83.1	.7952	73.7	25/32	.7812	87	.0052	.7864	82
							51/64	.7969	84	.0052	.8021	79
.875	14	UNF	.7980	83.0	.8068	73.5	0.8024	.8024	78	.0052	.8076	73
.875	16	UN	.8070	83.8	.8158	72.9	13/16	.8125	77	.0053	.8178	70
.875	20	UNEF	.8210	83.1	.8287	71.3	53/64	.8281	72	.0054	.8335	64
.875	28	UN	.8360	84.1	.8426	69.8	21.25 mm	.8366	83	.0054	.8420	71
.875	32	UN	.8410	83.8	.8469	69.2	27/32	.8438	77	.0055	.8493	63
.9375	12	UN	.8470	83.6	.8575	73.9	27/32	.8438	87	.0055	.8493	81
.9375	16	UN	.8700	83.1	.8783	72.9	7/8	.8750	77	.0057	.8807	70
.9375	20	UNEF	.8830	83.9	.8912	71.3	57/64	.8906	72	.0059	.8965	63
.9375	28	UN	.8990	83.0	.9051	69.8	22.75 mm	.8957	90	.0060	.9017	77
.9375	32	UN	.9040	82.5	.9094	69.2	29/32	.9062	77	.0060	.9122	62
1.000	8	UNC	.8650	83.1	.8797	74.1	55/64	.8594	87	.0059	.8653	83
							7/8	.8750	77	.0059	.8809	73
1.000	12	UNF	.9100	83.1	.9198	74.1	29/32	.9062	87	.0060	.9122	81
							59/64	.9219	84	.0060	.9279	78
1.000	14	UNS	.9230	83.0	.9315	73.8	0.9274	.9274	78	.0061	.9335	72
1.000	16	UN	.9320	83.8	.9408	72.9	15/16	.9375	77	.0062	.9437	69
1.000	20	UNEF	.9460	83.1	.9537	71.3	61/64	.9531	72	.0063	.9594	63
1.000	28	UN	.9610	84.1	.9676	69.8	24.5 mm	.9645	77	.0064	.9709	63
1.000	32	UN	.9660	83.8	.9719	69.2	31/32	.9688	77	.0065	.9753	61
1.0625	8	UN	.9270	83.4	.9422	74.1	59/64	.9219	87	.0060	.9279	83
							0.9274	.9274	83	.0061	.9335	79
							15/16	.9375	77	.0062	.9437	73
1.0625	12	UN	.9720	83.6	.9823	74.1	31/32	.9688	87	.0065	.9753	81
1.0625	16	UN	.9950	83.1	1.0033	72.9	1	1.0000	77	.0069	1.0069	68
1.0625	18	UNEF	1.0020	83.8	1.0105	72.1	1	1.0000	87	.0069	1.0069	77
1.0625	20	UN	1.0080	83.9	1.0162	71.3	1 1/64	1.0156	72	.0070	1.0226	61
1.0625	28	UN	1.0240	83.0	1.0301	69.8	1 1/32	1.0312	67	.0071	1.0383	52
1.125	7	UNC	.9700	83.5	.9875	74.1	31/32	.9688	84	.0062	.9750	81
							63/64	.9844	76	.0067	.9911	72
1.125	8	UN	.9900	83.1	1.0047	74.1	1	1.0000	77	.0069	1.0069	73
1.125	12	UNF	1.0350	83.1	1.0448	74.1	1 1/32	1.0312	87	.0071	1.0383	80
1.125	16	UN	1.0570	83.8	1.0658	72.9	1 1/16	1.0625	77	.0074	1.0699	68
1.125	18	UNEF	1.0650	83.1	1.0730	72.1	1 1/16	1.0625	87			
1.125	20	UN	1.0710	83.1	1.0787	71.3	1 1/64	1.0781	72			
1.125	28	UN	1.0860	84.1	1.0926	69.8	1 3/32	1.0938	67			
1.1875	8	UN	1.0520	83.4	1.0672	74.1	1 1/16	1.0625	77			
1.1875	12	UN	1.0970	83.6	1.1073	74.1	1 3/32	1.0938	87			
1.1875	16	UN	1.1200	83.1	1.1283	72.9	1 1/8	1.1250	77			
1.1875	18	UNEF	1.1270	83.8	1.1355	72.1	1 1/8	1.1250	87			
1.1875	20	UN	1.1330	83.9	1.1412	71.3	1 9/64	1.1406	72			
1.1875	28	UN	1.1490	83.0	1.1551	69.8	29.25 mm	1.1516	77			
1.250	7	UNC	1.0950	83.5	1.1125	74.1	1 3/32	1.0938	84			
1.250	8	UN	1.1150	83.1	1.1297	74.1	1 1/8	1.1250	77			
1.250	12	UNF	1.1600	83.1	1.1698	74.1	1 5/32	1.1562	87			
1.250	16	UN	1.1820	83.8	1.1908	72.9	1 3/16	1.1875	77			
1.250	18	UNEF	1.1900	83.1	1.1980	72.1	1 3/16	1.1875	87			
1.250	20	UN	1.1960	83.1	1.2037	71.3	1 13/64	1.2031	72			
1.250	28	UN	1.2110	84.1	1.2176	69.8	30.75 mm	1.2106	85			

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TABLE II.A.2 – Tap drill sizes, Unified screw threads, class 3B – continued

Thread size	Threads per inch	Designation	Class 3B minor diameter, internal threads				Tap drill and percent of thread					
			Minimum	Percent 1/ of Thread	Maximum	Percent 1/ of Thread	Drill size		Percent 1/ of Thread	Probable oversize, mean	Probable hole size	Percent 1/ of Thread
in			in		in		in	in		in	in	
1.3125	8	UN	1.1770	83.4	1.1922	74.1	1 11/64	1.1719	87			
							1 3/16	1.1875	77			
1.3125	12	UN	1.2220	83.6	1.2323	74.1	1 7/32	1.2188	87			
1.3125	16	UN	1.2450	83.1	1.2533	72.9	1 1/4	1.2500	77			
1.3125	18	UNEF	1.2520	83.8	1.2605	72.1	1 1/4	1.2500	87			
1.3125	20	UN	1.2580	83.9	1.2662	71.3	1 17/64	1.2656	72			
1.3125	28	UN	1.2740	83.0	1.2801	69.8	32.5 mm	1.2795	71			
1.375	6	UNC	1.1950	83.1	1.2146	74.1	1 3/16	1.1875	87			
							1 11/64	1.2031	79			
1.375	8	UN	1.2400	83.1	1.2547	74.1	1 15/64	1.2344	87			
							1 1/4	1.2500	77			
1.375	12	UNF	1.2850	83.1	1.2948	74.1	1 9/32	1.2812	87			
1.375	16	UN	1.3070	83.8	1.3158	72.9	1 5/16	1.3125	77			
1.375	18	UNEF	1.3150	83.1	1.3230	72.1	1 5/16	1.3125	87			
1.375	20	UN	1.3210	83.1	1.3287	71.3	1 21/64	1.3281	72			
1.375	28	UN	1.3360	84.1	1.3426	69.8	34 min	1.3386	78			
1.4375	6	UN	1.2570	83.4	1.2771	74.1	1 17/64	1.2656	79			
1.4375	8	UN	1.3020	83.4	1.3172	74.1	1 19/64	1.2969	87			
							1 5/16	1.3125	77			
1.4375	12	UN	1.3470	83.6	1.3573	74.1	1 11/32	1.3438	87			
1.4375	16	UN	1.3700	83.1	1.3783	72.9	1 3/8	1.3750	77			
1.4375	18	UNEF	1.3770	83.8	1.3855	72.1	1 3/8	1.3750	87			
1.4375	20	UN	1.3830	83.9	1.3912	71.3	1 23/64	1.3906	72			
1.4375	28	UN	1.3990	83.0	1.4051	69.8	35.5 mm	1.3976	86			
1.500	6	UNC	1.3200	83.1	1.3396	74.1	1 5/16	1.3125	87			
							1 21/64	1.3281	79			
1.500	8	UN	1.3650	83.1	1.3797	74.1	1 23/64	1.3594	87			
							1 3/8	1.3750	77			
1.500	12	UNF	1.4100	83.1	1.4198	74.1	1 13/32	1.4062	87			
1.500	16	UN	1.4320	83.8	1.4408	72.9	1 7/16	1.4375	77			
1.500	18	UNEF	1.4400	83.1	1.4480	72.1	1 7/16	1.4375	87			
1.500	20	UN	1.4460	83.1	1.4537	71.3	1 29/64	1.4531	72			
1.500	28	UN	1.4610	84.1	1.4676	69.8	37 mm	1.4567	93			
1.5625	6	UN	1.3820	83.4	1.4021	74.1	1 13/64	1.3906	79			
1.5625	8	UN	1.4270	83.4	1.4422	74.1	1 27/64	1.4219	87			
							1 7/16	1.4375	77			
1.5625	12	UN	1.4720	83.6	1.4823	74.1	1 15/32	1.4688	87			
1.5625	16	UN	1.4950	83.1	1.5033	72.9	1 1/2	1.5000	77			
1.5625	18	UNEF	1.5020	83.8	1.5105	72.1	1 1/2	1.5000	87			
1.5625	20	UN	1.5080	83.9	1.5162	71.3	1 33/64	1.5156	72			
1.625	6	UN	1.4450	83.1	1.4646	74.1	1 29/64	1.4531	79			
1.625	8	UN	1.4900	83.1	1.5047	74.1	1 31/64	1.4844	87			
							1 1/2	1.5000	77			
1.625	12	UN	1.5350	83.1	1.5448	74.1	1 17/32	1.5312	87			
1.625	16	UN	1.5570	83.8	1.5658	72.9	1 9/16	1.5625	77			
1.625	18	UNEF	1.5650	83.1	1.5730	72.1	1 9/16	1.5625	87			
1.625	20	UN	1.5710	83.1	1.5787	71.3	1 37/64	1.5781	72			
1.6875	6	UN	1.5070	83.4	1.5271	74.1	1 1/2	1.5000	87			
							1 33/64	1.5156	79			
1.6875	8	UN	1.5520	83.4	1.5672	74.1	1 5/8	1.5625	77			
1.6875	12	UN	1.5970	83.6	1.6073	74.1	1 19/32	1.5938	87			
1.6875	16	UN	1.6200	83.1	1.6283	72.9	1 5/8	1.6250	77			
1.6875	18	UNEF	1.6270	83.8	1.6355	72.1	1 5/8	1.6250	87			
1.6875	20	UN	1.6330	83.9	1.6412	71.3	1 41/64	1.6406	72			
1.750	5	UNC	1.5340	83.1	1.5575	74.1	1 17/32	1.5312	84			
							1 33/64	1.5469	78			
1.750	6	UN	1.5700	83.1	1.5896	74.1	1 5/8	1.5625	87			
							1 37/64	1.5781	79			
1.750	8	UN	1.6150	83.1	1.6297	74.1	1 39/64	1.6094	87			
							1 1/2	1.6250	77			
1.750	12	UN	1.6600	83.1	1.6698	74.1	1 21/32	1.6562	87			
1.750	16	UN	1.6820	83.8	1.6908	72.9	1 11/16	1.6875	77			
1.750	20	UN	1.6960	83.1	1.7037	71.3	1 45/64	1.7031	72			
1.8125	6	UN	1.6320	83.4	1.6521	74.1	1 5/8	1.6250	87			
							1 41/64	1.6406	79			
1.8125	8	UN	1.6770	83.4	1.6922	74.1	1 43/64	1.6719	87			
							1 11/16	1.6875	77			
1.8125	12	UN	1.7220	83.6	1.7323	74.1	1 23/32	1.7188	87			
1.8125	16	UN	1.7450	83.1	1.7533	72.9	1 3/4	1.7500	77			
1.8125	20	UN	1.7580	83.9	1.7662	71.3	1 49/64	1.7656	72			
1.875	6	UN	1.6950	83.1	1.7146	74.1	1 45/64	1.7031	79			
1.875	8	UN	1.7400	83.1	1.7547	74.1	1 3/4	1.7500	77			
1.875	12	UN	1.7850	83.1	1.7948	74.1	1 25/32	1.7812	87			
1.875	16	UN	1.8070	83.8	1.8158	72.9	1 13/16	1.8125	77			
1.875	20	UN	1.8210	83.1	1.8287	71.3	1 53/64	1.8281	72			
1.9375	6	UN	1.7570	83.4	1.7771	74.1	1 49/64	1.7656	79			
1.9375	8	UN	1.8020	83.4	1.8172	74.1	1 51/64	1.7969	87			
							1 13/16	1.8125	77			
1.9375	12	UN	1.8470	83.6	1.8573	74.1	1 27/32	1.8438	87			
1.9375	16	UN	1.8700	83.1	1.8783	72.9	1 7/8	1.8750	77			
1.9375	20	UN	1.8830	83.9	1.8912	71.3	1 57/64	1.8906	72			

See footnotes at end of table.

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TABLE II.A.2 – Tap drill sizes, Unified screw threads, class 3B – continued

Thread size	Threads per inch	Desig-nation	Class 3B minor diameter, internal threads				Tap drill and percent of thread				
			Minimum	Percent 1/ of Thread	Maximum	Percent 1/ of Thread	Drill size		Percent 1/ of Thread	Probable oversize, mean	Probable hole size	Percent 1/ of Thread
in			in		in		in	in		in	in	
2.000	4.5	UNC	1.7590	83.5	1.7861	74.1	1 35/64	1.7812	76			
2.000	6	UN	1.8200	83.1	1.8396	74.1	1 53/64	1.8281	79			
2.000	8	UN	1.8650	83.1	1.8797	74.1	1 7/8	1.8750	77			
2.000	12	UN	1.9100	83.1	1.9198	74.1	1 29/32	1.9062	87			
2.000	16	UN	1.9320	83.8	1.9408	72.9	1 15/16	1.9375	77			
2.000	20	UN	1.9460	83.1	1.9537	71.3	1 61/64	1.9531	72			
2.0625	16	UNS	1.9950	83.1	2.0033	72.9	2	2.0000	77			
2.125	6	UN	1.9450	83.1	1.9646	74.1	1 61/64	1.9531	79			
2.125	8	UN	1.9900	83.1	2.0047	74.1	2	2.0000	77			
2.125	12	UN	2.0350	83.1	2.0448	74.1	2 1/32	2.0312	87			
2.125	16	UN	2.0570	83.8	2.0658	72.9	2 1/16	2.0625	77			
2.125	20	UN	2.0710	83.1	2.0787	71.3	2 1/16	2.0625	96			
2.1875	16	UNS	2.1200	83.1	2.1283	72.9	2 1/8	2.1250	77			
2.250	4.5	UNC	2.0090	83.5	2.0361	74.1	2	2.0000	87			
							2 1/32	2.0312	76			
2.250	6	UN	2.0700	83.1	2.0896	74.1	2 1/16	2.0625	87			
2.250	8	UN	2.1150	83.1	2.1297	74.1	2 1/8	2.1250	77			
2.250	12	UN	2.1600	83.1	2.1698	74.1	2 5/32	2.1562	87			
2.250	16	UN	2.1820	83.8	2.1908	72.9	2 1/8	2.1875	77			
2.250	20	UN	2.1960	83.1	2.2037	71.3	2 1/16	2.1875	96			
2.3125	16	UNS	2.2450	83.1	2.2533	72.9	2 1/4	2.2500	77			
2.375	6	UN	2.1950	83.1	2.2146	74.1	2 1/16	2.1875	87			
2.375	8	UN	2.2400	83.1	2.2547	74.1	2 1/4	2.2500	77			
2.375	12	UN	2.2850	83.1	2.2948	74.1	58 mm	2.2835	85			
2.375	16	UN	2.3070	83.8	2.3158	72.9	2 5/16	2.3125	77			
2.375	20	UN	2.3210	83.1	2.3287	71.3	2 5/16	2.3125	96			
2.4375	16	UNS	2.3700	83.1	2.3783	72.9	2 3/8	2.3750	77			
2.500	4	UNC	2.2290	83.4	2.2594	74.1	2 7/32	2.2188	87			
							2 1/4	2.2500	77			
2.500	6	UN	2.3200	83.1	2.3396	74.1	2 5/16	2.3125	87			
2.500	8	UN	2.3650	83.1	2.3797	74.1	2 3/8	2.3750	77			
2.500	12	UN	2.4100	83.1	2.4198	74.1	2 13/32	2.4062	87			
2.500	16	UN	2.4320	83.8	2.4408	72.9	2 7/16	2.4375	77			
2.500	20	UN	2.4460	83.1	2.4537	71.3	2 7/16	2.4375	96			
2.625	4	UN	2.3540	83.4	2.3844	74.1	2 11/32	2.3438	87			
							2 3/8	2.3750	77			
2.625	6	UN	2.4450	83.1	2.4646	74.1	2 7/16	2.4375	87			
2.625	8	UN	2.4900	83.1	2.5047	74.1	2 1/2	2.5000	77			
2.625	12	UN	2.5350	83.1	2.5448	74.1	2 17/32	2.5312	87			
2.625	16	UN	2.5570	83.8	2.5658	72.9	2 9/16	2.5625	77			
2.625	20	UN	2.5710	83.1	2.5787	71.3	2 9/16	2.5625	96			
2.750	4	UNC	2.4790	83.4	2.5094	74.1	2 1/2	2.5000	77			
2.750	6	UN	2.5700	83.1	2.5896	74.1	2 9/16	2.5625	87			
2.750	8	UN	2.6150	83.1	2.6297	74.1	2 5/8	2.6250	77			
2.750	12	UN	2.6600	83.1	2.6698	74.1	2 21/32	2.6562	87			
2.750	16	UN	2.6820	83.8	2.6908	72.9	2 11/16	2.6875	77			
2.750	20	UN	2.6960	83.1	2.7037	71.3	2 11/16	2.6875	96			
2.875	4	UN	2.6040	83.4	2.6344	74.1	2 5/8	2.6250	77			
2.875	6	UN	2.6950	83.1	2.7146	74.1	2 11/16	2.6875	87			
2.875	8	UN	2.7400	83.1	2.7547	74.1	2 3/4	2.7500	77			
2.875	12	UN	2.7850	83.1	2.7948	74.1	2 25/32	2.7812	87			
2.875	16	UN	2.8070	83.8	2.8158	72.9	2 13/16	2.8125	77			
2.875	20	UN	2.8210	83.1	2.8287	71.3	2 13/16	2.8125	96			
3.000	4	UNC	2.7290	83.4	2.7594	74.1	2 3/4	2.7500	77			
3.000	6	UN	2.8200	83.1	2.8396	74.1	2 13/16	2.8125	87			
3.000	8	UN	2.8650	83.1	2.8797	74.1	2 7/8	2.8750	77			
3.000	12	UN	2.9100	83.1	2.9198	74.1	74 mm	2.9134	80			
3.000	16	UN	2.9320	83.8	2.9408	72.9	2 15/16	2.9375	77			
3.000	20	UN	2.9460	83.1	2.9537	71.3	2 15/16	2.9375	96			
3.250	4	UNC	2.9790	83.4	3.0094	74.1	3	3.0000	77			
3.500	4	UNC	3.2290	83.4	3.2594	74.1	3 1/4	3.2500	77			
3.750	4	UNC	3.4790	83.4	3.5094	74.1	3 1/2	3.5000	77			

1/ 100% of thread = 0.75H (see 20.2.3).

TABLE II.A.3 – Recommended hole size limits before threading for different lengths of engagement, standard Unified and some UNS threads, classes 1B and 2B (see 30.1) 1/

Nominal size in inches and threads per inch	Series designation	Minor diameter of internal threads				Recommended hole size limits for different lengths of engagement					
		Minimum	Percent 2/ of Thread	Maximum 3/	Percent 2/ of Thread	To and including 0.33D		Above 0.33D thru 0.67D		Above 0.67D thru 1.5D	
						Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	2	3	4	5	6	7	8	9	10	11	12
		in		in		in	in	in	in	in	in
.060-80 or No. 0-80	UNF	0.0465	83.1	0.0514	53.0	0.0465	0.0500	0.0479	0.0514	0.0479	0.0514
.073-64 or No. 1-64	UNC	.0561	83.3	.0623	52.7	.0561	.0599	.0580	.0618	.0585	.0623
.073-72 or No. 1-72	UNF	.0580	83.1	.0635	52.7	.0580	.0613	.0596	.0629	.0602	.0635
.086-56 or No. 2-56	UNC	.0667	83.2	.0737	53.0	.0667	.0705	.0686	.0724	.0699	.0737
.086-64 or No. 2-64	UNF	.0691	83.3	.0753	52.7	.0691	.0724	.0707	.0740	.0720	.0753
.099-48 or No. 3-48	UNC	.0764	83.5	.0843	53.6	.0764	.0804	.0785	.0825	.0805	.0845
.099-56 or No. 3-56	UNF	.0797	83.2	.0865	53.9	.0797	.0831	.0814	.0848	.0831	.0865
.112-40 or No. 4-40	UNC	.0849	83.4	.0939	55.7	.0849	.0894	.0871	.0916	.0894	.0939
.112-48 or No. 4-48	UNF	.0894	83.5	.0968	56.2	.0894	.0931	.0912	.0949	.0931	.0968
.125-40 or No. 5-40	UNC	.0979	83.4	.1062	57.9	.0979	.1020	.1000	.1041	.1021	.1062
.125-44 or No. 5-44	UNF	.1004	83.3	.1079	57.9	.1004	.1041	.1023	.1060	.1042	.1079
.138-32 or No. 6-32	UNC	.104	83.8	.114	59.1	.104	.109	.108	.112	.109	.114
.138-40 or No. 6-40	UNF	.111	83.1	.119	58.5	.111	.115	.113	.117	.115	.119
.164-32 or No. 8-32	UNC	.130	83.8	.139	61.6	.130	.135	.132	.137	.134	.139
.164-36 or No. 8-36	UNF	.134	83.1	.142	61.0	.134	.138	.136	.140	.138	.142
.190-24 or No. 10-24	UNC	.145	83.1	.156	62.8	.145	.150	.147	.153	.150	.156
.190-32 or No. 10-32	UNF	.156	83.8	.164	64.0	.156	.160	.158	.162	.160	.164
.216-24 or No. 12-24	UNC	.171	83.1	.181	64.7	.171	.176	.173	.178	.176	.181
.216-28 or No. 12-28	UNF	.177	84.1	.186	64.7	.177	.182	.179	.184	.181	.186
.216-32 or No. 12-32	UNEF	.182	83.8	.190	64.0	.182	.186	.184	.188	.186	.190
.250-20 or 1/4-20	UNC	.196	83.1	.207	66.2	.196	.202	.199	.204	.202	.207
.250-28 or 1/4-28	UNF	.211	84.1	.220	64.7	.211	.216	.213	.218	.216	.220
.250-32 or 1/4-32	UNEF	.216	83.8	.224	64.0	.216	.220	.218	.222	.220	.224
.250-36 or 1/4-36	UNS	.220	83.1	.226	66.5	.220	.223	.221	.225	.222	.226
.3125-18 or 5/16-18	UNC	.252	83.8	.265	65.8	.252	.259	.256	.262	.259	.265
.3125-20 or 5/16-20	20UN	.258	83.9	.270	65.4	.258	.264	.261	.267	.264	.270
.3125-24 or 5/16-24	UNF	.267	84.1	.277	65.6	.267	.272	.270	.275	.272	.277
.3125-28 or 5/16-28	28UN	.274	83.0	.282	65.7	.274	.278	.276	.280	.278	.282
.3125-32 or 5/16-32	UNEF	.279	82.5	.286	65.3	.279	.282	.280	.284	.282	.286
.3125-36 or 5/16-36	UNS	.282	84.5	.289	65.1	.282	.286	.283	.287	.285	.289
.375-16 or 3/8-16	UNC	.307	83.8	.321	66.5	.307	.314	.311	.318	.314	.321
.375-20 or 3/8-20	20UN	.321	83.1	.332	66.2	.321	.327	.324	.330	.327	.332
.375-24 or 3/8-24	UNF	.330	83.1	.340	64.7	.330	.335	.332	.337	.335	.340
.375-28 or 3/8-28	28UN	.336	84.1	.345	64.7	.336	.340	.338	.343	.340	.345
.375-32 or 3/8-32	UNEF	.341	83.8	.349	64.0	.341	.345	.343	.347	.345	.349
.375-36 or 3/8-36	UNS	.345	83.1	.352	63.7	.345	.348	.346	.350	.348	.352
.4375-14 or 7/16-14	UNC	.360	83.5	.376	66.3	.360	.368	.364	.372	.368	.376
.4375-16 or 7/16-16	16UN	.370	83.1	.384	65.9	.370	.377	.373	.380	.377	.384
.4375-20 or 7/16-20	UNF	.383	83.9	.395	65.4	.383	.389	.386	.392	.389	.395
.4375-28 or 7/16-28	UNEF	.399	83.0	.407	65.7	.399	.403	.401	.405	.403	.407
.4375-32 or 7/16-32	32UN	.404	82.5	.411	65.3	.404	.407	.405	.409	.407	.411
.500-12 or 1/2-12	UNS	.410	83.1	.428	66.5	.410	.419	.414	.423	.419	.428
.500-13 or 1/2/13	UNC	.417	83.1	.434	66.0	.417	.425	.421	.430	.425	.434
.500-16 or 1/2-16	16UN	.432	83.8	.446	66.5	.432	.439	.436	.443	.439	.446
.500-20 or 1/2-20	UNF	.446	83.1	.457	66.2	.446	.452	.449	.454	.452	.457
.500-28 or 1/2-28	UNEF	.461	84.1	.470	64.7	.461	.466	.463	.468	.466	.470
.500-32 or 1/2-32	32UN	.466	83.8	.474	64.0	.466	.470	.468	.472	.470	.474

See footnotes at end of table.

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TABLE II.A.3 – Recommended hole size limits before threading for different lengths of engagement, standard Unified and some UNS threads, classes 1B and 2B (see 30.1) – continued

Nominal size in inches and threads per inch	Series designation	Minor diameter of internal threads				Recommended hole size limits for different lengths of engagement					
		Minimum	Percent[2] of Thread	Maximum[3]	Percent[2] of Thread	To and including 0.33D		Above 0.33D thru 0.67D		Above 0.67D thru 1.5D	
						Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	2	3	4	5	6	7	8	9	10	11	12
		in		in		in	in	in	in	in	in
.5625–12 or 9/16–12	UNC	.472	83.6	.490	67.0	.472	.481	.477	.486	.481	.490
.5625–16 or 9/16–16	16UN	.495	83.1	.509	65.9	.495	.502	.498	.505	.502	.509
.5625–18 or 9/16–18	UNF	.502	83.8	.515	65.8	.502	.509	.506	.512	.509	.515
.5625–20 or 9/16–20	20UN	.508	83.9	.520	65.4	.508	.514	.511	.517	.514	.520
.5625–24 or 9/16–24	UNEF	.517	84.1	.527	65.6	.517	.522	.520	.525	.522	.527
.5625–28 or 9/16–28	28UN	.524	83.0	.532	65.7	.524	.528	.526	.530	.528	.532
.5625–32 or 9/16–32	32UN	.529	82.5	.536	65.3	.529	.532	.530	.534	.532	.536
.625–11 or 5/8–11	UNC	.527	83.0	.546	66.9	.527	.536	.532	.541	.536	.546
.625–12 or 5/8–12	12UN	.535	83.1	.553	66.5	.535	.544	.539	.548	.544	.553
.625–16 or 5/8–16	16UN	.557	83.8	.571	66.5	.557	.564	.561	.568	.564	.571
.625–18 or 5/8–18	UNF	.565	83.1	.578	65.1	.565	.571	.568	.574	.571	.578
.625–20 or 5/8–20	20UN	.571	83.1	.582	66.2	.571	.577	.574	.580	.577	.582
.625–24 or 5/8–24	UNEF	.580	83.1	.590	64.7	.580	.585	.582	.587	.585	.590
.625–28 or 5/8–28	28UN	.586	84.1	.595	64.7	.586	.590	.588	.593	.590	.595
.625–32 or 5/8–32	32UN	.591	83.8	.599	64.0	.591	.595	.593	.597	.595	.599
.6875–12 or 11/16–12	12UN	.597	83.6	.615	67.0	.597	.606	.602	.611	.606	.615
.6875–16 or 11/16–16	16UN	.620	83.1	.634	65.9	.620	.627	.623	.630	.627	.634
.6875–18 or 11/16–18	UNS	.627	83.8	.640	65.8	.627	.634	.630	.637	.634	.640
.6875–20 or 11/16–20	20UN	.633	83.9	.645	65.4	.633	.639	.636	.642	.639	.645
.6875–24 or 11/16–24	UNEF	.642	84.1	.652	65.6	.642	.647	.645	.650	.647	.652
.6875–28 or 11/16–28	28UN	.649	83.0	.657	65.7	.649	.653	.651	.655	.653	.657
.6875–32 or 11/16–32	32UN	.654	82.5	.661	65.3	.654	.657	.655	.659	.657	.661
.750–10 or 3/4–10	UNC	.642	83.1	.663	67.0	.642	.652	.647	.658	.652	.663
.750–12 or 3/4–12	12UN	.660	83.1	.678	66.5	.660	.669	.664	.673	.669	.678
.750–16 or 3/4–16	UNF	.682	83.8	.696	66.5	.682	.689	.686	.693	.689	.696
.750–18 or 3/4–18	UNS	.690	83.1	.703	65.1	.690	.696	.693	.699	.696	.703
.750–20 or 3/4–20	UNEF	.696	83.1	.707	66.2	.696	.702	.699	.704	.702	.707
.750–28 or 3/4–28	28UN	.711	84.1	.720	64.7	.711	.716	.713	.718	.716	.720
.750–32 or 3/4–32	32UN	.716	83.8	.724	64.0	.716	.720	.718	.722	.720	.724
.8125–12 or 13/16–12	12UN	.722	83.6	.740	67.0	.722	.731	.727	.736	.731	.740
.8125–16 or 13/16–16	16UN	.745	83.1	.759	65.9	.745	.752	.748	.755	.752	.795
.8125–18 or 13/16–18	UNS	.752	83.8	.765	65.8	.752	.759	.756	.762	.759	.765
.8125–20 or 13/16–20	UNEF	.758	83.9	.770	65.4	.758	.764	.761	.767	.764	.770
.8125–28 or 13/16–28	28UN	.774	83.0	.782	65.7	.774	.778	.776	.780	.778	.782
.8125–32 or 13/16–32	32UN	.779	82.5	.786	65.3	.779	.782	.780	.784	.782	.786
.875–9 or 7/8–9	UNC	.755	83.1	.778	67.2	.755	.766	.760	.772	.766	.778
.875–12 or 7/8–12	12UN	.785	83.1	.803	66.5	.785	.794	.789	.798	.794	.803
.875–14 or 7/8–14	UNF	.798	83.0	.814	65.7	.798	.806	.802	.810	.806	.814
.875–16 or 7/8–16	16UN	.807	83.8	.821	66.5	.807	.814	.811	.818	.814	.821
.875–18 or 7/8–18	UNS	.815	83.1	.828	65.1	.815	.821	.818	.824	.821	.828
.875–20 or 7/8–20	UNEF	.821	83.1	.832	66.2	.821	.827	.824	.830	.827	.832
.875–28 or 7/8–28	28UN	.836	84.1	.845	64.7	.836	.840	.838	.843	.840	.845
.875–32 or 7/8–32	32UN	.841	83.8	.849	64.0	.84	.845	.843	.847	.845	.849
.9375–12 or 15/16–12	12UN	.847	83.6	.865	67.0	.847	.856	.852	.861	.856	.865
.9375–16 or 15/16–16	16UN	.870	83.1	.884	65.9	.870	.877	.873	.880	.877	.884
.9375–20 or 15/16–20	UNEF	.883	83.9	.895	65.4	.883	.889	.886	.892	.889	.895
.9375–28 or 15/16–28	28UN	.899	83.0	.907	65.7	.899	.903	.901	.905	.903	.907
.9375–32 or 15/16–32	32UN	.904	82.5	.911	65.3	.904	.907	.905	.909	.907	.911

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1.000-8	UNC	.865	83.1	.890	67.7	.865	.877	.871	.884	.877	.890
1.000-12	UNF	.910	83.1	.928	66.5	.910	.919	.914	.923	.919	.928
1.000-14	UNS	.923	83.0	.938	66.8	.923	.931	.927	.934	.931	.938
1.000-16	16UN	.932	83.8	.946	66.5	.932	.939	.936	.943	.939	.946
1.000-18	UNS	.940	83.1	.953	65.1	.940	.946	.943	.949	.946	.953
1.000-20	UNEF	.946	83.1	.957	66.2	.946	.952	.949	.954	.952	.957
1.000-28	28UN	.961	84.1	.970	64.7	.961	.966	.963	.968	.966	.970
1.000-32	32UN	.966	83.8	.974	64.0	.966	.970	.968	.972	.970	.974
1.0625-8	8UN	.927	83.4	.952	68.1	.927	.940	.934	.946	.940	.952
1.0625-12	12UN	.972	83.6	.990	67.0	.972	.981	.977	.986	.981	.990
1.0625-14	UNS	.985	83.5	1.001	66.3	.985	.993	.989	.997	.993	1.001
1.0625-16	16UN	.995	83.1	1.009	65.9	.995	1.002	.998	1.005	1.002	1.009
1.0625-18	UNEF	1.002	83.8	1.015	65.8	1.002	1.009	1.006	1.012	1.009	1.015
1.0625-20	20UN	1.008	83.9	1.020	65.4	1.008	1.014	1.011	1.017	1.014	1.020
1.0625-28	28UN	1.024	83.0	1.032	65.7	1.024	1.028	1.026	1.030	1.028	1.032
1.125-7	UNC	0.970	83.5	0.998	68.4	0.970	0.984	0.977	0.991	0.984	0.998
1.125-8	8UN	.990	83.1	1.015	67.7	.990	1.002	.996	1.008	1.002	1.015
1.125-12	UNF	1.035	83.1	1.053	66.5	1.035	1.044	1.039	1.048	1.044	1.053
1.125-16	16UN	1.057	83.8	1.071	66.5	1.057	1.064	1.061	1.068	1.064	1.071
1.125-18	UNEF	1.065	83.1	1.078	65.1	1.065	1.071	1.068	1.074	1.071	1.078
1.125-20	20UN	1.071	83.1	1.082	66.2	1.071	1.077	1.074	1.080	1.077	1.082
1.125-28	28UN	1.086	84.1	1.095	64.7	1.086	1.090	1.088	1.093	1.090	1.095
1.1875-8	8UN	1.052	83.4	1.077	68.1	1.052	1.065	1.058	1.071	1.065	1.077
1.1875-12	12UN	1.097	83.6	1.115	67.0	1.097	1.106	1.102	1.111	1.106	1.115
1.1875-16	16UN	1.120	83.1	1.134	65.9	1.120	1.127	1.123	1.130	1.127	1.134
1.1875-18	UNEF	1.127	83.8	1.140	65.8	1.127	1.134	1.130	1.137	1.134	1.140
1.1875-20	20UN	1.133	83.9	1.145	65.4	1.133	1.139	1.136	1.142	1.139	1.145
1.1875-28	28UN	1.149	83.0	1.157	65.7	1.149	1.153	1.151	1.155	1.153	1.157
1.250-7	UNC	1.095	83.5	1.123	68.4	1.095	1.109	1.102	1.116	1.109	1.123
1.250-8	8UN	1.115	83.1	1.140	67.7	1.115	1.127	1.121	1.134	1.127	1.140
1.250-12	UNF	1.160	83.1	1.178	66.5	1.160	1.169	1.164	1.173	1.169	1.178
1.250-16	16UN	1.182	83.8	1.196	66.5	1.182	1.189	1.186	1.193	1.189	1.196
1.250-18	UNEF	1.190	83.1	1.203	65.1	1.190	1.196	1.193	1.199	1.196	1.203
1.250-20	20UN	1.196	83.1	1.207	66.2	1.196	1.202	1.199	1.204	1.202	1.207
1.250-28	28UN	1.211	84.1	1.220	64.7	1.211	1.216	1.213	1.218	1.216	1.220
1.3125-8	8UN	1.177	83.4	1.202	68.1	1.177	1.190	1.184	1.196	1.190	1.202
1.3125-12	12UN	1.222	83.6	1.240	67.0	1.222	1.231	1.227	1.236	1.231	1.240
1.3125-16	16UN	1.245	83.1	1.259	65.9	1.245	1.252	1.248	1.255	1.252	1.259
1.3125-18	UNEF	1.252	83.8	1.265	65.8	1.252	1.259	1.256	1.262	1.259	1.265
1.3125-20	20UN	1.258	83.9	1.270	65.4	1.258	1.264	1.261	1.267	1.264	1.270
1.3125-28	28UN	1.274	83.0	1.282	65.7	1.274	1.278	1.276	1.280	1.278	1.282
1.375-6	UNC	1.195	83.1	1.225	69.3	1.195	1.210	1.202	1.218	1.210	1.225
1.375-8	8UN	1.240	83.1	1.265	67.7	1.240	1.252	1.246	1.258	1.252	1.265
1.375-12	UNF	1.285	83.1	1.303	66.5	1.285	1.294	1.289	1.298	1.294	1.303
1.375-16	16UN	1.307	83.8	1.321	66.5	1.307	1.314	1.311	1.318	1.314	1.321
1.375-18	UNEF	1.315	83.1	1.328	65.1	1.315	1.321	1.318	1.324	1.321	1.328
1.375-20	20UN	1.321	83.1	1.332	66.2	1.321	1.327	1.324	1.330	1.327	1.332
1.375-28	28UN	1.336	84.1	1.345	64.7	1.336	1.340	1.338	1.343	1.340	1.345
1.4375-6	6UN	1.257	83.4	1.288	69.1	1.257	1.272	1.265	1.280	1.272	1.288
1.4375-8	8UN	1.302	83.4	1.327	68.1	1.302	1.315	1.308	1.321	1.315	1.327
1.4375-12	12UN	1.347	83.6	1.365	67.0	1.347	1.356	1.352	1.361	1.356	1.365
1.4375-16	16UN	1.370	83.1	1.384	65.9	1.370	1.377	1.373	1.380	1.377	1.384
1.4375-18	UNEF	1.377	83.8	1.390	65.8	1.377	1.384	1.380	1.387	1.384	1.390
1.4375-20	20UN	1.383	83.9	1.395	65.4	1.383	1.389	1.386	1.392	1.389	1.395
1.4375-28	28UN	1.399	83.0	1.407	65.7	1.399	1.403	1.401	1.405	1.403	1.407
1.500-6	UNC	1.320	83.1	1.350	69.3	1.320	1.335	1.327	1.343	1.335	1.350
1.500-8	8UN	1.365	83.1	1.390	67.7	1.365	1.377	1.371	1.384	1.377	1.390
1.500-12	UNF	1.410	83.1	1.428	66.5	1.410	1.419	1.414	1.423	1.419	1.428
1.500-16	16UN	1.432	83.8	1.446	66.5	1.432	1.439	1.436	1.443	1.439	1.446
1.500-18	UNEF	1.440	83.1	1.453	65.1	1.440	1.446	1.443	1.449	1.446	1.453
1.500-20	20UN	1.446	83.1	1.457	66.2	1.446	1.452	1.449	1.454	1.452	1.457
1.500-28	28UN	1.461	84.1	1.470	64.7	1.461	1.466	1.463	1.468	1.466	1.470
1.5625-6	6UN	1.382	83.4	1.413	69.1	1.382	1.397	1.390	1.405	1.397	1.413
1.5625-8	8UN	1.427	83.4	1.452	68.1	1.427	1.440	1.434	1.446	1.440	1.452
1.5625-12	12UN	1.472	83.6	1.490	67.0	1.472	1.481	1.477	1.486	1.481	1.490
1.5625-16	16UN	1.495	83.1	1.509	65.9	1.495	1.502	1.498	1.505	1.502	1.509
1.5625-18	UNEF	1.502	83.8	1.515	65.8	1.502	1.509	1.506	1.512	1.509	1.515
1.5625-20	20UN	1.508	83.9	1.520	65.4	1.508	1.514	1.511	1.517	1.514	1.520

See footnotes at end of table.

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TABLE II.A.3 – Recommended hole size limits before threading for different lengths of engagement, standard Unified and some UNS threads, classes 1B and 2B (see 30.1) 1/ -continued

Nominal size in inches and threads per inch	Series designation	Minor diameter of internal threads				Recommended hole size limits for different lengths of engagement					
		Minimum	Percent 2/ of Thread	Maximum 3/	Percent 2/ of Thread	To and including 0.33D		Above 0.33D thru 0.67D		Above 0.67D thru 1.5D	
						Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	2	3	4	5	6	7	8	9	10	11	12
		in		in		in	in	in	in	in	in
1.625–6	6UN	1.445	83.1	1.475	69.3	1.445	1.460	1.452	1.468	1.460	1.475
1.625–8	8UN	1.490	83.1	1.515	67.7	1.490	1.502	1.496	1.508	1.502	1.515
1.625–12	12UN	1.535	83.1	1.553	66.5	1.535	1.544	1.539	1.548	1.544	1.553
1.625–16	16UN	1.557	83.8	1.571	66.5	1.557	1.564	1.561	1.568	1.564	1.571
1.625–18	UNEF	1.565	83.1	1.578	65.1	1.565	1.571	1.568	1.574	1.571	1.578
1.625–20	20UN	1.571	83.1	1.582	66.2	1.571	1.577	1.574	1.580	1.577	1.582
1.6875–6	6UN	1.507	83.4	1.538	69.1	1.507	1.522	1.515	1.530	1.522	1.538
1.6875–8	8UN	1.552	83.4	1.577	68.1	1.552	1.565	1.558	1.571	1.565	1.577
1.6875–12	12UN	1.597	83.6	1.615	67.0	1.597	1.606	1.602	1.611	1.606	1.615
1.6875–16	16UN	1.620	83.1	1.634	65.9	1.620	1.627	1.623	1.630	1.627	1.634
1.6875–18	UNEF	1.627	83.8	1.640	65.8	1.627	1.634	1.630	1.637	1.634	1.640
1.6875–20	20UN	1.633	83.9	1.645	65.4	1.633	1.639	1.636	1.642	1.639	1.645
1.750–5	UNC	1.534	83.1	1.568	70.1	1.534	1.550	1.542	1.559	1.550	1.568
1.750–6	6UN	1.570	83.1	1.600	69.3	1.570	1.585	1.577	1.593	1.585	1.600
1.750–8	8UN	1.615	83.1	1.640	67.7	1.615	1.627	1.621	1.634	1.627	1.640
1.750–12	12UN	1.660	83.1	1.678	66.5	1.660	1.669	1.664	1.673	1.669	1.678
1.750–16	16UN	1.682	83.8	1.696	66.5	1.682	1.689	1.686	1.693	1.689	1.696
1.750–20	20UN	1.696	83.1	1.707	66.2	1.696	1.702	1.699	1.704	1.702	1.707
1.8125–6	6UN	1.632	83.4	1.663	69.1	1.632	1.647	1.640	1.655	1.647	1.663
1.8125–8	8UN	1.677	83.4	1.702	68.1	1.677	1.690	1.684	1.696	1.690	1.702
1.8125–12	12UN	1.722	83.6	1.740	67.0	1.722	1.731	1.727	1.736	1.731	1.740
1.8125–16	16UN	1.745	83.1	1.759	65.9	1.745	1.752	1.748	1.755	1.752	1.759
1.8125–20	20UN	1.758	83.9	1.770	65.4	1.758	1.764	1.761	1.767	1.764	1.770
1.875–6	6UN	1.695	83.1	1.725	69.3	1.695	1.710	1.702	1.718	1.710	1.725
1.875–8	8UN	1.740	83.1	1.765	67.7	1.740	1.752	1.746	1.758	1.752	1.765
1.875–12	12UN	1.785	83.1	1.803	66.5	1.785	1.794	1.789	1.798	1.794	1.803
1.875–16	16UN	1.807	83.8	1.821	66.5	1.807	1.814	1.811	1.818	1.814	1.821
1.875–20	20UN	1.821	83.1	1.832	66.2	1.821	1.827	1.824	1.830	1.827	1.832
1.9375–6	6UN	1.757	83.4	1.788	69.1	1.757	1.772	1.765	1.780	1.772	1.788
1.9375–8	8UN	1.802	83.4	1.827	68.1	1.802	1.815	1.808	1.821	1.815	1.827
1.9375–12	12UN	1.847	83.6	1.865	67.0	1.847	1.856	1.852	1.861	1.856	1.865
1.9375–16	16UN	1.870	83.1	1.884	65.9	1.870	1.877	1.873	1.880	1.877	1.884
1.9375–20	20UN	1.883	83.9	1.895	65.4	1.883	1.889	1.886	1.892	1.889	1.895
2.000–4.5	UNC	1.759	83.5	1.795	71.0	1.759	1.777	1.768	1.786	1.777	1.795
2.000–6	6UN	1.820	83.1	1.850	69.3	1.820	1.835	1.827	1.843	1.835	1.850
2.000–8	8UN	1.865	83.1	1.890	67.7	1.865	1.877	1.871	1.884	1.877	1.890
2.000–12	12UN	1.910	83.1	1.928	66.5	1.910	1.919	1.914	1.923	1.919	1.928
2.000–16	16UN	1.932	83.8	1.946	66.5	1.932	1.939	1.936	1.943	1.939	1.946
2.000–20	20UN	1.946	83.1	1.957	66.2	1.946	1.952	1.949	1.954	1.952	1.957

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2.0625-16	UNS	1.995	83.1	2.009	65.9	1.995	2.002	1.998	2.005	2.002	2.009
2.125-6	6UN	1.945	83.1	1.975	69.3	1.945	1.960	1.952	1.968	1.960	1.975
2.125-8	8UN	1.990	83.1	2.015	67.7	1.990	2.002	1.996	2.008	2.002	2.015
2.125-12	12UN	2.035	83.1	2.053	66.5	2.035	2.044	2.039	2.048	2.044	2.053
2.125-16	16UN	2.057	83.8	2.071	66.5	2.057	2.064	2.061	2.068	2.064	2.071
2.125-20	20UN	2.071	83.1	2.082	66.2	2.071	2.077	2.074	2.080	2.077	2.082
2.1875-16	UNS	2.120	83.1	2.134	65.9	2.120	2.127	2.123	2.130	2.127	2.134
2.250-4.5	UNC	2.009	83.5	2.045	71.0	2.009	2.027	2.018	2.036	2.027	2.045
2.250-6	6UN	2.070	83.1	2.100	69.3	2.070	2.085	2.077	2.093	2.085	2.100
2.500-4	UNC	2.229	83.4	2.267	71.7	2.229	2.248	2.239	2.258	2.248	2.267
2.750-4	UNC	2.479	83.4	2.517	71.7	2.479	2.498	2.489	2.508	2.498	2.517
3.000-4	UNC	2.729	83.4	2.767	71.7	2.729	2.748	2.739	2.758	2.748	2.767
3.250-4	UNC	2.979	83.4	3.017	71.7	2.979	2.998	2.989	3.008	2.998	3.017

1/ The differences between limits are equal to the minor diameter tolerances for lengths of engagement to and including 0.33D. However, the minimum values for lengths of engagement greater than 0.33D in sizes 0.25 in. and larger are adjusted so that the difference between limits is never less than 0.0040 in. For diameter-pitch combinations other than those given in this table, see 30.2.

Hole size limits for diameter-pitch combinations which do not appear in this table may be obtained by use of values in this table provided there is a diameter-pitch combination in the table:

(1) with the same pitch and

(2) with a diameter that is less by an integral amount than the diameter of the diameter-pitch combination for which hole size values are desired. (NOTE: Values in the table for nominal sizes less than 0.25 in. cannot be used for this purpose.)

EXAMPLE: To obtain the values for the 4.000-4UN-1B or 2B thread, add 2.000 to values for the 2.000-8UN thread shown in the table. These values would then become: 3.865, 3.877, 3.871, 3.884, 3.877, 3.890. The percentages of thread will remain unchanged.

2/ Based on values as rounded off in the preceding column. 100 percent of thread = 0.75H (see 20.2.3).

3/ Based on a length of engagement equal to the nominal diameter.

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TABLE II.A.4. – Recommended hole size limits before threading for different lengths of engagement, standard Unified and some UNS threads, class 3B (see 30.1) 1/

Nominal size in inches and threads per inch	Series designation	Minor diameter of internal threads				Recommended hole size limits for different lengths of engagement					
		Minimum	Percent of Thread 2/	Maximum 3/	Percent of Thread 2/	To and including 0.33D		Above 0.33D thru 0.67D		Above 0.67D thru 1.5D	
						Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	2	3	4	5	6	7	8	9	10	11	12
		in		in		in	in	in	in	in	in
.060–80 or No. 0–80	UNF	0.0465	83.1	0.0514	53.0	0.0465	0.0500	0.0479	0.0514	0.0479	0.0514
.073–64 or No. 1–64	UNC	.0561	83.3	.0623	52.7	.0561	.0599	.0580	.0618	.0585	.0623
.073–72 or No. 1–72	UNF	.0580	83.1	.0635	52.7	.0580	.0613	.0596	.0629	.0602	.0635
.086–56 or No. 2–56	UNC	.0667	83.2	.0737	53.0	.0667	.0705	.0686	.0724	.0699	.0737
.086–64 or No. 2–64	UNF	.0691	83.3	.0753	52.7	.0691	.0724	.0707	.0740	.0720	.0753
.099–48 or No. 3–48	UNC	.0764	83.5	.0845	53.6	.0764	.0804	.0785	.0825	.0805	.0845
.099–56 or No. 3–56	UNF	.0797	83.2	.0865	53.9	.0797	.0831	.0814	.0848	.0831	.0865
.112–40 or No. 4–40	UNC	.0849	83.4	.0939	55.7	.0849	.0894	.0871	.0916	.0894	.0939
.112–48 or No. 4–48	UNF	.0894	83.5	.0968	56.2	.0894	.0931	.0912	.0949	.0931	.0968
.125–40 or No. 5–40	UNC	.0979	83.4	.1062	57.9	.0979	.1020	.1000	.1041	.1021	.1062
.125–44 or No. 5–44	UNF	.1004	83.3	.1079	57.9	.1004	.1041	.1023	.1060	.1042	.1079
.138–32 or No. 6–32	UNC	.1040	83.8	.1140	59.1	.1040	.1091	.1066	.1115	.1091	.1140
.138–40 or No. 6–40	UNF	.1110	83.1	.1186	59.7	.1110	.1148	.1128	.1167	.1147	.1186
.164–32 or No. 8–32	UNC	.1300	83.8	.1389	61.8	.1300	.1345	.1324	.1367	.1346	.1389
.164–36 or No. 8–36	UNF	.1340	83.1	.1416	62.1	.1340	.1377	.1359	.1397	.1378	.1416
.190–24 or No. 10–24	UNC	.1450	83.1	.1555	63.7	.1450	.1502	.1475	.1528	.1502	.1555
.190–32 or No. 10–32	UNF	.1560	83.8	.1641	63.8	.1560	.1601	.1582	.1621	.1602	.1641
.216–24 or No. 12–24	UNC	.1710	83.1	.1807	65.2	.1710	.1758	.1733	.1782	.1758	.1807
.216–28 or No. 12–28	UNF	.1770	84.1	.1857	65.3	.1770	.1815	.1794	.1836	.1815	.1857
.216–32 or No. 12–32	UNEF	.1820	83.8	.1895	65.3	.1820	.1858	.1841	.1877	.1859	.1895
.250–20	UNC	.1960	83.1	.2067	66.7	.1960	.2013	.1986	.2040	.2013	.2067
.250–28	UNF	.2110	84.1	.2190	66.8	.2110	.2152	.2131	.2171	.2150	.2190
.250–32	UNEF	.2160	83.8	.2229	66.8	.2160	.2196	.2172	.2212	.2189	.2229
.250–36	UNS	.2200	83.1	.2258	67.1	.2200	.2229	.2203	.2243	.2218	.2258
.3125–18	UNC	.2520	83.8	.2630	68.6	.2520	.2577	.2551	.2604	.2577	.2630
.3125–20	20UN	.2580	83.9	.2680	68.5	.2580	.2632	.2608	.2656	.2632	.2680
.3125–24	UNF	.2670	84.1	.2754	68.5	.2670	.2714	.2694	.2734	.2714	.2754
.3125–28	28UN	.2740	83.0	.2807	68.5	.2740	.2772	.2749	.2789	.2767	.2807
.3125–32	UNEF	.2790	82.5	.2847	68.5	.2790	.2817	.2792	.2832	.2807	.2847
.3125–36	UNS	.2820	84.5	.2877	68.7	.2820	.2850	.2823	.2863	.2837	.2877
.375–16	UNC	.3070	83.8	.3182	70.0	.3070	.3127	.3101	.3155	.3128	.3182
.375–20	20UN	.3210	83.1	.3297	69.7	.3210	.3253	.3231	.3275	.3253	.3297
.375–24	UNF	.3300	83.1	.3372	69.8	.3300	.3336	.3314	.3354	.3332	.3372
.375–28	28UN	.3360	84.1	.3426	69.8	.3360	.3395	.3370	.3410	.3386	.3426
.375–32	UNEF	.3410	83.8	.3469	69.2	.3410	.3441	.3415	.3455	.3429	.3469
.375–36	UNS	.3450	83.1	.3501	69.0	.3450	.3475	.3450	.3490	.3461	.3501
.4375–14	UNC	.3600	83.5	.3717	70.9	.3600	.3660	.3630	.3688	.3659	.3717
.4375–16	16UN	.3700	83.1	.3800	70.8	.3700	.3749	.3723	.3774	.3749	.3800
.4375–20	UNF	.3830	83.9	.3916	70.7	.3830	.3875	.3855	.3896	.3875	.3916
.4375–28	UNEF	.3990	83.0	.4051	69.8	.3990	.4020	.3995	.4035	.4011	.4051
.4375–32	32UN	.4040	82.5	.4094	69.2	.4040	.4066	.4040	.4080	.4054	.4094

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.500-12	UNS	.4100	83.1	.4223	71.8	.4100	.4161	.4129	.4192	.4160	.4223
.500-13	UNC	.4170	83.1	.4284	71.7	.4170	.4225	.4196	.4254	.4226	.4284
.500-16	16UN	.4320	83.8	.4419	71.6	.4320	.4371	.4347	.4395	.4371	.4419
.500-20	UNF	.4460	83.1	.4537	71.3	.4460	.4498	.4477	.4517	.4497	.4537
.500-28	UNEF	.4610	84.1	.4676	69.8	.4610	.4645	.4620	.4660	.4638	.4676
.500-32	32UN	.4660	83.8	.4719	69.2	.4660	.4691	.4665	.4705	.4679	.4719
.5625-12	UNC	.4720	83.6	.4843	72.2	.4720	.4783	.4753	.4813	.4783	.4843
.5625-16	16UN	.4950	83.1	.5040	72.1	.4950	.4994	.4971	.5017	.4994	.5040
.5625-18	UNF	.5020	83.8	.5106	71.9	.5020	.5065	.5045	.5086	.5065	.5106
.5625-20	20UN	.5080	83.9	.5162	71.3	.5080	.5123	.5102	.5142	.5122	.5162
.5625-24	UNEF	.5170	84.1	.5244	70.4	.5170	.5209	.5188	.5226	.5204	.5244
.5625-28	28UN	.5240	83.0	.5301	69.8	.5240	.5270	.5245	.5285	.5261	.5301
.5625-32	32UN	.5290	82.5	.5344	69.2	.5290	.5316	.5290	.5330	.5304	.5344
.625-11	UNC	.5270	83.0	.5391	72.7	.5270	.5328	.5298	.5360	.5329	.5391
.625-12	12UN	.5350	83.1	.5463	72.7	.5350	.5406	.5377	.5435	.5405	.5463
.625-16	16UN	.5570	83.8	.5662	72.4	.5570	.5617	.5596	.5640	.5618	.5662
.625-18	UNF	.5650	83.1	.5730	72.1	.5650	.5690	.5669	.5710	.5689	.5730
.625-20	20UN	.5710	83.1	.5787	71.3	.5710	.5748	.5727	.5767	.5747	.5787
.625-24	UNEF	.5800	83.1	.5869	70.4	.5800	.5834	.5811	.5851	.5829	.5869
.625-28	28UN	.5860	84.1	.5926	69.8	.5860	.5895	.5870	.5910	.5886	.5926
.625-32	32UN	.5910	83.8	.5969	69.2	.5910	.5941	.5915	.5955	.5929	.5969
.6875-12	12UN	.5970	83.6	.6085	73.0	.5970	.6029	.6001	.6057	.6029	.6085
.6875-16	16UN	.6200	83.1	.6284	72.8	.6200	.6241	.6219	.6262	.6241	.6284
.6875-18	UNS	.6270	83.8	.6355	72.1	.6270	.6315	.6294	.6335	.6314	.6355
.6875-20	20UN	.6330	83.9	.6412	71.3	.6330	.6373	.6352	.6392	.6372	.6412
.6875-24	UNEF	.6420	84.1	.6494	70.4	.6420	.6459	.6436	.6476	.6454	.6494
.6875-28	28UN	.6490	83.0	.6551	69.8	.6490	.6520	.6495	.6535	.6511	.6551
.6875-32	32UN	.6540	82.5	.6594	69.2	.6540	.6566	.6540	.6580	.6554	.6594
.750-10	UNC	.6420	83.1	.6545	73.5	.6420	.6481	.6449	.6513	.6481	.6545
.750-12	12UN	.6600	83.1	.6707	73.3	.6600	.6652	.6626	.6680	.6653	.6707
.750-16	UNF	.6820	83.8	.6908	72.9	.6820	.6868	.6844	.6887	.6865	.6908
.750-18	UNS	.6900	83.1	.6980	72.1	.6900	.6940	.6919	.6960	.6939	.6980
.750-20	UNEF	.6960	83.1	.7037	71.3	.6960	.6998	.6977	.7017	.6997	.7037
.750-28	28UN	.7110	84.1	.7176	69.8	.7110	.7145	.7120	.7160	.7138	.7176
.750-32	32UN	.7160	83.8	.7219	69.2	.7160	.7191	.7165	.7205	.7179	.7219
.8125-12	12UN	.7220	83.6	.7329	73.5	.7220	.7276	.7250	.7303	.7276	.7329
.8125-16	16UN	.7450	83.1	.7533	72.9	.7450	.7491	.7469	.7512	.7490	.7533
.8125-18	UNS	.7520	83.8	.7605	72.1	.7520	.7565	.7544	.7585	.7564	.7605
.8125-20	UNEF	.7580	83.9	.7662	71.3	.7580	.7623	.7602	.7642	.7622	.7662
.8125-28	28UN	.7740	83.0	.7801	69.8	.7740	.7770	.7745	.7785	.7761	.7801
.8125-32	32UN	.7790	82.5	.7844	69.2	.7790	.7816	.7790	.7830	.7804	.7844
.875-9	UNC	.7550	83.1	.7681	74.1	.7550	.7614	.7580	.7647	.7614	.7681
.875-12	12UN	.7850	83.1	.7952	73.7	.7850	.7900	.7874	.7926	.7900	.7952
.875-14	UNF	.7980	83.0	.8068	73.5	.7980	.8022	.8000	.8045	.8023	.8068
.875-16	16UN	.8070	83.6	.8158	72.9	.8070	.8116	.8094	.8137	.8115	.8158
.875-18	UNS	.8150	83.1	.8230	72.1	.8150	.8190	.8169	.8210	.8189	.8230
.875-20	UNEF	.8210	83.1	.8287	71.3	.8210	.8248	.8227	.8267	.8247	.8287
.875-28	28UN	.8360	84.1	.8426	69.8	.8360	.8395	.8370	.8410	.8388	.8426
.875-32	32UN	.8410	83.8	.8469	69.2	.8410	.8441	.8415	.8455	.8429	.8469
.9375-12	12UN	.8470	83.6	.8575	73.9	.8470	.8524	.8499	.8550	.8524	.8575
.9375-16	16UN	.8700	83.1	.8783	72.9	.8700	.8741	.8719	.8762	.8740	.8783
.9375-20	UNEF	.8830	83.9	.8912	71.3	.8830	.8873	.8852	.8892	.8872	.8912
.9375-28	28UN	.8990	83.0	.9051	69.8	.8990	.9020	.8995	.9035	.9011	.9051
.9375-32	32UN	.9040	82.5	.9094	69.2	.9040	.9066	.9040	.9080	.9054	.9094
1.000-8	UNC	.8650	83.1	.8797	74.1	.8650	.8722	.8684	.8759	.8722	.8797
1.000-12	UNF	.9100	83.1	.9198	74.1	.9100	.9148	.9123	.9173	.9148	.9198
1.000-14	UNS	.9230	83.0	.9315	73.8	.9230	.9271	.9249	.9293	.9271	.9315
1.000-16	16UN	.9320	83.8	.9408	72.9	.9320	.9366	.9344	.9387	.9365	.9408
1.000-18	UNS	.9400	83.1	.9480	72.1	.9400	.9440	.9419	.9460	.9439	.9480
1.000-20	UNEF	.9460	83.1	.9537	71.3	.9460	.9498	.9477	.9517	.9497	.9537
1.000-28	28UN	.9610	84.1	.9676	69.8	.9610	.9645	.9620	.9660	.9636	.9676
1.000-32	32UN	.9660	83.8	.9719	69.2	.9660	.9691	.9665	.9705	.9679	.9719

See footnotes at end of table.

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TABLE II.A.4. – Recommended hole size limits before threading for different lengths of engagement, standard Unified and some UNS threads, class 3B (see 30.1) 1/. – Continued

Nominal size in inches and threads per inch	Series designation	Minor diameter of internal threads				Recommended hole size limits for different lengths of engagement					
		Minimum	2/ Percent of Thread	3/ Maximum	2/ Percent of Thread	To and including 0.33D		Above 0.33D thru 0.67D		Above 0.67D thru 1.5D	
						Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1	2	3	4	5	6	7	8	9	10	11	12
		in		in		in	in	in	in	in	in
1.0625-8	8UN	.9270	83.4	.9422	74.1	.9270	.9347	.9309	.9384	.9347	.9422
1.0625-12	12UN	.9720	83.6	.9823	74.1	.9720	.9773	.9748	.9798	.9773	.9823
1.0625-14	UNS	.9850	83.5	.9940	73.8	.9850	.9896	.9874	.9918	.9896	.9940
1.0625-16	16UN	.9950	83.1	1.0033	72.9	.9950	.9991	.9969	1.0012	.9990	1.0033
1.0625-18	UNEF	1.0020	83.8	1.0105	72.1	1.0020	1.0065	1.0044	1.0085	1.0064	1.0105
1.0625-20	20UN	1.0080	83.9	1.0162	71.3	1.0080	1.0123	1.0102	1.0142	1.0122	1.0162
1.0625-28	28UN	1.0240	83.0	1.0301	69.8	1.0240	1.0270	1.0245	1.0285	1.0261	1.0301
1.125-7	UNC	0.9700	83.5	0.9875	74.1	0.9700	0.9790	0.9747	0.9833	0.9789	0.9875
1.125-8	8UN	.9900	83.1	1.0047	74.1	.9900	.9972	.9934	1.0009	.9972	1.0047
1.125-12	UNF	1.0350	83.1	1.0448	74.1	1.0350	1.0398	1.0373	1.0423	1.0398	1.0448
1.125-16	16UN	1.0570	83.8	1.0658	72.9	1.0570	1.0616	1.0594	1.0637	1.0615	1.0658
1.125-18	UNEF	1.0650	83.1	1.0730	72.1	1.0650	1.0690	1.0669	1.0710	1.0689	1.0730
1.125-20	20UN	1.0710	83.1	1.0787	71.3	1.0710	1.0748	1.0727	1.0767	1.0747	1.0787
1.125-28	28UN	1.0860	84.1	1.0926	69.8	1.0860	1.0895	1.0870	1.0910	1.0886	1.0926
1.1875-8	8UN	1.0520	83.4	1.0672	74.1	1.0520	1.0597	1.0559	1.0634	1.0597	1.0672
1.1875-12	12UN	1.0970	83.6	1.1073	74.1	1.0970	1.1023	1.0998	1.1048	1.1023	1.1073
1.1875-16	16UN	1.1200	83.1	1.1283	72.9	1.1200	1.1241	1.1219	1.1262	1.1240	1.1283
1.1875-18	UNEF	1.1270	83.8	1.1355	72.1	1.1270	1.1315	1.1294	1.1335	1.1314	1.1355
1.1875-20	20UN	1.1330	83.9	1.1412	71.3	1.1330	1.1373	1.1352	1.1392	1.1372	1.1412
1.1875-28	28UN	1.1490	83.0	1.1551	69.8	1.1490	1.1520	1.1495	1.1535	1.1511	1.1551
1.250-7	UNC	1.0950	83.5	1.1125	74.1	1.0950	1.1040	1.0997	1.1083	1.1039	1.1125
1.250-8	8UN	1.1150	83.1	1.1297	74.1	1.1150	1.1222	1.1184	1.1259	1.1222	1.1297
1.250-12	UNF	1.1600	83.1	1.1698	74.1	1.1600	1.1648	1.1623	1.1673	1.1648	1.1698
1.250-16	16UN	1.1820	83.8	1.1908	72.9	1.1820	1.1866	1.1844	1.1887	1.1865	1.1908
1.250-18	UNEF	1.1900	83.1	1.1980	72.1	1.1900	1.1940	1.1919	1.1960	1.1939	1.1980
1.250-20	20UN	1.1960	83.1	1.2037	71.3	1.1960	1.1998	1.1977	1.2017	1.1997	1.2037
1.250-28	28UN	1.2110	84.1	1.2176	69.8	1.2110	1.2145	1.2120	1.2160	1.2136	1.2176
1.3125-8	8UN	1.1770	83.4	1.1922	74.1	1.1770	1.1847	1.1809	1.1884	1.1847	1.1922
1.3125-12	12UN	1.2220	83.6	1.2323	74.1	1.2220	1.2273	1.2248	1.2298	1.2273	1.2323
1.3125-16	16UN	1.2450	83.1	1.2533	72.9	1.2450	1.2491	1.2469	1.2512	1.2490	1.2533
1.3125-18	UNEF	1.2520	83.8	1.2605	72.1	1.2520	1.2565	1.2544	1.2585	1.2564	1.2605
1.3125-20	20UN	1.2580	83.9	1.2662	71.3	1.2580	1.2623	1.2602	1.2642	1.2622	1.2662
1.3125-28	28UN	1.2740	83.0	1.2801	69.8	1.2740	1.2770	1.2745	1.2785	1.2761	1.2801
1.375-6	UNC	1.1950	83.1	1.2146	74.1	1.1950	1.2046	1.1996	1.2096	1.2046	1.2146
1.375-8	8UN	1.2400	83.1	1.2547	74.1	1.2400	1.2472	1.2434	1.2509	1.2472	1.2547
1.375-12	UNF	1.2850	83.1	1.2948	74.1	1.2850	1.2898	1.2873	1.2923	1.2898	1.2948
1.375-16	16UN	1.3070	83.8	1.3158	72.9	1.3070	1.3116	1.3094	1.3137	1.3115	1.3158
1.375-18	UNEF	1.3150	83.1	1.3230	72.1	1.3150	1.3190	1.3169	1.3210	1.3189	1.3230
1.375-20	20UN	1.3210	83.1	1.3287	71.3	1.3210	1.3248	1.3227	1.3267	1.3247	1.3287
1.375-28	28UN	1.3360	84.1	1.3426	69.8	1.3360	1.3395	1.3370	1.3410	1.3386	1.3426
1.4375-6	6UN	1.2570	83.4	1.2771	74.1	1.2570	1.2671	1.2621	1.2721	1.2671	1.2771
1.4375-8	8UN	1.3020	83.4	1.3172	74.1	1.3020	1.3097	1.3059	1.3134	1.3097	1.3172
1.4375-12	12UN	1.3470	83.6	1.3573	74.1	1.3470	1.3523	1.3498	1.3548	1.3523	1.3573
1.4375-16	16UN	1.3700	83.1	1.3783	72.9	1.3700	1.3741	1.3719	1.3762	1.3740	1.3783
1.4375-18	UNEF	1.3770	83.8	1.3855	72.1	1.3770	1.3815	1.3794	1.3835	1.3814	1.3855
1.4375-20	20UN	1.3830	83.9	1.3912	71.3	1.3830	1.3873	1.3852	1.3892	1.3872	1.3912
1.4375-28	28UN	1.3990	83.0	1.4051	69.8	1.3990	1.4020	1.3995	1.4035	1.4011	1.4051
1.500-6	UNC	1.3200	83.1	1.3396	74.1	1.3200	1.3296	1.3246	1.3346	1.3296	1.3396
1.500-8	8UN	1.3650	83.1	1.3797	74.1	1.3650	1.3722	1.3684	1.3759	1.3722	1.3797
1.500-12	UNF	1.4100	83.1	1.4198	74.1	1.4100	1.4148	1.4123	1.4173	1.4148	1.4198
1.500-16	16UN	1.4320	83.8	1.4408	72.9	1.4320	1.4366	1.4344	1.4387	1.4365	1.4408
1.500-18	UNEF	1.4400	83.1	1.4480	72.1	1.4400	1.4440	1.4419	1.4460	1.4439	1.4480
1.500-20	20UN	1.4460	83.1	1.4537	71.3	1.4460	1.4498	1.4477	1.4517	1.4497	1.4537
1.500-28	28UN	1.4610	84.1	1.4676	69.8	1.4610	1.4645	1.4620	1.4660	1.4636	1.4678

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1.5625-6	6UN	1.3820	83.4	1.4021	74.1	1.3820	1.3921	1.3871	1.3971	1.3921	1.4021
1.5625-8	8UN	1.4270	83.4	1.4422	74.1	1.4270	1.4347	1.4309	1.4384	1.4347	1.4422
1.5625-12	12UN	1.4720	83.6	1.4823	74.1	1.4720	1.4773	1.4748	1.4798	1.4773	1.4823
1.5625-16	16UN	1.4950	83.1	1.5033	72.9	1.4950	1.4991	1.4969	1.5012	1.4990	1.5033
1.5625-18	UNEF	1.5020	83.8	1.5105	72.1	1.5020	1.5065	1.5044	1.5085	1.5064	1.5105
1.5625-20	20UN	1.5080	83.9	1.5162	71.3	1.5080	1.5123	1.5102	1.5142	1.5122	1.5162
1.625-6	6UN	1.4450	83.1	1.4646	74.1	1.4450	1.4546	1.4496	1.4596	1.4546	1.4646
1.625-8	8UN	1.4900	83.1	1.5047	74.1	1.4900	1.4972	1.4934	1.5009	1.4972	1.5047
1.625-12	12UN	1.5350	83.1	1.5448	74.1	1.5350	1.5398	1.5373	1.5423	1.5398	1.5448
1.625-16	16UN	1.5570	83.8	1.5658	72.9	1.5570	1.5616	1.5594	1.5637	1.5615	1.5658
1.625-18	UNEF	1.5650	83.1	1.5730	72.1	1.5650	1.5690	1.5669	1.5710	1.5689	1.5730
1.625-20	20UN	1.5710	83.1	1.5787	71.3	1.5710	1.5748	1.5727	1.5767	1.5747	1.5787
1.6875-6	6UN	1.5070	83.4	1.5271	74.1	1.5070	1.5171	1.5121	1.5221	1.5171	1.5271
1.6875-8	8UN	1.5520	83.4	1.5672	74.1	1.5520	1.5597	1.5559	1.5634	1.5597	1.5672
1.6875-12	12UN	1.5970	83.6	1.6073	74.1	1.5970	1.6023	1.5998	1.6048	1.6023	1.6073
1.6875-16	16UN	1.6200	83.1	1.6283	72.9	1.6200	1.6241	1.6219	1.6262	1.6240	1.6283
1.6875-18	UNEF	1.6270	83.8	1.6355	72.1	1.6270	1.6315	1.6294	1.6335	1.6314	1.6355
1.6875-20	20UN	1.6330	83.9	1.6412	71.3	1.6330	1.6373	1.6352	1.6392	1.6372	1.6412
1.750-5	UNC	1.5340	83.1	1.5575	74.1	1.5340	1.5455	1.5395	1.5515	1.5455	1.5575
1.750-6	6UN	1.5700	83.1	1.5896	74.1	1.5700	1.5796	1.5746	1.5846	1.5796	1.5896
1.750-8	8UN	1.6150	83.1	1.6297	74.1	1.6150	1.6222	1.6184	1.6259	1.6222	1.6297
1.750-12	12UN	1.6600	83.1	1.6698	74.1	1.6600	1.6648	1.6623	1.6673	1.6648	1.6698
1.750-16	16UN	1.6820	83.8	1.6908	72.9	1.6820	1.6866	1.6844	1.6887	1.6865	1.6908
1.750-20	20UN	1.6960	83.1	1.7037	71.3	1.6960	1.6998	1.6977	1.7017	1.6997	1.7037
1.8125-6	6UN	1.6320	83.4	1.6521	74.1	1.6320	1.6421	1.6371	1.6471	1.6421	1.6521
1.8125-8	8UN	1.6770	83.4	1.6922	74.1	1.6770	1.6847	1.6809	1.6884	1.6847	1.6922
1.8126-12	12UN	1.7220	83.6	1.7323	74.1	1.7220	1.7273	1.7248	1.7298	1.7273	1.7323
1.8125-16	16UN	1.7150	83.1	1.7533	72.9	1.7450	1.7491	1.7469	1.7512	1.7490	1.7533
1.8125-20	20UN	1.7580	83.9	1.7662	71.3	1.7580	1.7623	1.7602	1.7642	1.7622	1.7662
1.875-6	6UN	1.6950	83.1	1.7146	74.1	1.6950	1.7046	1.6996	1.7096	1.7046	1.7146
1.875-8	8UN	1.7400	83.1	1.7547	74.1	1.7400	1.7472	1.7434	1.7509	1.7472	1.7547
1.875-12	12UN	1.7850	83.1	1.7948	74.1	1.7850	1.7898	1.7873	1.7923	1.7898	1.7948
1.875-16	16UN	1.8070	83.8	1.8158	72.9	1.8070	1.8116	1.8094	1.8137	1.8115	1.8158
1.875-20	20UN	1.8210	83.1	1.8287	71.3	1.8210	1.8248	1.8227	1.8267	1.8247	1.8287
1.9375-6	6UN	1.7570	83.4	1.7771	74.1	1.7570	1.7671	1.7621	1.7721	1.7671	1.7771
1.9375-8	8UN	1.8020	83.4	1.8172	74.1	1.8020	1.8097	1.8059	1.8134	1.8097	1.8172
1.9375-12	12UN	1.8470	83.6	1.8573	74.1	1.8470	1.8523	1.8498	1.8548	1.8523	1.8573
1.9375-16	16UN	1.8700	83.1	1.8783	72.9	1.8700	1.8741	1.8719	1.8762	1.8740	1.8783
1.9375-20	20UN	1.8830	83.9	1.8912	71.3	1.8830	1.8873	1.8852	1.8892	1.8872	1.8912
2.000-4.5	UNC	1.7590	83.5	1.7881	74.1	1.7590	1.7727	1.7661	1.7794	1.7728	1.7881
2.000-6	6UN	1.8200	83.1	1.8396	74.1	1.8200	1.8296	1.8246	1.8346	1.8296	1.8396
2.000-8	8UN	1.8650	83.1	1.8797	74.1	1.8650	1.8722	1.8684	1.8759	1.8722	1.8797
2.000-12	12UN	1.9100	83.1	1.9198	74.1	1.9100	1.9148	1.9123	1.9173	1.9148	1.9198
2.000-16	16UN	1.9320	83.8	1.9408	72.9	1.9320	1.9366	1.9344	1.9387	1.9365	1.9408
2.000-20	20UN	1.9460	83.1	1.9537	71.3	1.9460	1.9498	1.9477	1.9517	1.9497	1.9537
2.0625-16	UNS	1.9950	83.1	2.0033	72.9	1.9950	1.9991	1.9969	2.0012	1.9990	2.0033
2.125-6	6UN	1.9450	83.1	1.9646	74.1	1.9450	1.9546	1.9496	1.9596	1.9546	1.9646
2.125-8	8UN	1.9900	83.1	2.0047	74.1	1.9900	1.9972	1.9934	2.0009	1.9972	2.0047
2.125-12	12UN	2.0350	83.1	2.0448	74.1	2.0350	2.0398	2.0373	2.0423	2.0398	2.0448
2.125-16	16UN	2.0570	83.8	2.0658	72.9	2.0570	2.0616	2.0594	2.0637	2.0615	2.0658
2.125-20	20UN	2.0710	83.1	2.0787	71.3	2.0710	2.0748	2.0727	2.0767	2.0747	2.0787
2.1875-16	UNS	2.1200	83.1	2.1283	72.9	2.1200	2.1241	2.1219	2.1262	2.1240	2.1283
2.250-4.5	UNC	2.0090	83.5	2.0381	74.1	2.0090	2.0227	2.0161	2.0294	2.0228	2.0361
2.250-6	6UN	2.0700	83.1	2.0896	74.1	2.0700	2.0796	2.0746	2.0846	2.0796	2.0896
2.500-4	UNC	2.2290	83.4	2.2594	74.1	2.2290	2.2444	2.2369	2.2519	2.2444	2.2594
2.750-4	UNC	2.4790	83.4	2.5094	74.1	2.4790	2.4944	2.4869	2.5019	2.4944	2.5094
3.000-4	UNC	2.7290	83.4	2.7594	74.1	2.7290	2.7444	2.7369	2.7519	2.7444	2.7594
3.250-4	UNC	2.9790	83.4	3.0094	74.1	2.9790	2.9944	2.9869	3.0019	2.9944	3.0094

1/ The differences between limits are equal to the minor diameter tolerances for lengths of engagement to and including 0.33D. However, the minimum values for lengths of engagement greater than 0.33D in sizes 0.25 in. and larger are adjusted so that the difference between limits is never less than 0.0040 in. For diameter-pitch combinations other than those given in this table, see 30.2.

Hole size limits for diameter-pitch combinations which do not appear in this table may be obtained by use of values in this table provided there is a diameter-pitch combination in the table:

(1) with the same pitch and

(2) with a diameter that is less by an integral amount than the diameter of the diameter-pitch combination for which hole size values are desired. (NOTE: Values in the table for nominal sizes less than 1.00 in. cannot be used for this purpose.)

EXAMPLE: To obtain the values for the 4.000-8UN-3B thread, add 2.000 to the values for the 2.000-8UN thread shown in the table. These values would then become: 3.8650, 3.8722, 3.8884, 3.8759, 3.8722, 3.8797. The percentages of thread will remain unchanged.

2/ Based on values as rounded off in the preceding column. 100 percent of thread = 0.75H (see 20.2.3).

3/ Based on a length of engagement equal to the nominal diameter.

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APPENDIX B

DESIGN OF UNIFIED SCREW THREADS

40. Scope. This appendix provides guidelines which may be used in the design of unified screw threads for threaded parts. It is not a mandatory part of the standard. The information contained herein is intended for guidance only. It supplements information contained in Appendix B of ANSI B1.1-1982.

50. General.

50.1 Introduction. In general, any given problem in thread design may be susceptible to several more or less satisfactory solutions based on the preliminary selection of certain elements of the design and the proper adjustment of the other elements. In other words, thread design is to a large extent empirical and is partially based on previous experience with similar designs and the judgment of the designer. Accordingly, it is not practicable to present a definite system of approach to the design of a threaded assembly but merely to present a discussion of various design factors.

50.2 Factor relationships. The interrelation of length of engagement, minimum major diameter of the external thread, maximum minor diameter of the internal thread, and the strength of the assembled thread needs to be understood and carefully considered in order to produce the optimum design of a special thread. It is not economical to use either a length of thread engagement which is longer than required or shorter than that which will develop the full strength of the externally threaded member. Other factors, such as control of tap breakage, proper seating of a threaded part on a shoulder, the prevention of cross threading, conditions of loading when the assembled parts are not concentric, and possible collapse of a hollow externally threaded member, require careful analysis and adjustment of the design with respect to selection of the diameter-pitch combination, the class of thread, length of engagement, and major and minor diameter tolerances.

50.3 Thread fit considerations. A close fitting thread assembly under some conditions may fail, whereas the cause of failure may be eliminated by providing a looser fit. A cap screw that seats only on one side of the bearing surface under the head may break off when the screw is tightened. When a screw has a large bearing surface under the head or when the head must be square with a projecting pin, sufficient pitch diameter clearance must be provided to allow for any out-of-squareness of the screw axis with the bearing surface under the head. Thus, as large a pitch diameter tolerance as possible, together with providing proper tolerances on squareness of face with the thread axis where seating is required, may avoid the necessity for specifying a heat treated bolt.

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50.4 Standard threads. Use of standard threads is required in accordance with 4.1. Information on preferred sizes and classes for special threads ap-pears in 5.1 and 5.2. Whenever practicable, lengths of engagement for coarse, fine, 4,6 and 8 thread series should be between 5 pitches and 1 1/2 diameters; for all other series they should be between 5 and 15 pitches. Application of these principles will help keep costs of manufacture and gaging to a minimum.

60. Eccentricity of assembly and cross threading.

Note: Table 6 of ANSI B1.1-1982 includes tables of 0.375H, 0.75H and H.

In assembly and use, the combined tolerances and allowances on both mating parts should not allow threads to disengage on one side when assembly is eccentric. The axis of the internal thread can be displaced radially from coincidence with the axis of the external thread by an amount equal to the sum of the pitch diameter tolerances and the allowance. This radial displacement may be sufficient so that the flank contact is entirely on one side and on the opposite side the crest of the external thread will be in line with the crest of the internal thread with the following results when the screw is constrained in such a position in a tapped hole: (1) There will be danger of crossing the threads in starting, and (2) the screw may pull out of the hole when tension is exerted in this constrained position. The minimum amount of overlap is arbitrary and controversial, but the following general rule can be used in lieu of more specific data:

As the first step to assure the minimum safe overlap on both sides when the assembly is concentric, the difference between the minimum major diameter of the external thread and the maximum minor diameter of the internal thread should not be less than twice the addendum of the external thread (0.75H). Otherwise stated, the sum of the major-diameter tolerance and allowance, if any, of the external thread and the minor-diameter tolerance of the internal thread should not be greater than 4/3 the addendum of the external thread, 0.5H. This provides for a minimum of 50 percent thread engagement. As the second step, to assure the minimum safe overlap on one side when the assembly is eccentric, the difference between the maximum pitch diameter of the internal thread and the minimum pitch diameter of the external thread should not be greater than the basic thread height (0.625H). Otherwise stated, the sum of the pitch-diameter tolerances of both threads and the allowance, if any, should not be greater than the basic thread height (0.625H). This provides for an eccentric assembly condition equal to half the basic thread height (0.3125H) and zero minimum overlap on one side. If the results from the limits of size selected violate the above rules, the tolerances should be reduced by using a closer class of tolerance, assuming tolerances consistent with manufacturing possibility, or a coarser pitch should be used to increase the amount of overlap. The major-diameter tolerance of the external thread or minor-diameter tolerance of the internal thread should not be less than the pitch-diameter tolerance of the respective thread to maintain thread form. Also, it should be noted that, if the tolerance on the minor diameter of the internal thread must necessarily be large, the major diameter of the external thread must be held close to the maximum major diameter and vice versa.

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70. Strength factors.

70.1 Tensile stress area. Tests have shown that externally threaded parts fail in tension at loads corresponding to those of unthreaded parts with diameters midway between their pitch and minor diameters. Formulas (1a) and (1b) in table II.B.1 provide stress area based upon a diameter approximately midway between minimum pitch diameter and minimum minor diameter. These formulas have been applied successfully to steel and other metals with ultimate strengths up to 180,000 psi and are often used for product acceptance. Tensile stress areas for standard sizes are tabulated in section 11 of ANSI B1.1-1982.

70.2 Shear areas at minimum material. The geometric shear area of an internal thread at minimum material is equal to the area of that thread which is intersected by a cylinder with a diameter equal to the minimum major diameter of the mating external thread over the length of engagement. This is identified in figure 2.B.1 for a one pitch section and formulas (2a) and (2b) in table II.B.1 are used for calculation. Similarly, the geometric shear area of an external thread at minimum material is equal to the area of that thread which is intersected by a cylinder with a diameter equal to the maximum minor diameter of the mating internal thread. This is also identified in figure 2.B.1 for a one pitch section and formulas (4a) and (4b) in table II.B.1 are used for calculation.

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TABLE II.B.1 FORMULAS FOR SCREW THREAD STRENGTH FACTORS

FORMULA NUMBER	CHARACTERISTIC	FORMULA	REFERENCE PARAGRAPH
(1a)	Tensile Stress Area	$A_s = 3.1416\left(\frac{d_2\,bsc}{2} - \frac{3H}{16}\right)^2$	70.1
(1b)		$A_s = 0.7854\left(d\,bsc - \frac{0.9743}{n}\right)^2$	70.1
(2a)	Shear area, internal threads (Min material ext and int threads)	$AS_n\,min = 3.1416\,n\,LE\,d_{min}\left[\frac{1}{2n} + 0.57735\left(d_{min} - D_2\,max\right)\right]$	70.2
(2b)		$AS_n\,min = 3.1416\,d_{min}\left[0.875 - 0.57735n\left(Td + TD_2 + es\right)\right]LE$	70.2
(3)	Shear area, internal threads (Simplified: for d equal to or greater than 0.250 inch)	$AS_n = 3.1416\,D_2\,bsc\,\frac{3LE}{4}$	70.4
(4a)	Shear area, external threads (Min material ext and int threads)	$AS_s\,min = 3.1416\,n\,LE\,D_1\,max\left[\frac{1}{2n} + 0.57735\left(d_2\,min - D_1\,max\right)\right]$	70.2
(4b)		$AS_s\,min = 3.1416\,D_1\,max\left[0.75 - 0.57735n\left(TD_1 + Td_2 + es\right)\right]LE$	70.2
(5)	Shear area, external threads (Simplified)	$AS_s = 3.1416\,d_2\,bsc\,\frac{5}{8}\,LE$	70.4
(6a)	Shear area, external threads (Basic size ext and int threads)	$AS_s\,max = 3.1416\,D_1\,bsc\,\frac{3}{4}\left(\frac{LE}{d\,bsc}\text{ from Fig 2.B.2}\right)d_{bsc}$	70.3
(6b)		$AS_s\,max = 3.1416\,D_1\,bsc\,\frac{3}{4}\,LE$	70.3
(7)	Shear area, combined failure	$AS = 3.1416\,D_2\,bsc\,\frac{LE}{2}$	70.5
(8)	Shear stress area ratio	$R_1 = \frac{\text{Formula (6a) or (6b)}}{\text{Formula (2a) or (2b)}}$	70.7.5
(9)	Material strength ratio	$R_2 = \frac{UTS_n}{UTS_s}$	70.7.5

Notation: d = major diameter, external thread (was D_s)

d_2 = pitch diameter, external thread (was E_s)

D_1 = minor diameter, internal thread (was K_n)

D_2 = pitch diameter, internal thread (was E_n)

es = allowance, external thread (was G)

LE = length of thread engagment (was Le)

n = number of threads per inch

UTS_n = ultimate tensile strength of internally threaded part

UTS_s = ultimate tensile strength of externally threaded part

Td, Td_2, TD_1, TD_2, = tolerance on d, d_2, D_1, D_2 respectively

$\frac{3H}{16}$, 0.1875H = half external thread addendum (tabulated in Table 6 of ANSI B1.1-1982)

bsc, max, min = modifiers denoting basic, maximum and minimum values, respectively

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TABLE II.B.2 FORMULAS FOR SCREW THREAD DESIGN

FORMULA NUMBER	CHARACTERISTIC	FORMULA	REFERENCE PARAGRAPH
(11)	Tensile stress, externally threaded part – pure tension	$S_t = \frac{F}{A_s^{*} \text{ from (1a) or (1b)}}$	70.6
(12)	Combined tensile stress, externally threaded part	$S_t' = S_s' + \frac{S_t}{2}$ with $S_t = \frac{F}{0.7854\left[(d_1 \min)^2 - d_h^2\right]}$ $S_s' = \sqrt{\left(\frac{S_t}{2}\right)^2 + (S_s)^2}$ $S_s = \frac{T \; d_1 \min}{0.1963\left[(d_1 \min)^4 - d_h^4\right]}$	70.6
(13)	Length of engagement based upon combined shear failure of external and internal threads	$LE = \frac{4A_s^{*} \text{ from (1a) or (1b)}}{3.1416\, d_2 \, bsc}$	70.7.3
(14)	Length of engagement based upon shear of external thread	$LE = \frac{2A_s^{*} \text{ from (1a) or (1b)}}{\frac{AS_s \text{ from (4a) or (4b)}}{LE}}$	70.7.4
(15)	Length of engagement based upon developing full tensile strength of external thread with threads at basic size – used with (16)	$LE = \frac{2A_s^{*} \text{ from (1a) or (1b)}}{\frac{AS_s \text{ from (6b)}}{LE}}$	70.7.5
(16)	Length of engagement based upon shear of internal thread $\left(\frac{R_1}{R_2} \text{ is greater than } 1\right)$	$LE = LE \text{ from (15)} \times \frac{R_1 \text{ from (8)}}{R_2 \text{ from (9)}}$	70.7.5

Notes: 1. Where A_s^{*} is indicated, subtract $0.7854 d_h^2$ from A_s for a hollow part.
2. Numbers in parenthesis are formula numbers from Table II and from this table.

Notation $d_1 \min$ = minimum minor diameter, external thread, flat form (was $K_s \min$), inch. In formula (12), $d_1 \min = d_2 bsc - \frac{3}{4}H = d_{bsc} - \frac{1.2990}{n}$.

d_h = hole diameter, externally threaded part, inch. If there is no hole, $d_h = 0$

F = axial load on externally threaded part, lb

S_s = shear stress, psi

S_s' = combined shear stress, psi

T = transmitted wrench torque in threaded section (approximately half of the applied wrench torque), in.-lb.

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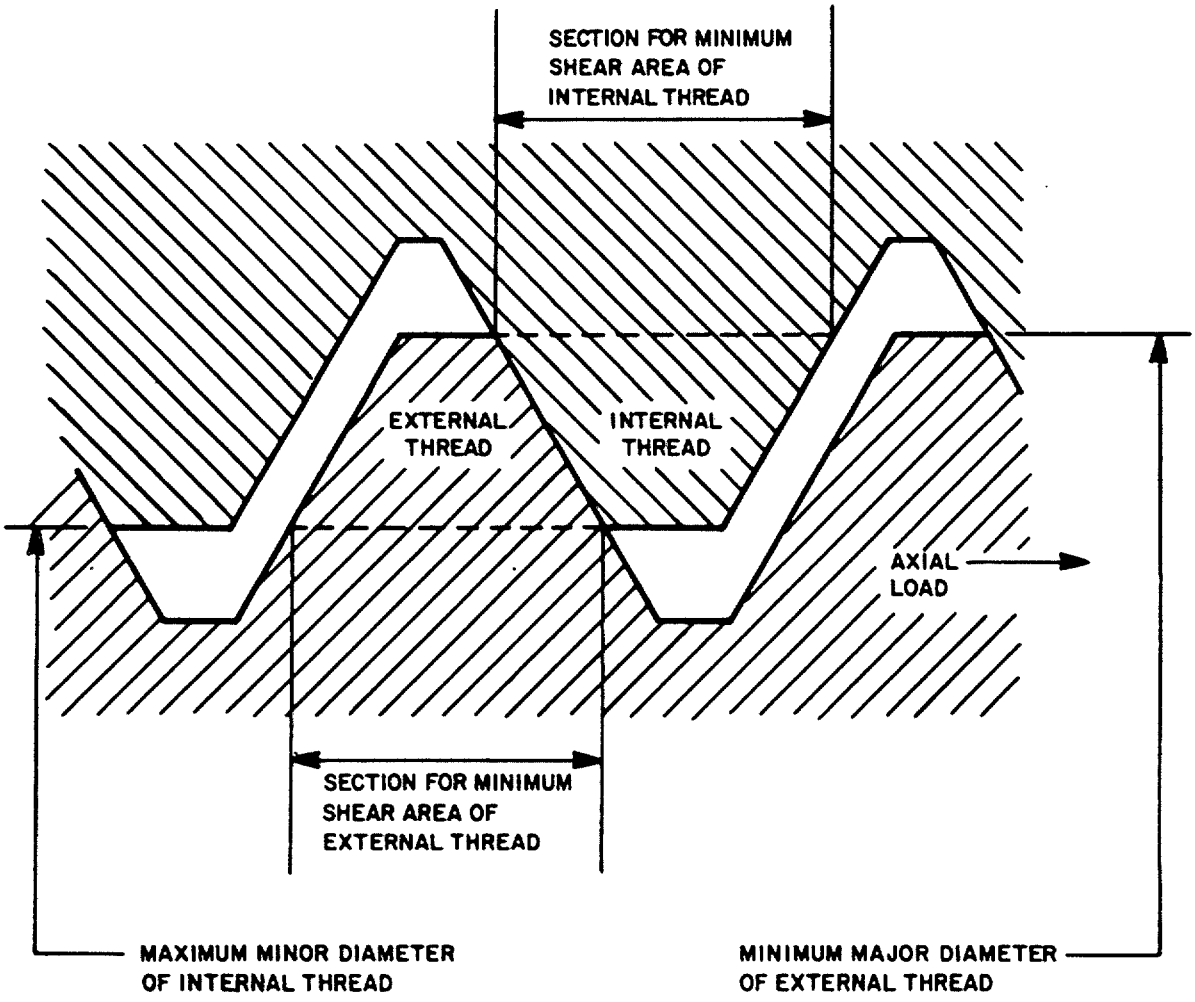

FIGURE 2.B.1 SHEAR AREAS AT MINIMUM MATERIAL

70.3 Shear areas at basic size. The geometric shear area of an external thread at basic size is equal to the area of a basic size thread which is intersected by a cylinder with a diameter equal to the basic minor diameter. Formulas (6a) and (6b) of table II.B.1 are used for calculation. The geometric shear area of an internal thread at basic size is not ordinarily used for calculations.

70.4 Shear area simplified formulas. Formulas (3) and (5) in table II.B.1 are simplified formulas for internal and external thread shear areas. They are based upon empirical data and give shear areas which vary from the geometric minimum material shear areas. In some cases, test data agrees more closely with these simplified formula shear areas than with geometric shear areas.

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70.5 Shear area, combined failure of external and internal threads. When the mating external and internal threads are on parts manufactured from materials of approximately equal strength, failure will usually take place in both threads simultaneously. Thread bending during failure changes the thread geometry in this case so that effective shear area is significantly smaller than those calculated from formulas discussed in 70.2, 70.3 and 70.4 above. Formula (7) in table II.B.1 is an empirical formula which gives an approximate equivalent for this case. Numerically, it describes a failure at the pitch diameter of one of the threads.

70.6 Tensile stress. Formula (11) in table II.B.2 is often used for acceptance of externally threaded fasteners with ultimate tensile strength, yield strength, or some other selected stress level applied to S_t in order to determine the required axial test load. When threads are used in a joint, a tightening torque is applied to overcome friction under a bolt head or nut, to overcome thread friction, and to develop the axial load. This torque results in a shear stress, which when combined with the tensile stress from the axial load, causes an increase in the effective tensile stress. Formula (12) in table II.B.2 describes this situation. Experience has shown that for a solid externally threaded part, the combined stress is generally about 20% greater than the tensile stress calculated from formula (11). Therefore, in this case, the combined stress is often assumed to be $1.2S_t$ or is not considered due to satisfactory experience with the Factor of Safety used.

70.7 Length of engagement, LE.

70.7.1 If failure of a fastening system using standard threaded fasteners should occur it is generally more economical that the externally threaded part will break rather than that either the external or internal thread will strip. In other words, the length of thread engagement should be sufficient to develop the full strength of the screw. Thus, the length of internal thread and the dimensions of this thread, particularly its minor diameter, should be such that, taking into account a possible difference in strength of material of the internal and external threads, the threaded portion of the externally threaded part will break before either the external or internal threads strip. Due to this situation, lengths of engagement formulas are derived from shear formulas with tensile stress area A_s replaced by 2AS because the required area in shear is twice the tensile stress area in order to develop the full strength of the externally threaded part. This relationship is based upon experiments made by the National Bureau of Standards in 1929, in which it was found that for hot-rolled and cold-rolled steel, and brass screws and nuts, this factor varied from 1.7 to 2.0. The effect of combined stress is not taken into account in calculation of LE because the added shear load affects both tensile and shear stresses in approximately the same proportion.

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70.7.2 All formulas for length of engagement, given in table II.B.2 yield approximate values since they are based in part upon shear areas which are not exact due to nut dilation which varies with geometry, friction forces, and material properties. Also, the effectiveness of partial threads, in the countersinks (or chamfers) on the ends of the internal thread, is not always the same. For calculations, approximately half the countersink depth may be considered in the length of engagement. It is advisable that calculations of length of engagement and corresponding load capabilities of a threaded joint be checked by actual tests, for critical joints.

70.7.3 When the externally and internally threaded parts are made from materials of approximately the same strength, required length of engagement in formula (13) of table II.B.2 may be applied. This assumes a combination failure of both threads. See 70.5.

70.7.4 When the strength of the internal thread materially exceeds that of the external thread, required length of engagement in formula (14) of table II.B.2 may be applied. This assumes shear of the external thread and uses the geometric shear area of the minimum external thread. See 70.2. A slightly longer or shorter length of engagement will be indicated if the simplified formula (5) in table II.B.1 is used.

70.7.5 When the strength of the external thread materially exceeds that of the internal thread, required length of engagement in formula (16) of table II.B.2 is used. This is based upon the internal thread stripping load being equal to the nominal external thread stripping load which will develop full strength of the externally threaded part. If R_1/R_2 is less than 1, see 70.7.4 and if approximately equal to 1, see 70.7.3.

70.7.6 For an adjusting or lead screw, or if the connection will be frequently unscrewed, the calculated LE should be increased to allow for the expected wear on the flanks of the threads during the useful life of the components.

70.7.7 For tapped holes in sheet metal, the maximum size of the screw to be specified should be such that the thickness of sheet equals the LE required to develop full strength. In order to use the largest possible screw, it is necessary that the tolerance, TD_1, on the minor diameter of the hole should be the practical minimum. If it should prove to be impracticable to reduce the minor diameter tolerance to such a value, it may be necessary to decrease the minimum minor diameter of the internal thread and to increase the minor diameter tolerance by the same amount. If this is done, the maximum minor diameter of the screw must be reduced by the same amount to prevent interference and the minor diameter of the GO thread ring gage must likewise be decreased, as this is the only control of the minor diameter of the screw. In all such cases, where dimensions are altered from those calculated according to the standard, the threads should be designated as specified in section 6.7 of ANSI B1.1-1982.

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70.7.8 For retaining collars on shafts where the expected axial force resisted by the collar is appreciably less than the tensile force that the shaft itself is capable of resisting, LE need only be long enough to withstand the expected axial force on the collar. If F_c is the axial force to be carried by the collar, UTS_s is the tensile strength of the shaft and UTS_n is the tensile strength of the collar, calculate the required length of engagement from one of the following formulas:

a. Collar thread strip: $$LE = \frac{2F_c}{UTS_n \times \frac{AS_n \text{ from (2a), (2b) or (3)}}{LE}}$$

b. Shaft thread strip: $$LE = \frac{2F_c}{UTS_s \times \frac{AS_s \text{ from (4a), (4b) or (5)}}{LE}}$$

c. Combination thread stripping when $UTS_s = UTS_n$ approximately:

$$LE = \frac{2F_c}{(UTS_s \text{ or } UTS_n) \times \frac{AS \text{ from (7)}}{LE}}$$

Note: Numbers in parenthesis are formula numbers from table II.B.1.

70.7.9 For hollow, thin wall threaded parts as the wall thickness of either or both the internal and external members becomes thin, the tendency of the external member to enlarge and the internal member to neck down in the thread means that an LE greater than given by formula must be used, also that the tolerances on minor diameter of the internal thread and major diameter of the external thread, TD_1 and Td, must be small to obtain the maximum practicable depth of thread engagement. For components having threads on thin-wall tubing, tests under actual working conditions should be made to determine proper selection of wall thicknesses, length of engagement, and pitch of thread.

80. Thread proportions in relation to tapping.

80.1 In the production of threads it is considered impractical to tap a thread unless its nominal diameter is greater than six times the basic thread height; therefore, when the ratio of D to h is less than 6, the use of a larger diameter, a finer pitch of thread, or both, should be considered.

80.2 The size of D_1 is a factor in controlling tap breakage. Tap breakage is infrequent if the diameter of the tap is over 0.5 in or if the length of thread to be tapped is less than 0.5D. For sizes less than 0.5 in and length of thread over 0.5D, tap breakage can be minimized by use of a large D_1, that is TD_1 maximum. However, this means that LE may have to be increased to develop the full strength of the screw.

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90. Examples of thread design.

90.1 Gun barrel thread. A gun barrel is subjected to an internal explosive pressure that produces a tensile stress in the threaded end. The length of engagement of the threads should be sufficient to produce a minimum area in shear on the threads of the screw in line with the minor diameter of the tapped hole threads equal to twice the stress area of the threaded portion of the barrel. Assume that the thread on the barrel is 1.500-8UN-2A and the minimum internal diameter of the barrel at the threaded end is 0.792 inch.

Note: Symbol notation and formula numbers in parenthesis are in accordance with tables II.B.1 and II.B.2.

a. Required length of engagement is found using formula (14) for a hollow part.

$$LE = \frac{2\left(A_s - 0.7854\, d_h^2\right)}{3.1416\, n\, D_1 max\left[\frac{1}{2n} + 0.57735\,(d_2 min - D_1 max)\right]}$$

with $A_s = 0.7854\left(d_{bsc} - \frac{0.9743}{n}\right)^2$. In this case, A_s may be read as 1.492 from table 13 of ANSI B1.1-1982.

$d_h = 0.792$

$n = 8$

$D_1 max = 1.390$ from table 3A of ANSI B1.1-1982

$d_2 min = 1.4093$ from table 3A of ANSI B1.1-1982

b. Calculating from the above yields a required length of engagement of 0.777 inch. By reducing the internal thread minor diameter tolerance by half, the resulting D_1 max is reduced to 1.3775 inches, and the required length of engagement is reduced to 0.714 inch.

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90.2 Screws mounting bracket to cast iron part. The dimension is required for the largest steel cap screw that can be used to hold a bracket on a cast iron body. The tensile strength of the steel is 60,000 psi, the tensile strength of the cast iron 20,000 psi, and the thickness of the cast iron is such that the length of thread engagement cannot exceed 1.750 in. The screws on the top side of the bracket will be in tension.

Note: Symbol notation and formula numbers in parenthesis are in accordance with tables II.B.1 and II.B.2.

a. Since the external thread material is considerably stronger than that of the internal thread material, in accordance with 70.7.5, formula (16) will be used to calculate the length of engagement required. This formula is applied for LE based upon shear of the internal thread. To confirm this assumption, R_1/R_2 should be calculated.

b. R_1 cannot be calculated from formula (8) until a thread size is selected. By definition, however, R_1 is the ratio of external thread shear area to internal thread shear area. An approximation of R_1, can be made by using the simplified formulas for shear areas so

$$\text{Approximate } R_1 = \frac{\text{Formula (5)}}{\text{Formula (3)}} = 0.833$$

c. R_2 is calculated from formula (9).

$$R_2 = \frac{UTS_n}{UTS_s} = \frac{20000}{60000} = 0.333$$

d. From b and c above, $R_1/R_2 = 2.5$ approximately. This value being greater than 1 confirms the use of formula (16) for calculation of length of engagement.

e. From formula (16) it is seen that the length of engagement must be approximately 2.5 times as long as that required if shear in the external thread were the controlling factor. Thus, since the maximum available LE is 1.750 inches, the approximate LE required for the screw to develop full strength is 1.750/2.5 = 0.700 inch.

f. Inasmuch as the hole is tapped in cast iron, a relatively coarse thread would be required, that is UNC or coarser. The most readily available screws would be UNC. Select thread sizes from figure 2.B.2 which yield LE of approximately 0.700 inch. Figure 2.B.2 was developed from formula (15).

For 1"-8UNC, LE/D = 0.594 and LE = 0.594

For $1\frac{1}{8}$-7UNC, LE/D = 0.592 (est.) and LE = 0.656

For $1\frac{1}{4}$-7UNC, LE/D = 0.600 (est.) and LE = 0.750

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g. For a bracket screw, the preferred thread class is 2A so the selected thread is $1\frac{1}{8}$-7UNC-2A for the cap screw. The corresponding hole in the body would have a $1\frac{1}{8}$-7UNC-2B thread.

h. The thread should be checked in accordance with formula (16). Formula (16) may be expressed as follows:

$$LE = \frac{2\,A_s}{3.1416 D_1 min \times \frac{3}{4}} \times \frac{R_1}{R_2}$$

with $A_s = 0.7854 \left(d_{bsc} - \frac{0.9743}{n}\right)^2$. In this case, A_s may be read as 0.763 from table 8 of ANSI B1.1 – 1982.

$D_1 min = 0.970$ from table 3A of ANSI B1.1 – 1982.

$$R_1 = \frac{\text{Formula (6b)}}{\text{Formula (2a)}} = \frac{\frac{3}{4} \times D_1 min}{n\, d min \left[\frac{1}{2n} \times 0.57735 (d min - D_2 max)\right]}$$

$n = 7$

$d min = 1.1064$ from table 3A of ANSI B1.1 – 1982

$D_2 max = 1.0416$ from table 3A of ANSI B1.1 – 1982

so $R_1 = 0.863$

$R_2 = 0.333$ from c above.

i. Calculating from the above yields a required length of engagement of 1.729 inches. This is acceptable since it is less than the maximum available engagement length of 1.750.

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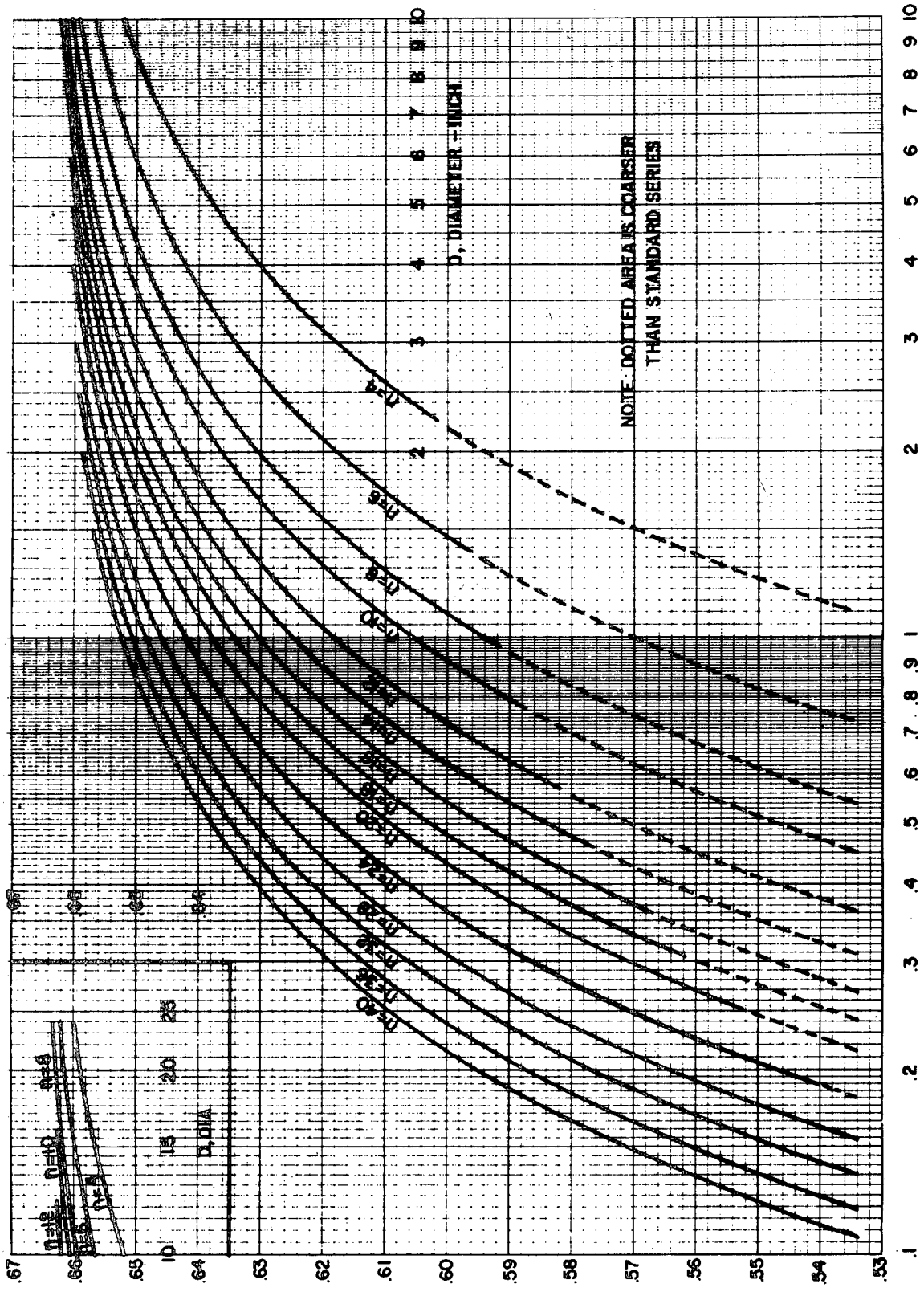

FIGURE 2.B.2 CHART FOR DETERMINING NOMINAL (MINIMUM) LENGTH OF THREAD ENGAGEMENT

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
FED-STD-H28/2A	Unified Inch Screw Threads-UN and UNR Thread Forms

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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