MILITARY SPECIFICATION

SCREW THREADS, CONTROLLED RADIUS ROOT WITH INCREASED MINOR
DIAMETER, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Purpose. This specification is the specification identified in FED-STD-H28/4 and contains the detailed requirements for use in the acquisition of threaded products with controlled root radius screw threads, UNJ symbol. The purpose of this specification is to:

a. Define the geometric requirements for a selected series of Unified Screw Threads, Classes 3A and 3B, of FED-STD-H28/2 modified to control the root radius and increase the minor diameter.

b. Establish requirements for continuous radius at the root of external threads.

c. Establish requirements for an increase in the minor diameter of both internal and external threads to accommodate the root radius.

d. Relate verification requirements to the intended service application of the threaded product.

e. Provide default verification requirements if not otherwise specified.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB, OH 45433-6503 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A   AREA THDS

f. Allow the use of methods of verification found in FED-STD-H28/20 and ANSI/ASME B1.3M.

g. Encourage the use of new or more efficient methods of verification, such as on-line or statistical process controls.

1.2 Use. Threads covered by this specification are recommended for the following applications:

a. Fatigue sensitive applications

b. Strength sensitive applications

c. Physical size and weight sensitive applications

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Standards. The following standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation. (See 2.4.1)

STANDARDS

FEDERAL

FED-STD-H28/1	Nomenclature, Definitions, and Letter Symbols for Screw Threads
FED-STD-H28/2	Unified Inch Screw Threads – UN and UNR Thread Forms
FED-STD-H28/4	Controlled Radius Root Screw Threads, UNJ Symbol
FED-STD-H28/6	Gages and Gaging for Unified Screw Threads
FED-STD-H28/20	Inspection Method for Acceptability of UN, UNR, UNJ, M and MJ Screw Threads

2.2 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS specified in the solicitation. (See 2.4.2)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI/ASME B1.2	Gages and Gaging for Unified Inch Screw Threads
ANSI/ASME B1.3M	Screw Thread Gaging System for Dimensional Acceptability-Inch and Metric Screw Threads (UN, UNB, UNJ and MJ)
ANSI/ASME B1.7M	Nomenclature, Definitions, and Letter Symbols for Screw Threads
ANSI/ASME B46.1	Surface Texture (Surface Roughness, Waviness, and Lay

2.3 <u>Order of precedence</u>. In the event of a conflict between the text of this document and the reference cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.4 <u>Sources of documents</u>

2.4.1 <u>Military specifications and standards</u>. Copies of the referenced federal and military specifications and standards are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094. For specific acquisition functions, these documents should be obtained from the contracting activity or as directed by the contracting activity.

2.4.2 <u>Sources for non-government publications</u>. Copies of ANSI and ANSI/ASME documents may be purchased from the American National Standards Institute Inc., 1430 Broadway, New York, NY 10018.

3. REQUIREMENTS

3.1 <u>Thread application categories</u>. Thread application categories shall be determined and specified in either the thread designation, a general note, referenced document or the purchase order for the threaded product made in accordance with this specification. These application categories determine the level of inspection requirements. The application categories are "Safety Critical Threads" (6.2.9) and "Other Threads" (see 6.2.7). The results of Durability and Damage Tolerance Analyses (DADTA), Failure Modes Effects and Criticality Analyses (FMECA) and critical parts

identification will provide the basis for determining the application category of these threads. See figure 1 for a typical selection process for determining the application category of a threaded product. "Safety Critical" designations shall be approved by the Military Engineering cognizant activity for the weapon system. In those cases where identification of a category is not feasible, for example, replacement of bench stock, the application category shall be "Other Threads."

3.2 <u>Thread series</u>. The two series of threads recognized by this specification are standard UNJ and special UNJ. The use of standard UNJ threads shall be given first consideration in the design of new equipment. Within standard UNJ threads, the use of fine threads (table III) shall be given preference to facilitate the maximum usage of a limited number of threads. The use of special UNJ threads in new equipment designs shall be justified by the designer when requested by the procuring activity. Terms for characteristics of thread shall be as defined in Section 6 herein and by FED-STD-H28/1 and ANSI/ASME B1.7M.

3.2.1 <u>Standard UNJ series</u>. The standard UNJ series of threads consists of three series with graded pitches (coarse, fine, and extra fine) and three series with constant pitches (8, 12, and 16 threads per inch). Standard UNJ threads shall be selected from those with diameter-pitch combinations listed in tables II through VII.

3.2.2 <u>Special UNJ series</u>. The special UNJ series of threads consists of all controlled root radius threads with combinations of diameter and pitch that are not included in the above standard UNJ series.

3.3 <u>Designations.</u> The threads described herein shall be designated in the following manner indicating the nominal diameter, number of threads per inch, thread series symbol (that is, thread form, controlled root radius symbol, and thread series), thread class including external "A" or internal "B" thread symbol and application category. The identifying letter "J" in the thread series symbol is restricted to use in the designation of threads defined by this specification. Reference to MIL-S-8879 shall be made in either the thread designation, a general note, or in a reference document.

3.3.1 <u>Standard UNJ thread designations</u>. Threads selected from the standard UNJ series shall be designated in the following manner:

<u>Example</u>

<u>External thread</u>:

    0.2500-28 UNJF-3A Safety Critical Thread
    MIL-S-8879

    0.2500-28 UNJF-3A Other Thread
    MIL-S-8879

<u>Internal thread</u>:

    0.2500-32 UNJEF-3B Safety Critical Thread
    MIL-S-8879

0.2500-32 UN J EF 3 B Safety Critical Thread

- Application category see 3.1
- Internal thread } Thread class
- Class of fit
- Extra fine thread
- Controlled root radius symbol } Thread series
- Unified thread form
- Number of threads per inch
- Nominal diameter
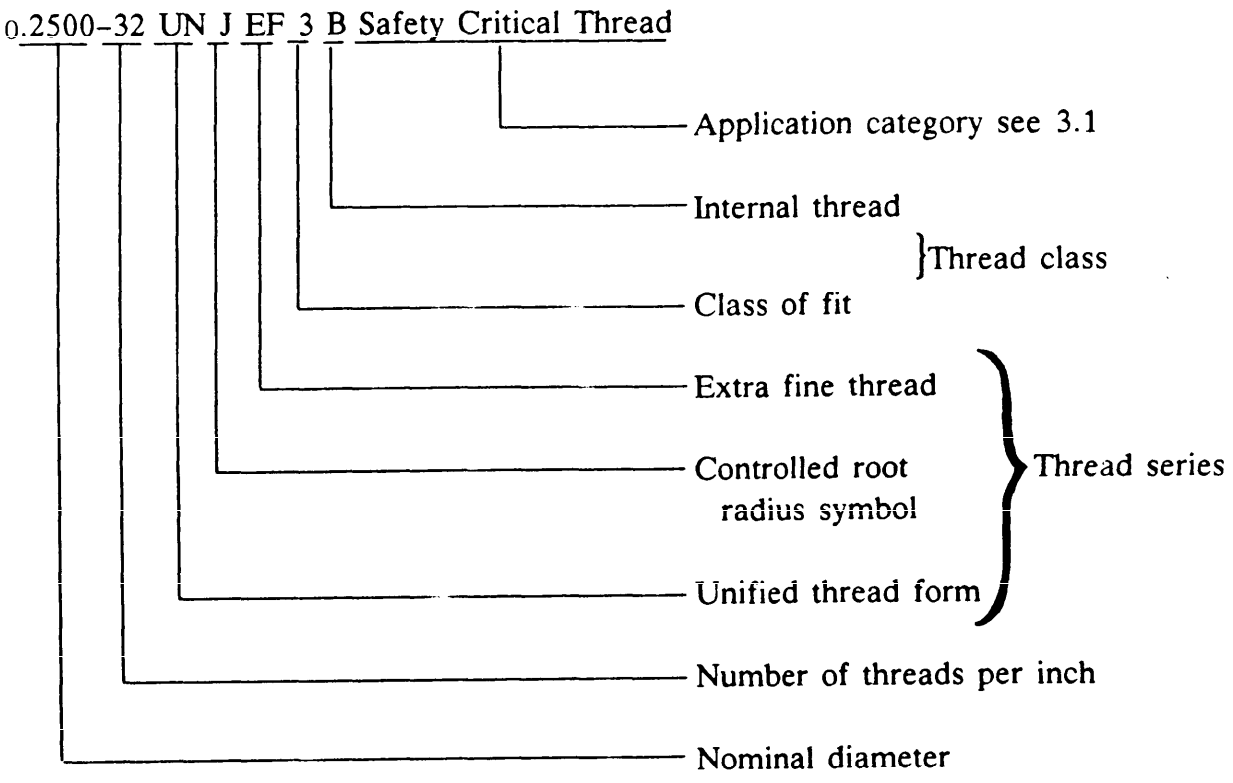
3.3.2 Special UNJ thread designations. The identifying letter "S" shall be included in the thread series symbol to indicate a special thread. Special diameter-pitch combinations developed in accordance with this specification shall be designated in the following manner:

Example

External thread:

8.750 – 8 UNJS-3A Safety Critical Thread

Major diameter	8.735 to 8.750
Pitch diameter	8.6625 to 8.6688
Minor diameter	8.5918 to 8.6056
Root radius	0.0188 to 0.0226
MIL-S-8879	

Internal thread:

8.750 – 8 UNJS-3B Other Thread

Major diameter	8.750 MIN
Pitch diameter	8.6688 to 8.6769
Minor diameter	8.6283 to 8.6433
MIL-S-8879	

3.4 Thread characteristics

3.4.1 Thread data

3.4.1.1 Basic thread data. The basic thread data for threads with standard pitches shall be in accordance with table I.

3.4.1.2 Standard UNJ thread data. Threads, in accordance with this specification, shall be within the limits of size specified in tables II through VII, for the diameter-pitch combinations shown therein. Characteristics shall include pitch diameter size, major diameter size and minor diameter size. "GO" functional diameter size must be within pitch diameter limits.

3.4.1.3 <u>Special UNJ thread data</u>. Dimensions for threads of special diameter pitch combinations shall be computed from the formulas in table VIII.

3.4.2 <u>External threads</u>. External threads shall be of the Unified form, in accordance with FED-STD-H28/2 and ANSI/ASME B1.1 (class 3A), altered at the root so that the flanks of the adjacent threads are joined by one continuous smoothly blended curve tangent to the flanks at a thread depth of 9H/16, where H is the height of the sharp V thread. The root radius (radius of curvature) tangent to the flanks shall be between 0.18042 pitch and 0.15011 pitch (see figures 2 and 4).

3.4.3 <u>Internal threads</u>. The internal threads shall be of the Unified form, in accordance with FED-STD-H28/2 and ANSI/ASME B1.1 (class 3B), modified at the minor diameter to the values given in tables II through VII (see figures 3 and 4).

3.4.4 <u>Length of engagement and tolerances</u>. The length of engagement for UNJC, UNJF, and 8UNJ series threads upon which their specified tolerances are based is equal to the basic major diameter. These tolerances are applicable for lengths of engagement of these threads of 1.0 to 1.5 times the basic major diameter. The length of engagement for UNJEF, 12UNJ, and 16UNJ series threads upon which their specified tolerances are based is equal to 9 pitches. These tolerances are applicable for lengths of engagement of these threads of 5 to 15 pitches.

3.4.5 <u>Variations</u>. The combined effect of variations in the following characteristics shall not result in exceedance of the pitch diameter tolerance.

3.4.5.1 <u>Pitch diameter</u>. No portion of the complete thread shall be permitted to project beyond the envelope defined by the maximum-material limits on the one hand, or beyond that defined by the minimum-material limits on the other, and thus be outside of the tolerance zone specified.

3.4.5.2 <u>Lead and flank angle</u>. The lead shall be the number of thread starts divided by the number of threads per inch. The flank angle shall be 30 degrees. The diameter equivalent of variations in lead (including helix variations), or flank angle, shall not exceed 0.4 of the total pitch diameter tolerance for each element individually.

3.4.5.3 Circularity (roundness). (See 6.2.1). The product screw thread pitch diameter shall be circular within a tolerance zone of one half the pitch diameter tolerance where pitch diameter tolerance is less than 0.004 inch. Where pitch diameter tolerance is 0.004 inch or larger, the tolerance zone is 0.002 inch. When circularity is checked using pitch diameter indicating gage segments or rolls, the circularity tolerance is equal to one half the difference between maximum and minimum pitch diameter readings. Threads 1.5000 inches and larger with 16 threads per inch or less may exceed the tolerance by 0.002 inch over a maximum arc of 15 degrees, in the direction of minimum material in this area provided that this overcut does not result in raised material on the thread flanks or roots. The tolerance shall fall within the pitch diameter tolerance except above the 15 degree arc.

3.4.5.4 Taper. Taper of the pitch diameter based on the length of engagement in 3.4.4 shall be within 0.4 of the pitch diameter tolerance.

3.4.6 Incomplete threads. Unless otherwise specified, the runout threads on externally threaded parts shall be no less than one nor more than two pitches in length. The threads shall run out onto the shank, eliminating any abrupt change in cross sectional area. The root of the runout threads shall be radiused. The radius, as it approaches the unthreaded portion of the shank, shall be no less than the radius of the full thread portion.

3 4.6.1 Lead threads. Unless otherwise specified, the entering end of external threads and the entering end of internal threads may be outside the specified limits of size for a length not to exceed two pitches, including chamfer. In no case shall the lead threads exceed the maximum material limit of size specified herein.

3.4.7 Material limits for coated/plated threads. When externally threaded parts are to be coated/plated the minimum pitch diameter shall not be reduced by more than 0.001 inch on all threads for which the pitch diameter tolerance specified herein does not exceed 0.0035 inch. For threaded parts for which the pitch diameter tolerance specified herein is greater than 0.0035 inch, the minimum pitch diameter may be reduced by an amount equal to 0.3 times the pitch diameter tolerance but not more than 0.0015 inch. All external thread elements shall be within the adjusted tolerance before coating. Internal thread to be coated/plated may be increased by the same amount permitted for external threads. All internal thread elements shall be within the adjusted tolerance before coating. The material limits for coated/plated threads shall be the same material limits as required in this specification for uncoated/unplated threads.

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3.4.7.1 <u>Coating threads with solid film lubricant</u>. External thread to be coated with solid film lubricant shall not have the minimum pitch diameter reduced by more than 0.001 inch. Internal thread to be coated with solid film lubricant shall not have the maximum pitch diameter increased by more than 0.001 inch. The variation in pitch diameter to accommodate solid film lubricant is not in addition to that specified in 3.4.7 if another coating is applied before the solid film lubricant. The solid film lubricant may be removed for gaging. The parts shall be recoated with solid film lubricant prior to restocking or usage.

3.4.8 <u>Runout</u>. (See 6.2.8). The circular runout of the external thread major diameter cylinder and internal thread minor diameter cylinder with the pitch diameter cylinder shall not exceed twice the pitch diameter tolerance.

3.4.9 <u>Surface roughness</u>. Unless otherwise specified on the drawing, product specification, or specification sheet, the surface roughness of the thread flanks, roots or crests shall be no greater than 63 microinches R_a for external threads and 100 microinches R_a for internal threads in accordance with ANSI/ASME B46.1.

4. VERIFICATION

4.1 <u>Responsibility for inspection</u>. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 <u>Responsibility for compliance</u>. All items shall be meet the requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the government for acceptance shall comply with all requirements of the contract. Sampling inspections, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements. However, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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4.2 <u>Application category requirements verification</u>. Drawings, product specifications and specification sheets applicable for the acquisition and use of screw threads shall be inspected/reviewed for accuracy and conformation of adherence to the the requirements of 3.1. Verification requirements shall be selected as appropriate for the application category. If the verification requirements are not specified, the requirements of paragraph 4.4.1.1 shall apply.

4.3 <u>Thread series and designations verification</u>. Drawings, product specifications and specification sheets applicable for the acquisition and use of screw threads shall be inspected/reviewed for accuracy and confirmation of adherence to the requirements of 3.2 and subparagraphs theretoand subparagraphs thereto regarding identification and call-out of the appropriate thread series and of 3.3 and subparagraph thereto regarding identification and call-out of the appropriate thread designations.

4.4 <u>Thread characteristics verification</u>. Drawings, product specifications and specification sheets applicable for the acquisition and use of screw threads as well as the threaded products themselves shall be inspected/reviewed for accuracy and confirmation of adherence to the requirement of 3.4 and subparagraphs therefore regarding thread characteristics. Unless otherwise specified in the drawing, product specification, or specification sheet, products having threads in accordance with this specification shall be inspected for dimensional conformance as stated herein.

4.4.1 <u>Lot quantities</u>. The quantities inspected for each lot shall be as specified for the application categories of 3.1, except as superseded by drawing, product specification or specification sheet.

<u>Application Category</u>	<u>Quantities</u>
Safety Critical Thread	Nondestructive thread inspection of each piece part.
	Destructive thread inspection of each lot by sampling as specified in the contract or purchase order.
Other Thread [1]	Nondestructive thread inspection of each lot by sampling as specified in the contract or purchase order.

[1] Includes threads for which the application category has not been specified or cannot be feasibly determined.

4.4.2 Application category verification inspections. Screw threads shall be inspected to ensure their ability to assemble with mating parts and shall be measured to ensure dimensional compliance with characteristics that are selected based on application category.

4.4.2.1 When characteristics are not specified on the drawing, product specification, or specification sheet, parts shall be inspected for the following characteristics based on application category:

Application Category	Inspection
Safety Critical Thread Thread	"GO" functional diameter size 1/ Pitch diameter size 1/ Major diameter size (external threads only) Minor diameter size Root radius (external threads only) Flank angle 1/ Lead (including helix variations) 1/ Circularity Taper Runout Surface roughness
Other Thread 3/	"GO" functional diameter 2/ Pitch diameter size Major diameter size (external threads only) Minor diameter size 2/ Root radius (external threads only)

1/ If the differential between "GO" functional size and pitch diameter size does not exceed 0.4 of the pitch diameter tolerance, inspection of flank angle and lead (including helix variations) is not necessary.

2/ For tapped holes with internal threads of nominal size less than 0.190 inches, only the functional diameter limit and the minor diameter limit inspections are to be performed.

3/ Includes threads for which the application category has not been specified or cannot be feasibly determined.

NOTE: For product manufactured prior to March 1993, when the pitch diameter size of functional diameter inspections cannot be accomplished on the completed screw thread because of a configuration change to the threads, acceptance shall be based on performance requirements only. Product manufactured after March 1993, when the pitch diameter size or functional diameter inspections cannot be accomplished on the completed screw thread because of a configuration change to the threads, shall meet the requirements of 4.4.2.1.1.

4.4.2.1.1 When the pitch diameter size or functional size measurement cannot be accomplished on a completed screw threads product because of a configuration change to the threads (e.g. deformation, slots, self locking devices), the screw threads shall be measured at the point of manufacture prior to the configuration change. The inspection shall be in accordance with the requirements based on the application category.

4.4.3 Methods of inspection. All methods of measuring the characteristics of thread forms presented in FED-STD-H28/20, ANSI/ASME B1.3M, and new or more effective methods are acceptable so long as they can be demonstrated to show and assure conformance of the threads to the requirements of this specification and drawings, product specifications, or specification sheets supporting or derived from this specification. Gages shall meet the requirements of FED-STD-H28/6, ANSI/ASME B1.2 and FED-STD-H28/20; new or more effective methods are acceptable. Buyer approved on-line or statistical process controls may be used.

5. PACKAGING

5.1 Packaging. Each safety critical thread shall be protected during shipment and storage in accordance with the product specification. Other threads shall be protected as specified in the drawing, product specification or specification sheet.

6. INFORMATION FOR GUIDANCE ONLY

6.1 <u>Clarification</u>. The following comments are intended to clarify subjects related to this specification and are not to be construed as screw thread requirements, per se.

6.1.1 <u>Inspection methods</u>. Inspection methods A, B and C have been eliminated. For new inspection criteria Safety Critical and Other application categories apply.

6.1.2 <u>Preferred selection</u>. Due to limitations in the ability to verify some characteristics, internal threads of nominal size 0.190 inches and less should not be selected for safety critical applications.

6.1.3 <u>Use of unified thread tools and gages</u>. The following UN form tools and gages may be used for UNJ threads covered by this specification:

a. Taps and thread gages for Class 3B.

b. Threaded gages for Class 3A except crest truncation of maximum material thread gage must be increased to 0.3125p flat.

6.1.4 <u>Calibration of gages</u>. Gages used for demonstrating compliance should be calibrated in accordance with MIL-STD-45662 or FED-STD-H28/20.

6.2 <u>Definitions</u>. For terms, symbols and data not defined or specified herein, see FED-STD-H28/1 and ANSI/ASME B1.7M.

6.2.1 <u>Circularity (roundness)</u>. Circularity or roundness of threads is defined as one-half the variation in pitch diameter of a screw thread around the circumference of the pitch cylinder. This definition differs from that of circularity (roundness) in ANSI Y14.5M which pertains to radial variation. The following roundness terms are used in screw thread gaging practice:

a. <u>Roundness, oval (2 point)</u>. One-half the difference between maximum and minimum pitch diameters over 180 degrees of the pitch cylinder circumference.

b. <u>Roundness, multilobe (3 point)</u>. One-half the difference between maximum and minimum variations in the positions of one side of an equiangle triangle which envelopes the pitch cylinder and the theoretical positions of that side, as this enveloping triangle is rotated around the circumference of the pitch cylinder.

6.2.2 <u>Coating</u>. Coating is one or more applications of additive finish of any material including solid film lubricants, but not including soft or liquid lubricant.

6.2.3 <u>Durability and damage tolerance analysis, (DADTA)</u>. An analysis performed to determine the growth of flaws, cracks, and other damage in the structure versus time.

6.2.4 <u>Failure modes effects and criticality analysis, (FMECA)</u>. An analysis performed to determine the various ways the structure or components of the system can fail and the effects of those failures on the capability of the system.

6.2.5 <u>"GO" functional diameter size</u>. The "GO" functional diameter size is the quantitative measurement of the functional diameter which is defined in ANSI/ASME B1.7M.

6.2.5.1 <u>"NOT GO" functional diameter</u>. The pitch diameter of an enveloping thread at the minimum material condition, with perfect form but reduced thread height, in accordance with the applicable gage standard.

6.2.6 <u>Pitch diameter size</u>. The pitch diameter size is the diameter of the cylinder (concentric with and parallel to the axis of the product) that passes through the thread profile of either a product's internal or external screw thread in such a manner as to make the width of the thread ridge and thread groove equal.

6.2.7 <u>Other threads</u>. An application in which thread failure is not safety critical. The designer specifies which characteristics are inspected and verified.

6.2.8 <u>Runout</u>. As applied to screw threads, this term refers to circular runout of the major cylinder (for external threads) or the minor cylinder (for internal threads) respect to the pitch cylinder. Circular runout, in accordance with ANSI Y14.5M, controls cumulative variations due to eccentricity and out-of-roundness. The amount of runout is usually expressed in terms of full indicator movement (FIM).

6.2.9 <u>Safety critical threads</u>. An application in which failure of the thread itself, for the purpose of this specification, would result in hazardous and unsafe conditions. The designer specifies which characteristics are inspected and verified.

6.2.10 <u>Thread series</u>. Thread series are groups of diameter and pitch combinations distinguished from each other by the number of threads per inch applied to specific diameters.

6.3 <u>Class 3BG</u>. Class 3BG for high temperature applications shall no longer be used in new designs. This special class provided an allowance of internal threads of 0.003 inch for 32 threads per inch and coarser and 0.001 inch for finer pitch threads.

6.4 <u>Key words</u>

Screw threads
Controlled radius root
Fatigue sensitive applications
Strength sensitive applications
Physical size and weight sensitive applications
Safety critical threads
Other threads
"GO" functional diameter
Pitch diameter
Major diameter
Minor diameter
UNJ screw threads
UNJS screw threads

6.5 <u>Responsible engineering office</u>. The responsible engineering office (REO) for development and technical maintenance of this specification is ASD/ENFSS Wright-Patterson AFB OH 45433-6503. Requests for additional information or assistance on this specification can be obtained from W. Torrey, ASD/ENFSS, Wright-Patterson AFB OH 45433-6503, AUTOVON 785-5471, Commercial (513) 255-5471. Any information obtained relating to Government contracts must be obtained through contracting officers.

6.6 <u>Changes from previous issue</u>. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
  Army - AR
  Navy - AS
  Air Force - 11

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  Navy - SH
  DISC - IS

Users:
  Army - AT, ME

Preparing activity:
  Air Force - 11

Project No. THDS-0067

TABLE I. Basic thread data

Threads per inch n	Pitch $p = 1/n$	Truncation of internal thread crest $\frac{5H}{16} = 0.27063p$	Flat at internal thread root and external thread crest $\frac{P}{8} = 0.125p$	Height of sharp V thread $H = 0.866025p$	Truncation of internal thread root and external thread crest $\frac{H}{8} = 0.10825p$	Minimum root radius $0.15011p$	Height from sharp "V" to external thread root and max. root radius $\frac{5H}{24} = 0.18042p$	Half addendum of external thread $\frac{3H}{16} = 0.16238p$	Flat at internal thread crest $\frac{5p}{16} = 0.3125p$
1	2	3	4	5	6	7	8	9	10
80	0.012500	0.00338	0.00156	0.010825	0.00135	0.0019	0.00226	0.00203	0.00391
72	0.013889	0.00376	0.00174	0.012028	0.00150	0.0021	0.00251	0.00226	0.00434
64	0.015625	0.00423	0.00195	0.013532	0.00169	0.0023	0.00282	0.00254	0.00488
56	0.017857	0.00483	0.00223	0.015465	0.00193	0.0027	0.00322	0.00290	0.00558
48	0.020833	0.00564	0.00260	0.018042	0.00226	0.0031	0.00376	0.00338	0.00651
44	0.022727	0.00615	0.00284	0.019682	0.00246	0.0034	0.00410	0.00369	0.00710
40	0.025000	0.00677	0.00312	0.021651	0.00271	0.0038	0.00451	0.00406	0.00781
36	0.027778	0.00752	0.00347	0.024056	0.00301	0.0042	0.00501	0.00451	0.00868
32	0.031250	0.00846	0.00391	0.027063	0.00338	0.0047	0.00564	0.00507	0.00977
28	0.035714	0.00967	0.00446	0.030929	0.00387	0.0054	0.00644	0.00580	0.01116
24	0.041667	0.01128	0.00521	0.036084	0.00451	0.0063	0.00752	0.00677	0.01302
20	0.050000	0.01353	0.00625	0.043301	0.00541	0.0075	0.00902	0.00812	0.01562
18	0.055556	0.01504	0.00694	0.048113	0.00601	0.0083	0.01002	0.00902	0.01736
16	0.062500	0.01691	0.00781	0.054127	0.00677	0.0094	0.01128	0.01015	0.01953
14	0.071429	0.01933	0.00893	0.061859	0.00773	0.0107	0.01289	0.01160	0.02232
13	0.076923	0.02082	0.00962	0.066617	0.00833	0.0115	0.01388	0.01249	0.02404
12	0.083333	0.02255	0.01042	0.072169	0.00902	0.0125	0.01503	0.01353	0.02604
11	0.090909	0.02460	0.01136	0.078730	0.00984	0.0136	0.01640	0.01476	0.02841
10	0.100000	0.02706	0.01250	0.086603	0.01083	0.0150	0.01804	0.01624	0.03125
9	0.111111	0.03007	0.01389	0.096225	0.01203	0.0167	0.02005	0.01804	0.03472
8	0.125000	0.03383	0.01562	0.108253	0.01353	0.0188	0.02255	0.02030	0.03906
7	0.142857	0.03866	0.01786	0.123718	0.01546	0.0214	0.02577	0.02320	0.04464
6	0.166667	0.04510	0.02083	0.144338	0.01804	0.0250	0.03007	0.02706	0.05208
5	0.200000	0.05413	0.02500	0.173205	0.02165	0.0300	0.03608	0.03248	0.06250
4.5	0.222222	0.06014	0.02778	0.192450	0.02406	0.0334	0.04009	0.03608	0.06944
4	0.250000	0.06766	0.03125	0.216506	0.02706	0.0375	0.04510	0.04059	0.07812

TABLE 1. Basic thread data – (Continued)

Addendum of external thread $\frac{3H}{8} = 0.32476p$	Height of internal thread and depth of thread engagement $\frac{9H}{16} = 0.48714p$	Height of external thread $\frac{2H}{3} = 0.57735p$	Twice the external thread addendum $\frac{3H}{4} = 0.649519p$	Difference between max-major and pitch diameters of internal thread $\frac{11H}{12} = 0.79386p$	Double Height of internal thread $\frac{9H}{8} = 0.97428p$	Double Height of external thread $\frac{4H}{3} = 1.1547p$	Difference between max. pitch dia. and max. minor diameter external thread $\frac{7H}{12} = 0.50518p$	Difference between min. pitch dia. and min. minor diameter of external thread $.6533H = 0.56580p$	Maj Dia Tolerance $.06\sqrt[3]{p^2}$
11	12	13	14	15	16	17	18	19	20
0.00406	0.00609	0.00722	0.008119	0.00992	0.01218	0.01443	0.00631	0.00707	0.0032
0.00451	0.00677	0.00802	0.009021	0.01103	0.01353	0.01604	0.00702	0.00786	0.0035
0.00507	0.00761	0.00902	0.010149	0.01240	0.01522	0.01804	0.00789	0.00884	0.0038
0.00580	0.00870	0.01031	0.011599	0.01418	0.01740	0.02062	0.00902	0.01010	0.0041
0.00677	0.01015	0.01203	0.013532	0.01654	0.02030	0.02406	0.01052	0.01179	0.0045
0.00738	0.01107	0.01312	0.014762	0.01804	0.02214	0.02624	0.01148	0.01286	0.0048
0.00812	0.01218	0.01443	0.016238	0.01985	0.02436	0.02887	0.01263	0.01414	0.0051
0.00902	0.01353	0.01604	0.018042	0.02205	0.02706	0.03208	0.01403	0.01572	0.0055
0.01015	0.01522	0.01804	0.020297	0.02481	0.03045	0.03608	0.01579	0.01768	0.0060
0.01160	0.01740	0.02062	0.023197	0.02835	0.03480	0.04124	0.01804	0.02021	0.0065
0.01353	0.02030	0.02406	0.027063	0.03308	0.04060	0.04811	0.02105	0.02358	0.0072
0.01624	0.02436	0.02887	0.032476	0.03969	0.04871	0.05774	0.02526	0.02829	0.0081
0.01804	0.02706	0.03208	0.036084	0.04410	0.05413	0.06415	0.02807	0.03143	0.0087
0.02030	0.03045	0.03608	0.040595	0.04962	0.06089	0.07217	0.03157	0.03536	0.0094
0.02320	0.03480	0.04124	0.046394	0.05670	0.06959	0.08248	0.03608	0.04041	0.0103
0.02498	0.03747	0.04441	0.049963	0.06107	0.07494	0.08882	0.03886	0.04352	0.0108
0.02706	0.04059	0.04811	0.054127	0.06615	0.08119	0.09622	0.04210	0.04715	0.0114
0.02952	0.04429	0.05249	0.059047	0.07217	0.08857	0.10497	0.04593	0.05144	0.0121
0.03248	0.04871	0.05774	0.064952	0.07939	0.09743	0.11547	0.05052	0.05658	0.0129
0.03608	0.05413	0.06415	0.072169	0.08821	0.10825	0.12830	0.05613	0.06287	0.0139
0.04059	0.06089	0.07217	0.081190	0.09923	0.12178	0.14434	0.06315	0.07072	0.0150
0.04639	0.06959	0.08248	0.092788	0.11341	0.13918	0.16496	0.07217	0.08083	0.0164
0.05413	0.08119	0.09623	0.108253	0.13231	0.16238	0.19245	0.08420	0.09430	0.0182
0.06495	0.09743	0.11547	0.129904	0.15877	0.19486	0.23094	0.10104	0.11316	0.0205
0.07217	0.10825	0.12830	0.144338	0.17641	0.21651	0.25660	0.11226	0.12573	0.0220
0.08119	0.12178	0.14434	0.162380	0.19846	0.24357	0.28868	0.12630	0.14145	0.0238

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TABLE II. Coarse thread series.

BASIC SIZE		THDS PER INCH	EXTERNAL THREAD – UNJF CLASS 3A								INTERNAL THREAD – UNF CLASS 3B				
			MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		ROOT RADIUS		MINOR DIAMETER		PITCH DIAMETER		MAJOR DIA
PRIMARY	SECONDARY		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	0.0730	64	0.0692	0.0730	0.0614	0.0629	0.0526	0.0550	0.0023	0.0028	0.0578	0.0619	0.0629	0.0648	0.0730
0.0860		56	0.0819	0.0860	0.0728	0.0744	0.0627	0.0654	0.0027	0.0032	0.0686	0.0732	0.0744	0.0765	0.0860
	0.0900	48	0.0945	0.0990	0.0838	0.0855	0.0720	0.0750	0.0031	0.0038	0.0787	0.0841	0.0855	0.0877	0.0990
0.1120		40	0.1069	0.1120	0.0939	0.0958	0.0798	0.0832	0.0038	0.0045	0.0877	0.0942	0.0958	0.0982	0.1120
0.1250		40	0.1199	0.1250	0.1069	0.1088	0.0928	0.0962	0.0038	0.0045	0.1007	0.1072	0.1088	0.1113	0.1250
0.1380		32	0.1320	0.1380	0.1156	0.1177	0.0979	0.1019	0.0047	0.0056	0.1076	0.1157	0.1177	0.1204	0.1380
0.1640		32	0.1580	0.1640	0.1415	0.1437	0.1238	0.1279	0.0047	0.0056	0.1336	0.1417	0.1437	0.1465	0.1640
0.1900		24	0.1828	0.1900	0.1604	0.1629	0.1368	0.1418	0.0063	0.0075	0.1494	0.1600	0.1629	0.1661	0.1900
	0.2160	24	0.2088	0.2160	0.1863	0.1889	0.1627	0.1678	0.0063	0.0075	0.1754	0.1852	0.1889	0.1922	0.2160
0.2500		20	0.2419	0.2500	0.2147	0.2175	0.1864	0.1922	0.0075	0.0090	0.2013	0.2121	0.2175	0.2211	0.2500
0.3125		18	0.3038	0.3125	0.2734	0.2764	0.2420	0.2483	0.0083	0.0100	0.2584	0.2690	0.2764	0.2803	0.3125
0.3750		16	0.3656	0.3750	0.3311	0.3344	0.2957	0.3028	0.0094	0.0113	0.3142	0.3251	0.3344	0.3387	0.3750
0.4375		14	0.4272	0.4375	0.3876	0.3911	0.3472	0.3550	0.0107	0.0129	0.3680	0.3795	0.3911	0.3957	0.4375
0.5000		13	0.4891	0.5000	0.4463	0.4500	0.4028	0.4111	0.0115	0.0139	0.4251	0.4368	0.4500	0.4548	0.5000
0.5625		12	0.5511	0.5625	0.5045	0.5084	0.4574	0.4663	0.0125	0.0150	0.4814	0.4914	0.5084	0.5135	0.5625
0.6250		11	0.6129	0.6250	0.5619	0.5660	0.5105	0.5201	0.0136	0.0164	0.5365	0.5474	0.5660	0.5714	0.6250
0.7500		10	0.7371	0.7500	0.6806	0.6850	0.6240	0.6345	0.0150	0.0180	0.6526	0.6646	0.6850	0.6907	0.7500
0.8750		9	0.8611	0.8750	0.7981	0.8028	0.7352	0.7467	0.0167	0.0200	0.7668	0.7801	0.8028	0.8089	0.8750
1.0000		8	0.9850	1.0000	0.9137	0.9188	0.8430	0.8556	0.0188	0.0226	0.8783	0.8933	0.9188	0.9254	1.0000
1.1250		7	1.1086	1.1250	1.0268	1.0322	0.9460	0.9600	0.0214	0.0258	0.9859	1.0030	1.0322	1.0393	1.1250
1.1250		7	1.2336	1.2500	1.1517	1.1572	1.0709	1.0850	0.0214	0.0258	1.1109	1.1280	1.1572	1.1644	1.12500
1.3750		6	1.3568	1.3750	1.2607	1.2667	1.1664	1.1825	0.0250	0.0301	1.2127	1.2327	1.2667	1.2745	1.3750
1.5000		6	1.4818	1.5000	1.3856	1.3917	1.2913	1.3075	0.0250	0.0301	1.3377	1.3577	1.3917	1.3996	1.5000
1.7500		5	1.7295	1.7500	1.6134	1.6201	1.5002	1.5191	0.0300	0.0361	1.5552	1.5792	1.6201	1.6288	1.7500

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TABLE II. Coarse thread series – (Continued)

BASIC SIZE		THDS PER INCH	EXTERNAL THREAD - UNJF CLASS 3A								INTERNAL THREAD - UNJF CLASS 3B				MAJOR DIA
			MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		ROOT RADIUS		MINOR DIAMETER		PITCH DIAMETER		
PRIMARY	SECONDARY		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2.0000		4.5	1.9780	2.0000	1.8486	1.8557	1.7229	1.7434	0.0334	0.0401	1.7835	1.8102	1.8557	1.8650	2.0000
2.2500		4.5	2.2280	2.2500	2.0984	2.1057	1.9727	1.9934	0.0334	0.0401	2.0335	2.0602	2.1057	2.1152	2.2500
2.5000		4	2.4762	2.5000	2.3298	2.3376	2.1884	2.2113	0.0375	0.0401	2.2565	2.2865	2.3376	2.3477	2.5000
2.7500		4	2.7262	2.7500	2.5797	2.5876	2.4382	2.4613	0.0375	0.0401	2.5065	2.5365	2.5876	2.5979	2.7500
3.0000		4	2.9762	3.0000	2.8296	2.8376	2.6882	2.7113	0.0375	0.0451	2.7565	2.7865	2.8376	2.8480	3.0000
3.2500		4	3.2262	3.2500	3.0794	3.0876	2.9380	2.9613	0.0375	0.0451	3.0065	3.0365	3.0876	3.0982	3.2500
2.5000		4	3.4762	3.5000	3.3293	3.3376	3.1878	3.2113	0.0375	0.0451	3.2565	3.2865	3.3376	3.3484	3.5000
2.7500		4	3.7262	3.7500	3.5792	3.5876	3.4378	3.4613	0.0375	0.0451	3.5065	3.5365	3.5876	3.5985	3.7500
4.0000		4	3.9762	4.0000	3.8291	3.8376	3.6876	3.7113	0.0375	0.0451	3.7565	3.7865	3.8376	3.8487	4.0000

TABLE III. Fine thread series.

BASIC SIZE PRIMARY	SECONDARY	THDS PER INCH	EXTERNAL THREAD – UNJF CLASS 3A								INTERNAL THREAD – UNJF CLASS 3B				
			MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		ROOT RADIUS		MINOR DIAMETER		PITCH DIAMETER		MAJOR DIA
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.0600		80	0.0568	0.0600	0.0506	0.0519	0.0435	0.0456	0.0019	0.0023	0.0479	0.0511	0.0519	0.0536	0.0600
	0.0730	72	0.0695	0.0730	0.0626	0.0640	0.0547	0.0570	0.0021	0.0025	0.0595	0.0631	0.0640	0.0659	0.0730
0.0860		64	0.0822	0.0860	0.0744	0.0759	0.0656	0.0680	0.0023	0.0028	0.0708	0.0749	0.0759	0.0779	0.0860
	0.0990	56	0.0949	0.0990	0.0858	0.0874	0.0757	0.0784	0.0027	0.0032	0.0816	0.0862	0.0874	0.0895	0.0990
0.1120		48	0.1075	0.1120	0.0967	0.0985	0.0849	0.0880	0.0031	0.0038	0.0917	0.0971	0.0985	0.1008	0.1120
0.1250		44	0.1202	0.1250	0.1083	0.1102	0.0954	0.0987	0.0034	0.0041	0.1029	0.1088	0.1102	0.1126	0.1250
0.1380		40	0.1329	0.1380	0.1198	0.1218	0.1057	0.1092	0.0038	0.0045	0.1137	0.1202	0.1218	0.1243	0.1380
0.1640		36	0.1585	0.1640	0.1439	0.1460	0.1282	0.1320	0.0042	0.0050	0.1370	0.1442	0.1460	0.1487	0.1640
0.1900		32	0.1840	0.1900	0.1674	0.1697	0.1497	0.1539	0.0047	0.0056	0.1596	0.1675	0.1697	0.1726	0.1900
	0.2160	28	0.2095	0.2160	0.1904	0.1928	0.1702	0.1748	0.0054	0.0064	0.1812	0.1896	0.1928	0.1959	0.2160
0.2500		28	0.2435	0.2500	0.2243	0.2268	0.2041	0.2088	0.0054	0.0064	0.2152	0.2229	0.2268	0.2300	0.2500
0.3125		24	0.3053	0.3125	0.2827	0.2854	0.2591	0.2644	0.0063	0.0075	0.2719	0.2799	0.2854	0.2890	0.3125
0.3750		24	0.3678	0.3750	0.3450	0.3479	0.3214	0.3268	0.0063	0.0075	0.3344	0.3418	0.3479	0.3516	0.3750
0.4375		20	0.4294	0.4375	0.4019	0.4050	0.3736	0.3797	0.0075	0.0090	0.3888	0.3970	0.4050	0.4091	0.4375
0.5000		20	0.4919	0.5000	0.4643	0.4675	0.4360	0.4422	0.0075	0.0090	0.4513	0.4591	0.4675	0.4717	0.5000
0.5625		18	0.5538	0.5625	0.5230	0.5264	0.4916	0.4983	0.0083	0.0100	0.5084	0.5166	0.5264	0.5308	0.5625
0.6250		18	0.6163	0.6250	0.5854	0.5889	0.5540	0.5608	0.0083	0.0100	0.5709	0.5788	0.5889	0.5934	0.6250
0.7500		16	0.7406	0.7500	0.7056	0.7094	0.6702	0.6778	0.0094	0.0113	0.6892	0.6977	0.7094	0.7143	0.7500
0.8750		14	0.8647	0.8750	0.8245	0.8286	0.7841	0.7925	0.0107	0.0129	0.8055	0.8152	0.8286	0.8339	0.8750
1.0000		12	0.9886	1.0000	0.9415	0.9459	0.8944	0.9038	0.0125	0.0150	0.9189	0.9298	0.9459	0.9516	1.0000
1.1250		12	1.1136	1.1250	1.0664	1.0709	1.0192	1.0288	0.0125	0.0150	1.0439	1.0539	1.0709	1.0768	1.1250
1.2500		12	1.2386	1.2500	1.1913	1.1959	1.1442	1.1538	0.0125	0.0150	1.1689	1.1789	1.1959	1.2019	1.2500
1.3750		12	1.3636	1.3750	1.3162	1.3209	1.2690	1.2788	0.0125	0.0150	1.2939	1.3039	1.3209	1.3270	1.3750
1.5000		12	1.4886	1.5000	1.4411	1.4459	1.3940	1.4038	0.0125	0.0150	1.4189	1.4289	1.4459	1.4522	1.5000

TABLE IV. Extra fine thread series.

BASIC SIZE PRIMARY	BASIC SIZE SECONDARY	THDS PER INCH	EXTERNAL THREAD – UNJEF CLASS 3A MAJOR DIAMETER MIN	MAX	PITCH DIAMETER MIN	MAX	MINOR DIAMETER MIN	MAX	ROOT RADIUS MIN	MAX	INTERNAL THREAD – UNJEF CLASS 3B MINOR DIAMETER MIN	MAX	PITCH DIAMETER MIN	MAX	MAJOR DIA MIN
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.2500	0.216	32	0.2100	0.2160	0.1933	0.1957	0.1756	0.1799	0.0047	0.0056	0.1856	0.1929	0.1957	0.1988	0.2160
0.3125		32	0.2440	0.2500	0.2273	0.2297	0.2096	0.2139	0.0047	0.0056	0.2196	0.2263	0.2297	0.2328	0.2500
0.3750		32	0.3065	0.3125	0.2898	0.2922	0.2721	0.2764	0.0047	0.0056	0.2820	0.2880	0.2922	0.2953	0.3125
0.3750		32	0.3690	0.3750	0.3522	0.3547	0.3345	0.3389	0.0047	0.0056	0.3446	0.3501	0.3547	0.3580	0.3750
0.4375		28	0.4310	0.4375	0.4116	0.4143	0.3914	0.3963	0.0054	0.0064	0.4027	0.4086	0.4143	0.4178	0.4375
0.5000		28	0.4935	0.5000	0.4740	0.4768	0.4538	0.4588	0.0054	0.0064	0.4652	0.4708	0.4768	0.4804	0.5000
0.5625		24	0.5553	0.5625	0.5325	0.5354	0.5089	0.5144	0.0063	0.0075	0.5219	0.5281	0.5354	0.5392	0.5625
0.6250		24	0.6178	0.6250	0.5949	0.5979	0.5713	0.5768	0.0063	0.0075	0.5844	0.5904	0.5979	0.6018	0.6250
	0.6875	24	0.6803	0.6875	0.6574	0.6604	0.6338	0.6394	0.0063	0.0075	0.6469	0.6547	0.6604	0.6643	0.6875
0.7500		20	0.7419	0.7500	0.7142	0.7175	0.6859	0.6922	0.0075	0.0090	0.7013	0.7081	0.7175	0.7218	0.7500
	0.8125	20	0.8044	0.8125	0.7767	0.7800	0.7484	0.7547	0.0075	0.0090	0.7638	0.7706	0.7800	0.7843	0.8125
0.8750		20	0.8669	0.8750	0.8392	0.8425	0.8109	0.8172	0.0075	0.0090	0.8263	0.8331	0.8425	0.8468	0.8750
	0.9375	20	0.9294	0.9375	0.9016	0.9050	0.8733	0.8797	0.0075	0.0090	0.8888	0.8956	0.9050	0.9094	0.9375
1.0000		20	0.9919	1.0000	0.9641	0.9675	0.9358	0.9422	0.0075	0.0090	0.9513	0.9581	0.9675	0.9719	1.0000
	1.0625	18	1.0538	1.0625	1.0228	1.0264	0.9914	0.9983	0.0083	0.0100	1.0084	1.0159	1.0264	1.0310	1.0625
1.1250		18	1.1163	1.1250	1.0853	1.0889	1.0539	1.0608	0.0083	0.0100	1.0709	1.0784	1.0889	1.0935	1.1250
	1.1875	18	1.1788	1.1875	1.1478	1.1514	1.1164	1.1233	0.0083	0.0100	1.1334	1.1409	1.1514	1.1561	1.1875
1.2500		18	1.2413	1.2500	1.2103	1.2139	1.1789	1.1858	0.0083	0.0100	1.1959	1.2034	1.2139	1.2186	1.2500
	1.3125	18	1.3038	1.3125	1.2728	1.2764	1.2414	1.2483	0.0083	0.0100	1.2584	1.2659	1.2764	1.2811	1.3125
1.3750		18	1.3663	1.3750	1.3353	1.3389	1.3039	1.3108	0.0083	0.0100	1.3209	1.3284	1.3389	1.3436	1.3750
	1.4375	18	1.4288	1.4375	1.3977	1.4014	1.3663	1.3733	0.0083	0.0100	1.3834	1.3909	1.4014	1.4062	1.4375
1.5000		18	1.4913	1.5000	1.4602	1.4639	1.4288	1.4358	0.0083	0.0100	1.4459	1.4534	1.4639	1.4687	1.5000
	1.5625	18	1.5538	1.5625	1.5227	1.5264	1.4913	1.4983	0.0083	0.0100	1.5084	1.5159	1.5264	1.5312	1.5625
1.6250		18	1.6163	1.6250	1.5852	1.5889	1.5538	1.5608	0.0083	0.0100	1.5709	1.5784	1.5889	1.5937	1.6250
	1.6875	18	1.6788	1.6875	1.6476	1.6514	1.6162	1.6233	0.0083	0.0100	1.6334	1.6409	1.6514	1.6563	1.6875

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TABLE V. Eight thread series.

BASIC SIZE		EXTERNAL THREAD – 8UNJ CLASS 3A ROOT RADIUS 0.0188 MIN 0.0226 MAX						INTERNAL THREAD – 8UNJ CLASS 3B				
PRI-MARY	SEC-OND-ARY	MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		MINOR DIAMETER		PITCH DIAMETER		MAJOR DIA
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13
	1.0625	1.0475	1.0625	0.9762	0.9813	0.9055	0.9182	0.9408	0.9558	0.9813	0.9880	1.0625
1.1250		1.1100	1.1250	1.0386	1.0438	0.9661	0.9806	1.0033	1.0183	1.0438	1.0505	1.1250
	1.1875	1.1725	1.1875	1.1011	1.1063	1.0304	1.0432	1.0658	1.0808	1.1063	1.1131	1.1875
1.2500		1.2350	1.2500	1.1635	1.1688	1.0928	1.1056	1.1283	1.1433	1.1688	1.1757	1.2500
	1.3125	1.2975	1.3125	1.2260	1.2313	1.1553	1.1682	1.1908	1.2058	1.2313	1.2382	1.3125
1.3750		1.3600	1.3750	1.2884	1.2938	1.2177	1.2306	1.2533	1.2683	1.2938	1.3008	1.3750
	1.4375	1.4225	1.4375	1.3509	1.3563	1.2802	1.2932	1.3158	1.3308	1.3563	1.3634	1.4375
1.5000		1.4850	1.5000	1.4133	1.4188	1.3426	1.3556	1.3783	1.3933	1.4188	1.4259	1.5000
	1.5625	1.5475	1.5625	1.4758	1.4813	1.4051	1.4182	1.4408	1.4558	1.4813	1.4885	1.5625
1.6250		1.6100	1.6250	1.5382	1.5438	1.4675	1.4806	1.5033	1.5183	1.5438	1.5510	1.6250
	1.6875	1.6725	1.6875	1.6007	1.6063	1.5300	1.5432	1.5658	1.5808	1.6063	1.6136	1.6875
1.7500		1.7350	1.7500	1.6632	1.6688	1.5924	1.6056	1.6283	1.6433	1.6688	1.6762	1.7500
	1.8125	1.7975	1.8125	1.7256	1.7313	1.6549	1.6682	1.6908	1.7058	1.7313	1.7387	1.8125
1.8750		1.8600	1.8750	1.7881	1.7938	1.7174	1.7306	1.7533	1.7683	1.7938	1.8013	1.8750
	1.9375	1.9225	1.9375	1.8505	1.8563	1.7798	1.7932	1.8158	1.8308	1.8563	1.8638	1.9375
2.0000		1.9850	2.0000	1.9130	1.9188	1.8423	1.8556	1.8783	1.8933	1.9188	1.9264	2.0000
	2.1250	2.1100	2.1250	2.0379	2.0438	1.9672	1.9806	2.0033	2.0183	2.0438	2.0515	2.1250
2.2500		2.2350	2.2500	2.1628	2.1688	2.0921	2.1056	2.1283	2.1433	2.1688	2.1766	2.2500
	2.3750	2.3600	2.3750	2.2878	2.2938	2.2171	2.2306	2.2533	2.2683	2.2938	2.3017	2.3750
2.5000		2.4850	2.5000	2.4127	2.4188	2.3420	2.3556	2.3783	2.3933	2.4188	2.4268	2.5000
	2.6250	2.6100	2.6250	2.5376	2.5438	2.4669	2.4806	2.5033	2.5183	2.5438	2.5518	2.6250
2.7500		2.7350	2.7500	2.6625	2.6688	2.5918	2.6056	2.6283	2.6433	2.6688	2.6769	2.7500
	2.8750	2.8600	2.8750	2.7875	2.7938	2.7168	2.7306	2.7533	2.7683	2.7938	2.8020	2.8750
3.0000		2.9850	3.0000	2.9124	2.9188	2.8417	2.8556	2.8783	2.8933	2.9188	2.9271	3.0000
	3.1250	3.1100	3.1250	3.0374	3.0438	2.9667	2.9806	3.0033	3.0183	3.0438	3.0522	3.1250
3.2500		3.2350	3.2500	3.1623	3.1688	3.0916	3.1056	3.1283	3.1433	3.1688	3.1773	3.2500
	3.3750	3.3600	3.3750	3.2872	3.2938	3.21765	3.2306	3.2533	3.2683	3.2938	3.3023	3.3750
3.5000		3.4850	3.5000	3.4122	3.4188	3.3415	3.3556	3.3783	3.3933	3.4188	3.4274	3.5000
	3.6250	3.6100	3.6250	3.5371	3.5438	3.4664	3.4806	3.5033	3.5183	3.5438	3.5525	3.6250
3.7500		3.7350	3.7500	3.6621	3.6688	3.5914	3.6056	3.6283	3.6433	3.6688	3.6776	3.7500
	3.8750	3.8600	3.8750	3.7870	3.7938	3.7163	3.7306	3.7533	3.7683	3.7938	3.8026	3.8750
4.0000		3.9850	4.0000	3.9120	3.9188	3.8413	3.8556	3.8783	3.8933	3.9188	3.9277	4.0000

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TABLE VI. Twelve thread series.

BASIC SIZE		EXTERNAL THREAD - 12UNJ CLASS 3A ROOT RADIUS 0.0125 MIN 0.0150 MAX						INTERNAL THREAD - 12 UNJ CLASS 3B				
PRIMARY	SECONDARY	MAJOR DIAMETER MIN	MAJOR DIAMETER MAX	PITCH DIAMETER MIN	PITCH DIAMETER MAX	MINOR DIAMETER MIN	MINOR DIAMETER MAX	MINOR DIAMETER MIN	MINOR DIAMETER MAX	PITCH DIAMETER MIN	PITCH DIAMETER MAX	MAJOR DIA MIN
1	2	3	4	5	6	7	8	9	10	11	12	13
0.6250		0.6136	0.6250	0.5668	0.5709	0.5196	0.5288	0.5439	0.5539	0.5709	0.5762	0.6250
	0.6875	0.6761	0.6875	0.6293	0.6334	0.5822	0.5913	0.6064	0.6164	0.6334	0.6387	0.6875
0.7500		0.7386	0.7500	0.6918	0.6959	0.6446	0.6538	0.6689	0.6789	0.6959	0.7013	0.7500
	0.8125	0.8011	0.8125	0.7543	0.7584	0.7072	0.7163	0.7314	0.7414	0.7584	0.7638	0.8125
0.8750		0.8636	0.8750	0.8168	0.8209	0.7696	0.7788	0.7939	0.8039	0.8209	0.8263	0.8750
	0.9375	0.9261	0.9375	0.8793	0.8834	0.8320	0.8413	0.8564	0.8664	0.8834	0.8889	0.9375
	1.0625	1.0511	1.0625	1.0042	1.0084	0.9570	0.9663	0.9814	0.9914	1.0084	1.0139	1.0625
	1.1875	1.1761	1.1875	1.1291	1.1334	1.0820	1.0913	1.1064	1.1164	1.1334	1.1390	1.1875
	1.3125	1.3011	1.3125	1.2541	1.2584	1.2070	1.2163	1.2314	1.2414	1.2584	1.2640	1.3125
	1.4375	1.4261	1.4375	1.3790	1.3834	1.3318	1.3413	1.3564	1.3664	1.3834	1.3891	1.4375
	1.5625	1.5511	1.5625	1.5040	1.5084	1.4568	1.4663	1.4814	1.4914	1.5084	1.5141	1.5625
1.6250		1.6136	1.6250	1.5665	1.5709	1.5194	1.5288	1.5439	1.5539	1.5709	1.5766	1.6250
	1.6875	1.6761	1.6875	1.6289	1.6334	1.5818	1.5913	1.6064	1.6164	1.6334	1.6392	1.6875
1.7500		1.7386	1.7500	1.6914	1.6959	1.6442	1.6538	1.6689	1.6789	1.6959	1.7017	1.7500
	1.8125	1.8011	1.8125	1.7539	1.7584	1.7068	1.7163	1.7314	1.7414	1.7584	1.7642	1.8125
1.8750		1.8636	1.8750	1.8164	1.8209	1.7692	1.7788	1.7939	1.8039	1.8209	1.8267	1.8750
	1.9375	1.9261	1.9375	1.8789	1.8834	1.8318	1.8413	1.8564	1.8664	1.8834	1.8893	1.9375
2.0000		1.9886	2.0000	1.9414	1.9459	1.8942	1.9038	1.9189	1.9289	1.9459	1.9518	2.0000
	2.1250	2.1136	2.1250	2.0664	2.0709	2.0192	2.0288	2.0439	2.0539	2.0709	2.0768	2.1250
2.2500		2.2386	2.2500	2.1914	2.1959	2.1442	2.1538	2.1689	2.1789	2.1959	2.2018	2.2500
	2.3750	2.3636	2.3750	2.3163	2.3209	2.2692	2.2788	2.2939	2.3039	2.3209	2.3269	2.3750
2.5000		2.4886	2.5000	2.4413	2.4459	2.3942	2.4038	2.4189	2.4289	2.4459	2.4519	2.5000
	2.6250	2.6136	2.6250	2.5663	2.5709	2.5192	2.5288	2.5439	2.5539	2.5709	2.5769	2.6250
2.7500		2.7386	2.7500	2.6913	2.6959	2.6442	2.6538	2.6689	2.6789	2.6959	2.7019	2.7500
	2.8750	2.8636	2.8750	2.8162	2.8209	2.7690	2.7788	2.7939	2.8039	2.8209	2.8271	2.8750
3.0000		2.9886	3.0000	2.9412	2.9459	2.8940	2.9038	2.9189	2.9289	2.9459	2.9521	3.0000
	3.1250	3.1136	3.1250	3.0662	3.0709	3.0190	3.0288	3.0439	3.0539	3.0709	3.0771	3.1250
3.2500		3.2386	3.2500	3.1912	3.1959	3.1440	3.1538	3.1689	3.1789	3.1959	3.2021	3.2500

TABLE VI. Twelve thread series. – (Continued)

BASIC SIZE PRI-MARY	BASIC SIZE SEC-OND-ARY	EXTERNAL THREAD – 12 UNJ CLASS 3A ROOT RADIUS 0.0125 MIN 0.0150 MAX MAJOR DIAMETER MIN	MAJOR DIAMETER MAX	PITCH DIAMETER MIN	PITCH DIAMETER MAX	MINOR DIAMETER MIN	MINOR DIAMETER MAX	INTERNAL THREAD – 12 UNJ CLASS 3B MINOR DIAMETER MIN	MINOR DIAMETER MAX	PITCH DIAMETER MIN	PITCH DIAMETER MAX	MAJOR DIA MIN
1	2	3	4	5	6	7	8	9	10	11	12	13
	3.3750	3.3636	3.3750	3.3161	3.3209	3.2690	3.2788	3.2939	3.3039	3.3209	3.3272	3.3750
3.5000		3.4886	3.5000	3.4411	3.4459	3.3940	3.4038	3.4189	3.4289	3.4459	3.4522	3.5000
	3.6250	3.6136	3.6250	3.5661	3.5709	3.5190	3.5288	3.5439	3.5539	3.5709	3.5772	3.6250
3.7500		3.7386	3.7500	3.6911	3.6959	3.6440	3.6538	3.6689	3.6789	3.6959	3.7022	3.7500
	3.8750	3.8636	3.8750	3.8160	3.8209	3.7688	3.7788	3.7939	3.8039	3.8209	3.8273	3.8750
4.0000		3.9886	4.0000	3.9410	3.9459	3.8938	3.9038	3.9189	3.9289	3.9459	3.9523	4.0000
	4.1250	4.1136	4.1250	4.0660	4.0709	4.0188	4.0288	4.0439	4.0539	4.0709	4.0773	4.1250
4.2500		4.2386	4.2500	4.1910	4.1959	4.1438	4.1538	4.1689	4.1789	4.1959	4.2023	4.2500
	4.3750	4.3636	4.3750	4.3160	4.3209	4.2688	4.2788	4.2939	4.3039	4.3209	4.3273	4.3750
4.5000		4.4886	4.5000	4.4410	4.4459	4.3938	4.4038	4.4189	4.4289	4.4459	4.4523	4.5000
	4.6250	4.6136	4.6250	4.5659	4.5709	4.5188	4.5288	4.5439	4.5539	4.5709	4.5775	4.6250
4.7500		4.7386	4.7500	4.6909	4.6959	4.6438	4.6538	4.6689	4.6789	4.6959	4.7025	4.7500
	4.8750	4.8636	4.8750	4.8159	4.8209	4.7688	4.7788	4.7939	4.8039	4.8209	4.8275	4.8750
5.0000		4.9886	5.0000	4.9409	4.9459	4.8938	4.9038	4.9189	4.9289	4.9459	4.9525	5.0000
	5.1250	5.1136	5.1250	5.0659	5.0709	5.0188	5.0288	5.0439	5.0539	5.0709	5.0775	5.1250
5.2500		5.2386	5.2500	5.1909	5.1959	5.1438	5.1538	5.1689	5.1789	5.1959	5.2025	5.2500
	5.3750	5.3636	5.3750	5.3159	5.3209	5.2688	5.2788	5.2939	5.3039	5.3209	5.3275	5.3750
5.5000		5.4886	5.5000	5.4409	5.4459	5.3938	5.4038	5.4189	5.4289	5.4459	5.4525	5.5000
	5.6250	5.6136	5.6250	5.5657	5.5709	5.5186	5.5288	5.5439	5.5539	5.5709	5.5776	5.6250
5.7500		5.7386	5.7500	5.6907	5.6959	5.6436	5.6538	5.6689	5.6789	5.6959	5.7026	5.7500
	5.8750	5.8636	5.8750	5.8157	5.8209	5.7686	5.7788	5.7939	5.8039	5.8209	5.8276	5.8750
6.0000		5.9886	6.0000	5.9407	5.9459	5.8936	5.9038	5.9189	5.9289	5.9459	5.9526	6.0000

TABLE VII. Sixteen thread series.

BASIC SIZE		EXTERNAL THREAD - 16 UNJ CLASS 3A ROOT RADIUS 0.0094 MIN 0.0113 MAX						INTERNAL THREAD - 16 UNJ CLASS 3B				
		MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		MINOR DIAMETER		PITCH DIAMETER		MAJOR DIA
PRI-MARY	SEC-OND-ARY	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13
0.4375		0.4281	0.4375	0.3935	0.3969	0.3581	0.3653	0.3767	0.3869	0.3969	0.4014	0.4375
0.5000		0.4906	0.5000	0.4559	0.4594	0.4205	0.4278	0.4392	0.4488	0.4594	0.4640	0.5000
0.5625		0.5531	0.5625	0.5184	0.5219	0.4830	0.4903	0.5017	0.5109	0.5219	0.5265	0.5625
0.6250		0.6156	0.6250	0.5808	0.5844	0.5454	0.5528	0.5642	0.5731	0.5844	0.5890	0.6250
	0.6875	0.6781	0.6875	0.6433	0.6469	0.6079	0.6153	0.6267	0.6353	0.6469	0.6515	0.6875
	0.8125	0.8031	.8125	0.7683	0.7719	0.7329	0.7403	0.7517	0.7602	0.7719	0.7766	0.8125
0.8750		0.8656	0.8750	0.8308	0.8344	0.7954	0.8028	0.8142	0.8227	0.8344	0.8391	0.8750
	0.9375	0.9281	0.9375	0.8932	0.8969	0.8578	0.8653	0.8767	0.8852	0.8969	0.9018	0.9375
1.0000		0.9906	1.0000	0.9557	0.9594	0.9203	0.9278	0.9392	0.9477	0.9594	0.9643	1.0000
	1.0625	1.0531	1.0625	1.0182	1.0219	0.9828	0.9903	1.0017	1.0102	1.0219	1.0268	1.0625
1.1250		1.1156	1.1250	1.0807	1.0844	1.0453	1.0528	1.0642	1.0727	1.0844	1.0893	1.1250
	1.1875	1.1781	1.1875	1.1431	1.1469	1.1077	1.1153	1.1267	1.1352	1.1469	1.1519	1.1875
1.2500		1.2406	1.2500	1.2056	1.2094	1.1702	1.1778	1.1892	1.1977	1.2094	1.2144	1.2500
	1.3125	1.3031	1.3125	1.2681	1.2719	1.2327	1.2403	1.2517	1.2602	1.2719	1.2769	1.3125
1.3750		1.3656	1.3750	1.3306	1.3344	1.2952	1.3028	1.3142	1.3227	1.3344	1.3394	1.3750
	1.4375	1.4281	1.4375	1.3930	1.3969	1.3576	1.3653	1.3767	1.3852	1.3969	1.4020	1.4375
1.5000		1.4906	1.5000	1.4555	1.4594	1.4201	1.4278	1.4392	1.4477	1.4594	1.4645	1.5000
	1.5625	1.5531	1.5625	1.5180	1.5219	1.4826	1.4903	1.5017	1.5102	1.5219	1.5270	1.5625
1.6250		1.6156	1.6250	1.5805	1.5844	1.5451	1.5528	1.5642	1.5727	1.5844	1.5895	1.6250
	1.6875	1.6781	1.6875	1.6429	1.6469	1.6075	1.6153	1.6267	1.6352	1.6469	1.6521	1.6875
1.7500		1.7406	1.7500	1.7054	1.7094	1.6700	1.6778	1.6892	1.6977	1.7094	1.7146	1.7500
	1.8125	1.8031	1.8125	1.7679	1.7719	1.7325	1.7403	1.7517	1.7602	1.7719	1.7771	1.8125
1.8750		1.8656	1.8750	1.8304	1.8344	1.7950	1.8028	1.8142	1.8227	1.8344	1.8396	1.8750
	1.9375	1.9281	1.9375	1.8929	1.8969	1.8575	1.8653	1.8767	1.8852	1.8969	1.9021	1.9375
2.0000		1.9906	2.0000	1.9554	1.9594	1.9200	1.9278	1.9392	1.9477	1.9594	1.9646	2.0000
	2.1250	2.1156	2.1250	2.0803	2.0844	2.0450	2.0528	2.0642	2.0727	2.0844	2.0896	2.1250
2.2500		2.2406	2.2500	2.2053	2.2094	2.1700	2.1778	2.1892	2.1977	2.2094	2.2146	2.2500
	2.3750	2.3656	2.3750	2.3303	2.3344	2.2949	2.3028	2.3142	2.3227	2.3344	2.3398	2.3750

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TABLE VII. Sixteen thread series. – (Continued)

BASIC SIZE		EXTERNAL THREAD - 16 UNJ CLASS 3A ROOT RADIUS 0.0094 MIN 0.0113 MAX						INTERNAL THREAD - 16 UNJ CLASS 3B				MAJOR DIA
PRI-MARY	SEC-OND-ARY	MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		MINOR DIAMETER		PITCH DIAMETER		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	2	3	4	5	6	7	8	9	10	11	12	13
2.5000		2.4906	2.5000	2.4553	2.4594	2.4199	2.4278	2.4392	2.4477	2.4594	2.4648	2.5000
	2.6250	2.6156	2.6250	2.5803	2.5844	2.5449	2.5528	2.5642	2.5727	2.5844	2.5898	2.6250
2.7500		2.7406	2.7500	2.7053	2.7094	2.6699	2.6778	2.6892	2.6977	2.7094	2.7148	2.7500
	2.8750	2.8656	2.8750	2.8302	2.8344	2.7948	2.8028	2.8142	2.8227	2.8344	2.8399	2.8750
3.0000		2.9906	3.0000	2.9552	2.9594	2.9198	2.9278	2.9392	2.9477	2.9594	2.9649	3.0000
	3.1250	3.1156	3.1250	3.0802	3.0844	3.0448	3.0528	3.0642	3.0727	3.0844	3.0899	3.1250
3.2500		3.2406	3.2500	3.2052	3.2094	3.1698	3.1778	3.1892	3.1977	3.2094	3.2149	3.2500
	3.3750	3.3656	3.3750	3.3301	3.3344	3.2947	3.3028	3.3142	3.3227	3.3344	3.3400	3.3750
3.5000		3.4906	3.5000	3.4551	3.4594	3.4197	3.4278	3.4392	3.4477	3.4594	3.4650	3.5000
	3.6250	3.6156	3.6250	3.5801	3.5844	3.5447	3.5528	3.5642	3.5727	3.5844	3.5900	3.6250
3.7500		3.7406	3.7500	3.7051	3.7094	3.6697	3.6778	3.6892	3.6977	3.7094	3.7150	3.7500
	3.8750	3.8656	3.8750	3.8300	3.8344	3.7946	3.8028	3.8142	3.8227	3.8344	3.8401	3.8750
4.0000		3.9906	4.0000	3.9550	3.9594	3.9196	3.9278	3.9392	3.9477	3.9594	3.9651	4.0000
	4.1250	4.1156	4.1250	4.0800	4.0844	4.0446	4.0528	4.0642	4.0727	4.0844	4.0901	4.1250
4.2500		4.2406	4.2500	4.2050	4.2094	4.1696	4.1778	4.1892	4.1977	4.2094	4.2151	4.2500
	4.3750	4.3656	4.3750	4.3300	4.3344	4.2946	4.3028	4.3142	4.3227	4.3344	4.3401	4.3750
4.5000		4.4906	4.5000	4.4550	4.4594	4.4196	4.4278	4.4392	4.4477	4.4594	4.4651	4.5000
	4.6250	4.6156	4.6250	4.5799	4.5844	4.5445	4.5528	4.5642	4.5727	4.5844	4.5903	4.6250
4.7500		4.7406	4.7500	4.7049	4.7094	4.6695	4.6778	4.6892	4.6977	4.7094	4.7153	4.7500
	4.8750	4.8656	4.8750	4.8299	4.8344	4.7945	4.8028	4.8142	4.8227	4.8344	4.8403	4.8750
5.0000		4.9906	5.0000	4.9549	4.9594	4.9195	4.9278	4.9392	4.9477	4.9594	4.9653	5.0000
	5.1250	5.1156	5.1250	5.0799	5.0844	5.0445	5.0528	5.0642	5.0727	5.0844	5.0903	5.1250
5.2500		5.2406	5.2500	5.2049	5.2094	5.1695	5.1778	5.1892	5.1977	5.2094	5.2153	5.2500
	5.3750	5.3656	5.3750	5.3299	5.3344	5.2945	5.3028	5.3142	5.3227	5.3344	5.3403	5.3750
5.5000		5.4906	5.5000	5.4549	5.4594	5.4195	5.4278	5.4392	5.4477	5.4594	5.4653	5.5000
	5.6250	5.6156	5.6250	5.5797	5.5844	5.5443	5.5528	5.5642	5.5727	5.5844	5.5905	5.6250
5.7500		5.7406	5.7500	5.7047	5.7094	5.6693	5.6778	5.6892	5.6977	5.7094	5.7155	5.7500
	5.8750	5.8656	5.8750	5.8297	5.8344	5.7943	5.8028	5.8142	5.8227	5.8344	5.8405	5.8750
6.0000		5.9906	6.0000	5.9547	5.9594	5.9193	5.9278	5.9392	5.9477	5.9594	5.9655	6.0000

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TABLE VIII. Special diameter-pitch computations.

Dimensions for threads of special diameter-pitch combinations shall be computed by the following formulas:

External threads:

Maximum major diameter	=	Basic major diameter
Minimum major diameter	=	Maximum major diameter minus tolerance specified in table I, column 20 herein.
Maximum pitch diameter	=	Basic major diameter minus 0.649519p. See table I, column 14 herein.
Minimum pitch diameter	=	Maximum pitch diameter minus tolerance specified in ANSI B1.1.
Maximum minor diameter	=	Maximum pitch diameter minus 0.50518p. See table I, column 18 herein.
Minimum minor diameter	=	Minimum pitch diameter minus 0.56580p. See table I, column 19 herein.
Maximum root radius	=	0.18042p. See table I, column 8 herein.
Minimum root radius	=	0.15011p. See table I, column 7 herein.

Internal threads:

Minimum major diameter	=	Basic major diameter
Minimum pitch diameter	=	Basic major diameter minus 0.649519p. See table I, column 14 herein.
Maximum pitch diameter	=	Minimum pitch diameter plus tolerance specified in ANSI B1.1, table 38
Minimum minor diameter	=	Basic major diameter minus 0.97428p. See table I, column 16 herein. Round up to the next larger fourth place decimal, unless the fifth place is zero.
Maximum minor diameter	=	Minimum minor diameter plus the internal thread minor diameter tolerances.
Minor diameter tolerance	=	$[0.05 \sqrt[3]{p^2} + 0.03 \, p/D] - 0.002$ except that the tolerance shall not be greater than 0.259809p nor less than 0.135315p for threads 13 per inch and finer. For threads 12 per inch and coarser the tolerance is equal to 0.120p.

Where p = Pitch
D = Basic major diameter

NOTE: Dimensions of special threads shall be rounded off to 4 decimal places as required after all computations are made.
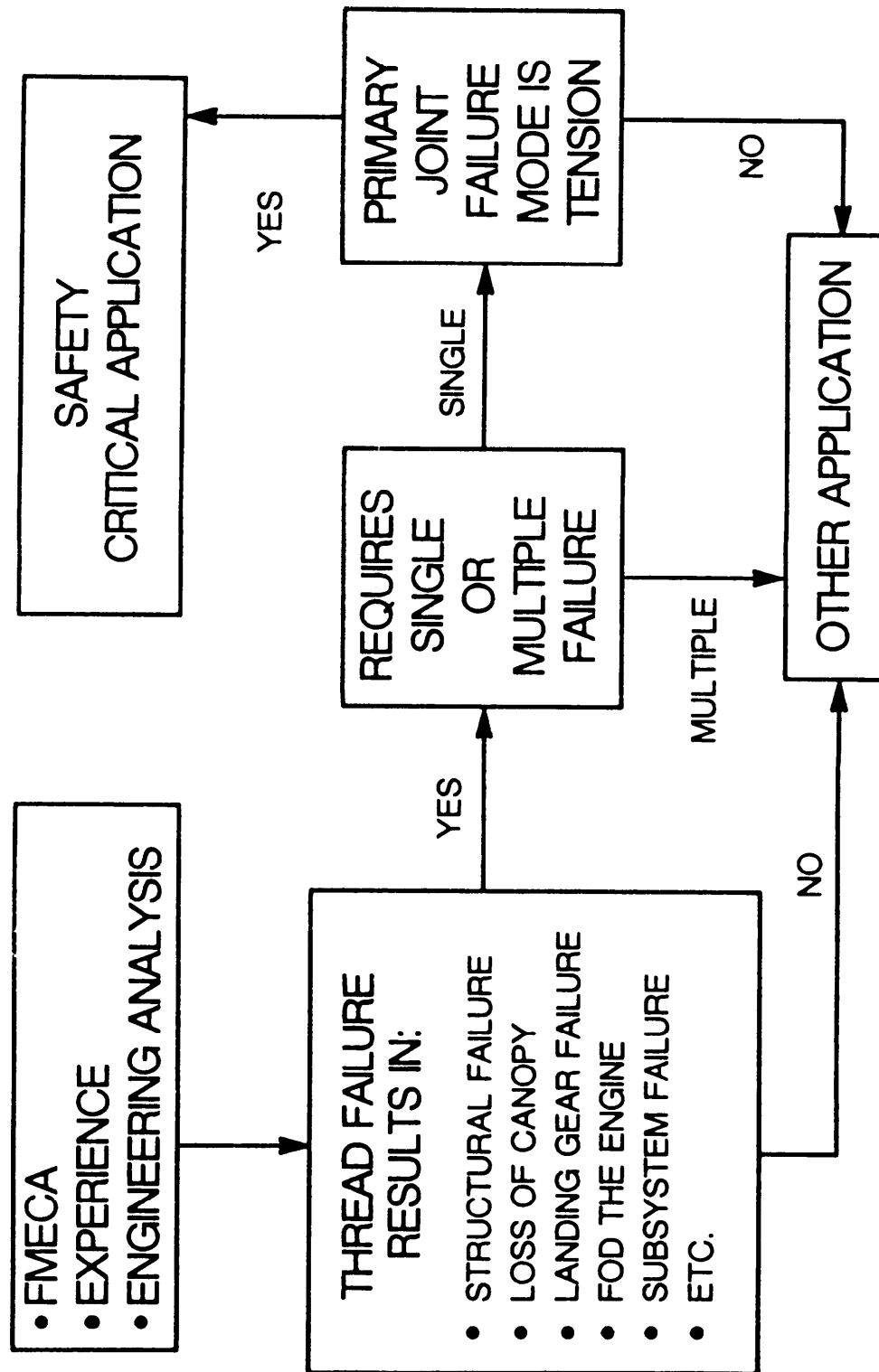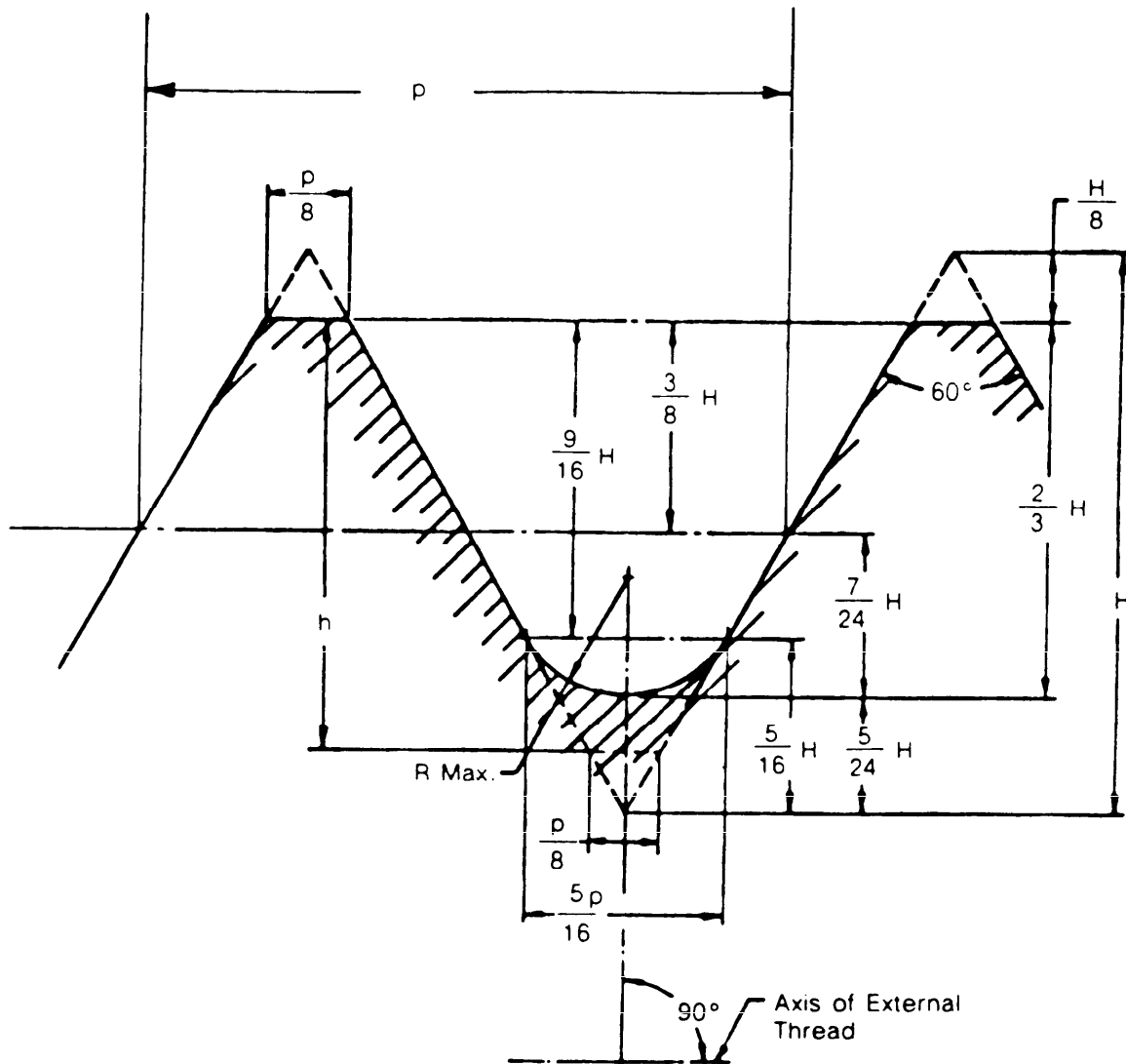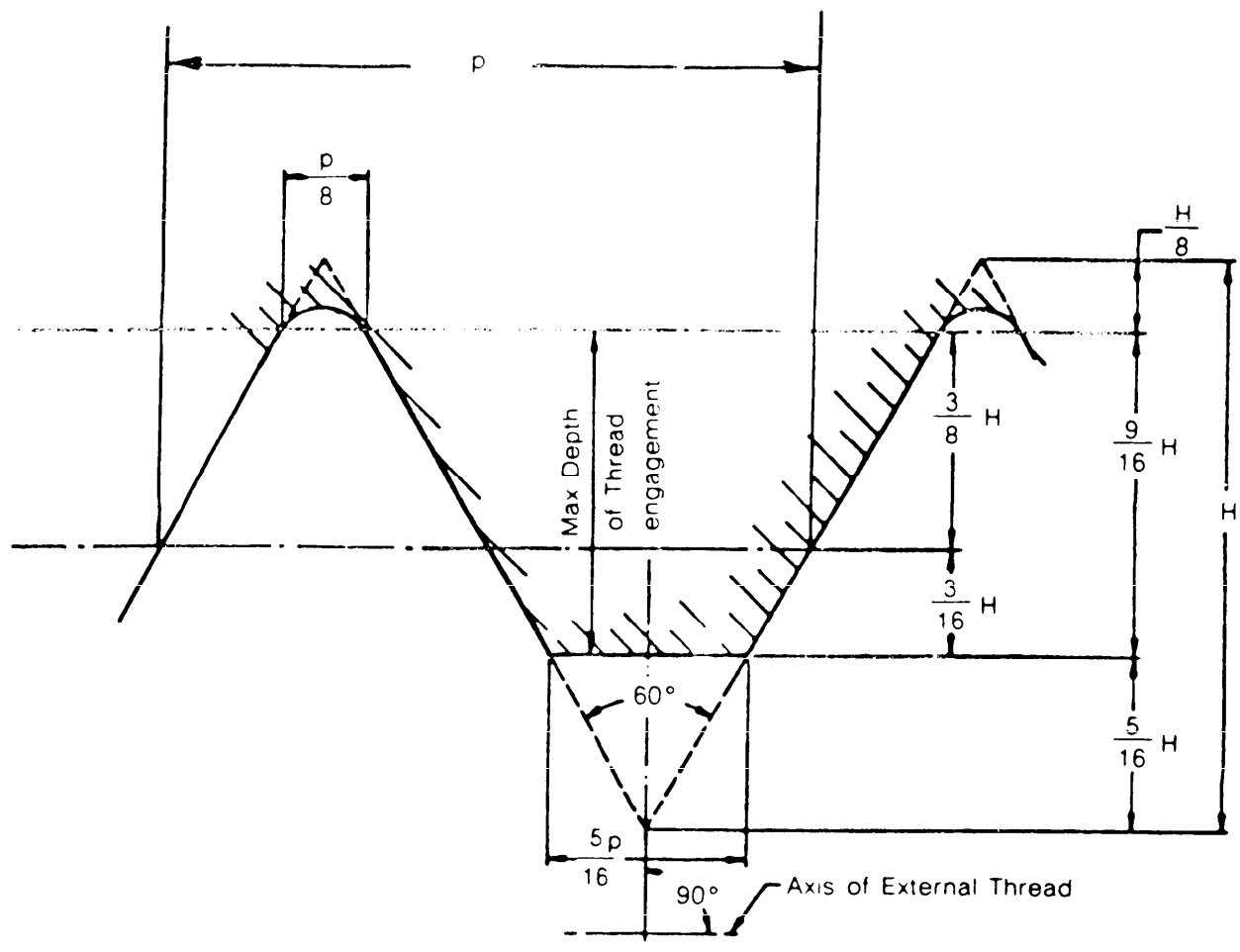
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TYPICAL THREAD CLASSIFICATION LOGIC

FIGURE 1. Typical thread classification logic.

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p = Pitch = 1/n

n = number of threads per inch

H = 0.866025p

h = 0.649519p

FIGURE 2. <u>External thread maximum material condition</u>.

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p = Pitch = 1/n

n = number of threads per inch

H = 0.866025p

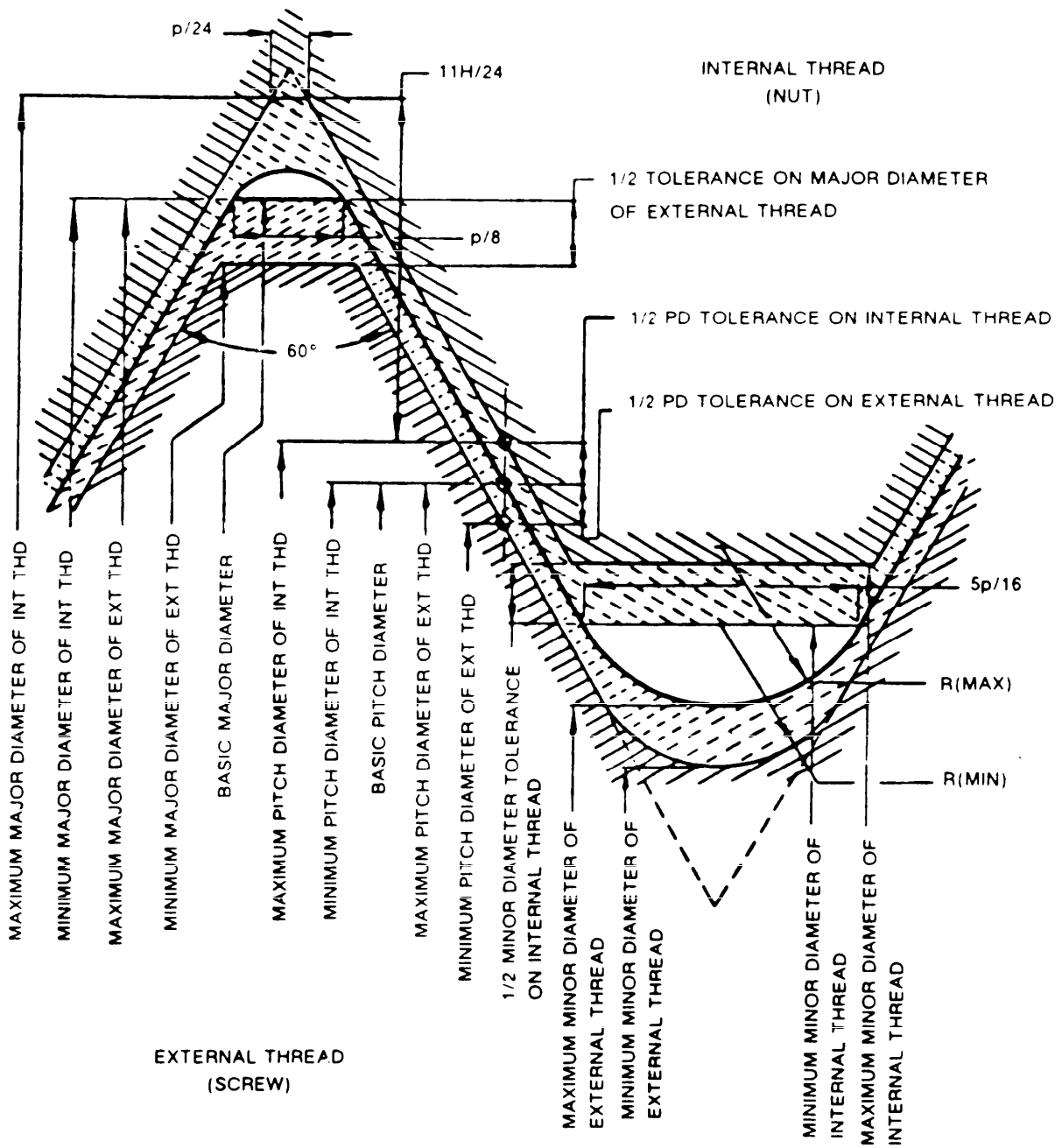FIGURE 3. <u>Internal thread maximum material condition</u>.

FIGURE 4. Disposition of tolerances and crest clearances.

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3. DOCUMENT TITLE	Screw Threads, Controlled Radius Root With Increased Minor Diameter, General Specification For

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

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