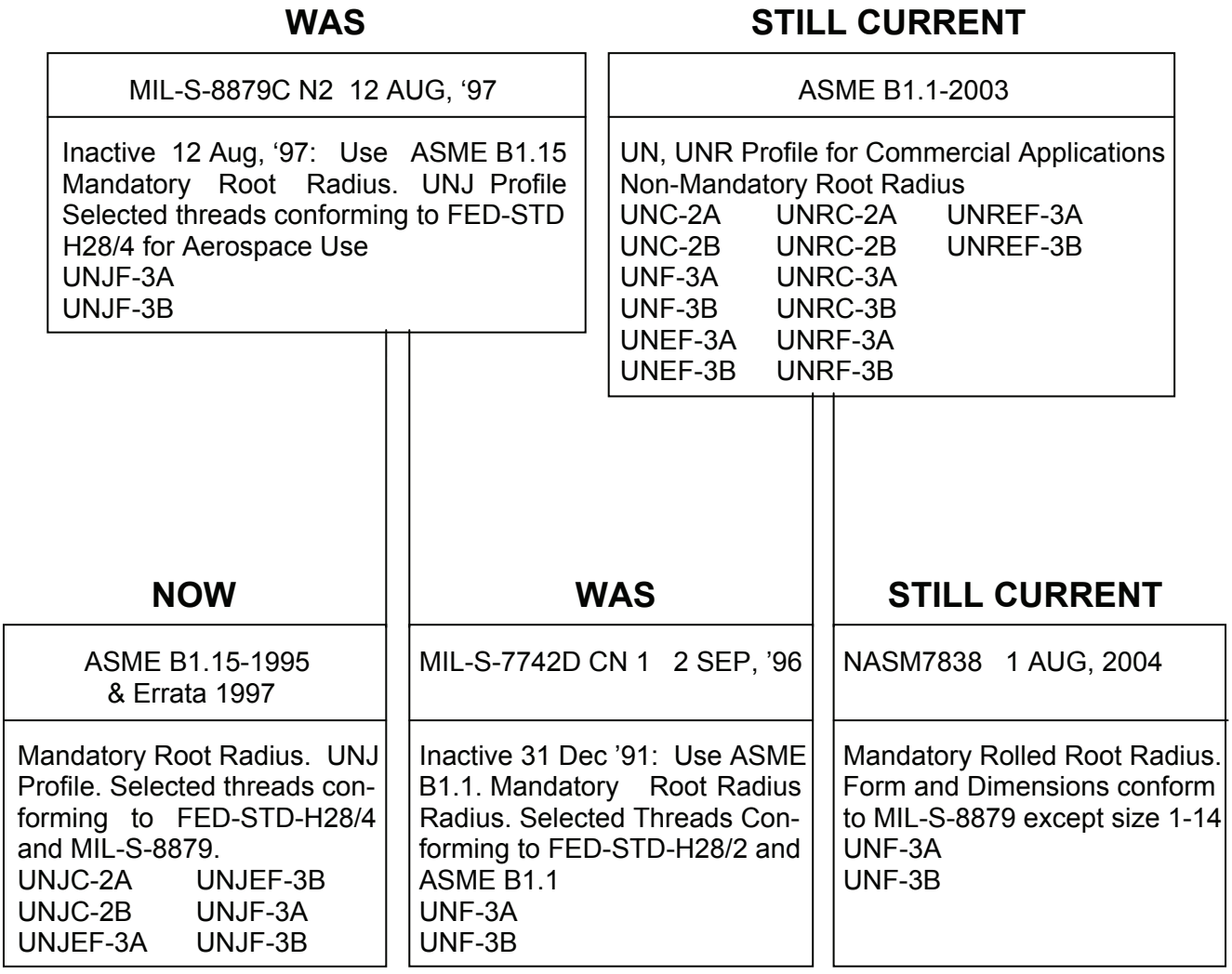
12.1 SCOPE.

12.1.1 Purpose. This section establishes the method of representing and specifying threads on engineering drawings for both inch and metric thread specifications. Straight unified inch “UN”, “UNR”, “UNJ”, form and metric “M”, “MJ” form screw threads are emphasized in this SECTION in consideration of their wide use and general purpose applications. The same drafting practices apply to straight and taper pipe threads, Acme, Stub Acme, Buttress, Helical coil insert and interference fit threads except for differences noted.

12.1.2 Change of Intent for Specifying Threads on Engineering Drawings. The DoD has dramatically changed the way it buys new systems and equipment; specifically, relying on ASME B1 series for threads and performance specifications (i.e. MIL-PRF-XXXX) and leaving the responsibility for design decisions and internal processes, such as quality control, in the hands of the manufacturer. Military specifications and standards which prescribe particular design solutions and/or quality control protocols (i.e. MIL-DTL-XXXX) are no longer encouraged as requirements in solicitations for new designs or in contracts for newly designed equipment.

12.1.3 When a Performance Specification is Not Practicable and a Non-Government Standard (NGS) Does Not Exist. DoD is retaining those existing documents (such as MIL-S-8879C 1991 before ASME B15.15-1995 became available) in “inactive status”. This means that DoD may cite such a document when reprocuring previously designed items.



12.1.4 Use of Non-Government Standards (NGS) in Lieu of Previous Government/Military Standards for the Same Subject The requirement to obtain a waiver to use government/military specifications and standards stated in "Acquisition Reform Policy Memo 98-2" has been rescinded. Policy Memo 05-3 overturned the waiver requirement, allowing MIL-SPECS, MIL-STDS and other government specifications and standards to be invoked and used in government contracts. See Preface 1 in Section 2 of the DRM. The following TABLE shows compatible non-government and government standards that relate to threads and threaded fasteners.

See PARAGRAPH 12.2 for TITLES	
NON-GOVERNMENT STANDARD (NGS)	**GOVERNMENT STANDARD**
ASME B1.1	FED-STD-H28/2
ASME B1.5	FED-STD-H28/12
ASME B1.7	FED-STD-H28/1
ASME B1.8	FED-STD-H28/13
ASME B1.9	FED-STD-H28/14
ASME B1.10M	FED-STD-H28/5
ASME B1.11	FED-STD-H28/16
ASME B1.12	FED-STD-H28/23
ASME B1.13M	FED-STD-H28/21
ASME B1.15 and ERRATA	FED-STD-H28/4 (MIL-S-8879)
ASME B1.20.1	FED-STD-H28/7
ASME B1.20.3	FED-STD-H28/8
ASME B1.20.7	FED-STD-H28/10
ASME B1.21M	FED-STD-H28/21
ASME B18.29.1	NA
ASME B18.29.2M	NA

12.2 APPLICABLE DOCUMENTS. Note: DoD Policy Memo 05-3 "Elimination of Waivers to Cite Military Specifications and Standards in Solicitation and Contracts" has eliminated the need for waivers to use MIL-SPECS and MIL-STDS on DoD contracts. (See PREFACE 1, Section 2)

MIL-P-7105 Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT, General Requirements (Replaced by SAE AS71051)

MIL-S-7742 Screw Threads, Standard, Optimum Selected Series: General Specification for (INACTIVE 31 DEC, 1991: USE MIL-S-8879)

MIL-B-7838 Bolt, Internal Wrenching, 160 KSI FTU (CNCLD: Supsd by NASM7838)

MIL-S-8879 Screw Threads, Controlled Radius Root with Increased Minor Diameter: General Specification for

MIL-STD-100 Engineering Drawing Practices (Use in conjunction with ASME Y14.100.) (CNCLD Supsd by: ASME Y14.100 & Appendices, ASME Y14.24, Y14.34M & Y14.35M)

FED-STD-H28 Screw Thread Standards for Federal Services

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

FED-STD-H28/2 Unified Screw Threads – UN and UNR Thread Forms

12.2 APPLICABLE DOCUMENTS. (Continued)

FED-STD-H28/4	Controlled Radius Root Screw Threads, UNJ Symbol
FED-STD-H28/5	Unified Miniature Screw Threads
FED-STD-H28/7	Screw Standards For Federal Services Section 7 Pipe Threads General Purpose
FED-STD-H28/8	Screw Standards For Federal Services Section 8 Dryseal Pipe Threads
FED-STD-H28/9	Gas Cylinder Valve Outlet and Inlet Threads
FED-STD-H28/10	Hose Coupling and Fire Hose Coupling Screw Threads
FED-STD-H28/12	Acme Threads
FED-STD-H28/13	Stub Acme Threads
FED-STD-H28/14	Buttress Screw Threads 7 Degrees/45 Degrees Flank Angles
FED-STD-H28/16	Microscope Objective and Nosepiece Threads, 0.8000-36AMO
FED-STD-H28/21	Metric Screw Threads
FED-STD-H28/23	Class 5 Interference-Fit Screw Threads
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.3	Screw Thread Gaging Systems for Dimensional Acceptability-Inch and Metric Threads (UN, UNR, UNJ, M and MJ)
ASME B1.5	Acme Screw Threads
ASME B1.7	Nomenclature, Definitions and Letter Symbols for Screw Threads
ASME B1.8	Stub Acme Screw Threads
ASME B1.9	Buttress Inch Screw Threads
ASME B1.10M	Unified Miniature Screw Threads
ASME B1.11	Microscope Objective Thread
ASME B1.12	Class 5 Interference-Fit Thread
ASME B1.13M	Metric Screw Threads – M Profile
ASME B1.15	Unified Inch Screw Threads (UNJF Thread Form)
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B1.20.3	Dryseal Pipe Threads (Inch)
ASME B1.20.7	Hose Coupling Screw Threads (Inch)

12.2 APPLICABLE DOCUMENTS. (Continued)

ASME B1.21M	Metric Screw Threads - MJ Profile
ASME B18.29.1	Helical Coil Screw Thread Inserts (Inch Series)
ASME B18.29.2M	Helical Coil Screw Thread Inserts (Metric Series)
ASME Y14.6	Screw Thread Representation
ASME Y14.100	Engineering Drawing Practices
NASM7838	Bolt, Internal Wrenching, 160 KSI FTU-Rev 2; FSC 5306
SAE AS71051	Pipe Threads, Taper Aeronautical Form, Symbol ANPT, Design and Inspection Standard
SAE Handbook	
SAE AS 1338	Aerospace Metric 60° Screw Thread Profile and Tolerance Classes
SAE MA 1370	Metric Screw Threads - MJ Profile
ISO 68-1	General Purpose Screw Threads- Basic Profile
ISO 261	ISO General Purpose Metric Screw Threads- General Plan

12.3 DEFINITIONS. (Alphabetically Listed)

12.3.1 ACME Screw Threads. An ACME screw thread is a thread form designed for high stress in a traversing motion and power transmission. See ASME BI.5 replacing FED-STD-H28/12 TABLE 12-1.

12.3.2 Aeronautical National Form Taper Pipe Thread. Aeronautical National form pipe threads are used for Air Force pipe thread requirements. This thread is designated ANPT. See SAE AS71051 & TABLE 12-9 herein.

12.3.3 American National Form Threads. The principal difference between the Unified and the American National Form threads (FED-STD-H28 Appendix 1) is in the application of allowance, differences in amount of pitch diameter tolerance applied to internal and external threads, and the variation of tolerance with size. These threads are designated: N, NC, NF, NEF, or NS. This series superseded by the UN series ASME B1.1.

12.3.4 American Standard Taper Pipe Threads. The American Standard taper pipe thread is a form of screw thread used on pipe and pipe fittings. It is characterized by a fine pitch and a taper of 1 in 16 (.75 inch per foot) on the diameter. This thread is designated NPT. See ASME B1.20.1 replacing FED-STD-H28/7 TABLE 7-2.

12.3.5 Buttress Screw Threads. The Buttress form of thread is designated for applications involving exceptionally high stresses, in one direction only, along the thread axis. Standards for Buttress threads are presented in ASME B1.9 which designates **BUTT** (external thread pulls) and **PUSH-BUTT** (external thread pushes) replacing FED-STD-H28/14 TABLE 14-1. These threads are designated (N BUTT or (N BUTT. The arrow and single parentheses indicates whether the screw is to push or pull. The former indicates that the screw will push and the latter indicates the screw will pull.

12.3.6 Controlled Radius Root Threads. Controlled radius root threads are unified screw threads used to avoid stress conditions at root. Classes 3A and 3B are altered to include mandatory continuous radius at the root of the external thread, and the minor diameter of both the external and internal threads is increased over the unified thread values to accommodate the root radius. UNJ external threads will not assemble with UN internal threads. See TABLE 12-4 herein and ASME B1.15.

12.3.7 Dryseal American Standard Pipe Thread. A pipe thread in which metal to metal contact (at the crest and root prior to or coincident with flank contact) is ensured by dimensional controls, producing a leak proof and pressure-tight connection without the use of sealants. All external dryseal pipe threads are tapered, and the internal threads may be either straight or tapered. They are separated into the four types described below and can be interchanged within the limitations shown in ASME B1.20.3, TABLE 12-9 herein replacing FED-STD-H28/8 TABLE 8-4.

TYPE 1 **NPTF Dryseal American Standard Taper Pipe Thread.** Both internal and external threads tapered. Generally considered superior to NPT and ANPT for strength and sealing.

TYPE 2 **PTF-Short Dryseal SAE Short Taper Pipe Thread.** Same as NPTF except that there is one thread less at large end on internal threads and one thread less on small end of external threads.

TYPE 3 **NPSF Dryseal American Standard Fuel Internal Straight Pipe Thread.** These are straight internal threads, intended to mate with tapered external threads, and are generally used in soft and ductile material which will deform at assembly.

TYPE 4 **NPSI Dryseal American Standard Intermediate Internal Straight Pipe Thread.** These are straight internal threads, intended to mate with tapered external threads, and are generally used in hard material of heavy sections where there is minimum thread expansion at assembly.

12.3.8 Incomplete Threads. Sometimes referred to as runout, these may be defined as the imperfect portion of thread extending from the fully formed thread portion to the completely unthreaded shank or hole. Dimensions and tolerances specified on the drawing that apply to the depth or length of threads control the depth or length of full threads according to ASME Y14.6.

12.3.9 Nominal Size. The nominal size is the designation used for general identification of threads.

12.3.10 Pitch. The pitch of a thread is the distance, measured parallel to its axis, between corresponding points on adjacent thread forms in the same axial plane and on the same side of the axis.

12.3.11 Rolled Threads. These are threads made between suitable hardened-steel dies by displacement of metal to conform with the die contours. No material is removed from the original blank. These threads are for high production. They are superior to those produced by machining. The tensile and shear strength, as well as fatigue resistance, is increased to a marked degree. In addition, they possess smooth, hard, burnished surfaces and the process produces accurate threads and forms on soft, tough and stringy materials which are impossible to machine without tearing. Internal threads are not normally made by this process. MIL-B-7838 is a typical specification for a bolt having the thread form conforming to MIL-S-7742 with the exception that the thread roots are controlled and produced by a single rolling process after heat treatment. ASME B1.15 and MIL-S-8879 employ rolled external threads with a high root radius for added strength. See TABLE 12-4 herein.

12.3.12 Standard Series Threads. Standard Series Threads are threads of Unified Form, having diameter and pitch combinations listed in TABLE 12-2 herein. (Ref: ASME B1.1 optional root radius and ASME B1.15 mandatory root radius)

12.3.13 Terms Relating To Dimension Of Screw Threads. The terms that follow generally appear in a thread callout on a drawing. Standard threads require minimum identification, while special threads require all of those listed below and in some cases more. Further information is described elsewhere in this section. See FIGURES 12-1a and 12-1b.

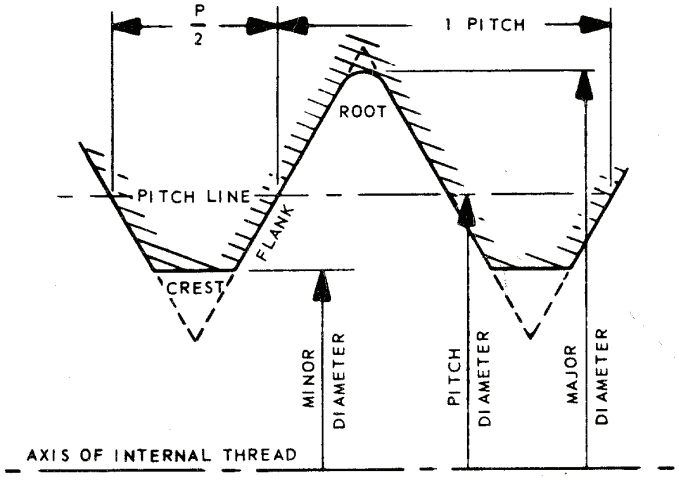
a. **MAJOR DIAMETER.** The major diameter is the diameter of the coaxial cylinder that would bound the crest of an external thread or the root of an internal thread.

b. **MINOR DIAMETER.** The minor diameter is the diameter of the coaxial cylinder that would bound the root of an external thread or the crest of an internal thread.

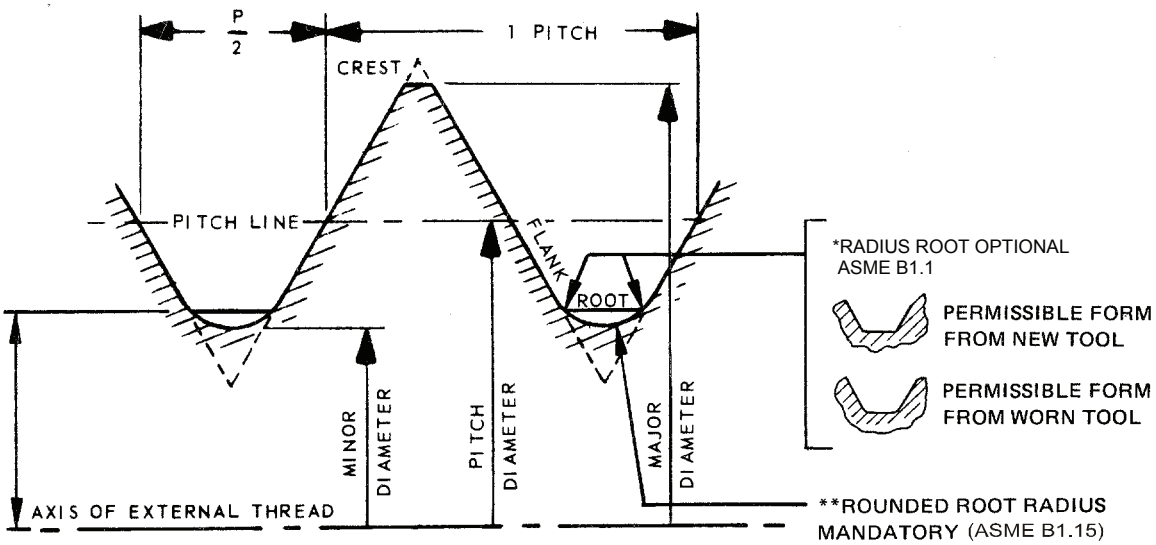
c. **PITCH DIAMETER (Simple Effective Diameter).** The pitch diameter is the diameter of the coaxial cylinder, the surface of which would pass through the thread profiles at such points as to make the width of the groove equal to one-half of the basic pitch.

d. **PITCH** - See PARAGRAPH 12.3.10.

12.3.14 Unified Form Threads. Unified Form Threads are those which have been agreed upon by the standards bodies of Canada, the United States and the United Kingdom. They are mechanically interchangeable with American National threads of the same diameter and pitch and are designated as UN, UNC, UNF, UNEF, UNS, or UNM. For limits of sizes see TABLE 12-2 thru 12-7 herein.



INCH INTERNAL THREAD PROFILE
FIGURE 12-1a
For dimensions see TABLE 12-2 herein for ASME B1.1 and see TABLE 12-4 herein for ASME B1.15
(For use with high root radius external threads)



INCH EXTERNAL THREAD PROFILE
FIGURE 12-1b
* For dimensions see TABLE 12-2 herein for ASME B1.1
** For dimensions see TABLE 12-4 herein for ASME B1.15

12.3.15 Unified Form Threads With Mandatory Controlled Root Radius On External Thread. Where added strength is required (achieved by controlled root radius and rolled threads), the requirements for Unified screw threads, classes 3A and 3B,are altered to include a mandatory continuous radius at the root of the external threads with the minor diameter of both the external and internal threads increased (over the Unified thread values) to accommodate the root radius. See TABLE 12-4 herein and ASME B1.15 for added information and sizes.

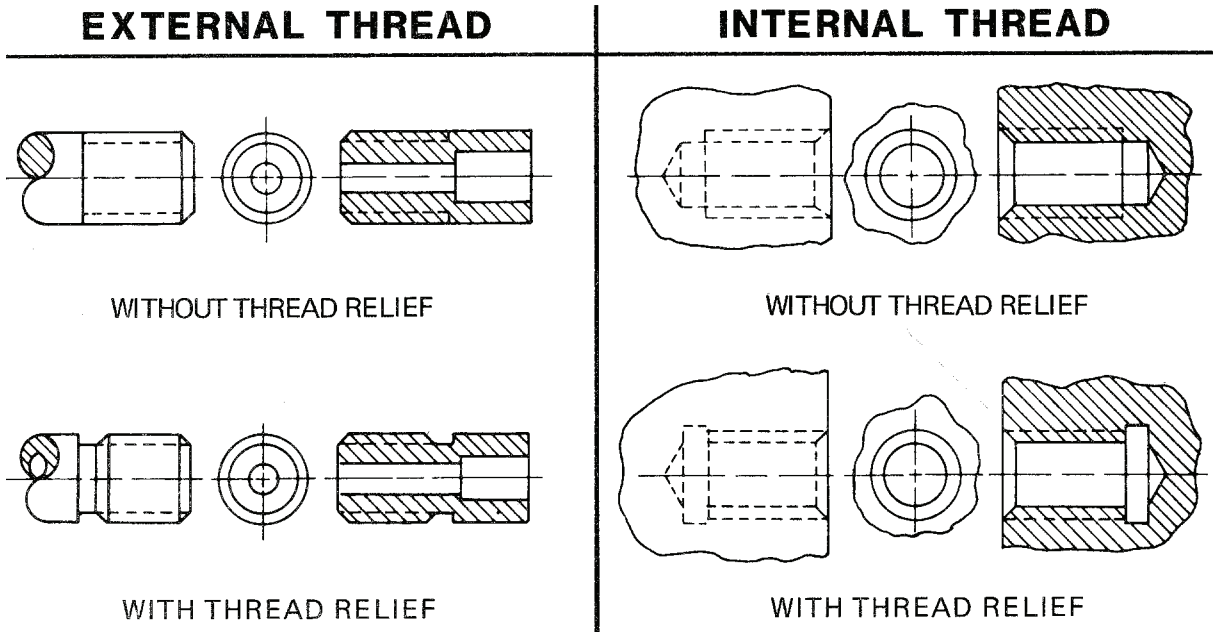
12.3.15.1 External Threads Of Unified Form. External threads of Unified form are in accordance with ASMEB1.15 class 3A only, and are altered per ASME B1.15 at the root so that the flanks of the adjacent threads are joined by one continuous, smoothly-blended curve tangent to the flanks. The radius of curvature adjacent to the flanks shall be between 0.18042p and 0.15011p where "p" equals the pitch. See FIGURE 12-1b, TABLE 12-4 herein and ASME B1.15 for added information and sizes.

12.3.15.2 Internal Threads Of Unified Form. Internal threads of Unified form are in accordance with ASME B1.15 class 3B only, and are modified per ASME B1.15 at the minor diameter per TABLE 12-4 herein. See ASME B1.15 for added information and sizes.

12.4 DRAWING APPLICATION.

12.4.1 Thread Representation.

12.4.1.1 Simplified Thread Representation. ASME Y14.6 simplified method of thread representation shall be used. See FIGURE 12-2. Where design requirements make detailed representation desirable, see FIGURES 12-3 and 12-4.



SIMPLIFIED THREAD REPRESENTATION
(PREFERRED)
FIGURE 12-2

12.4.1.1 (Continued)

SCHEMATIC THREAD REPRESENTATION

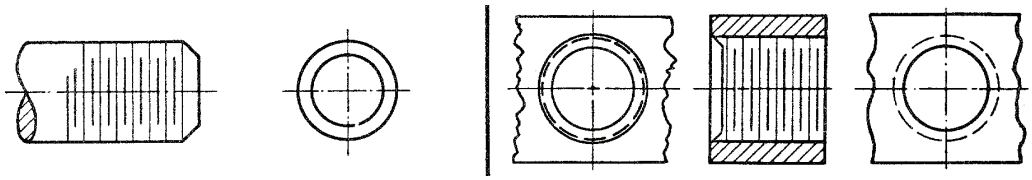
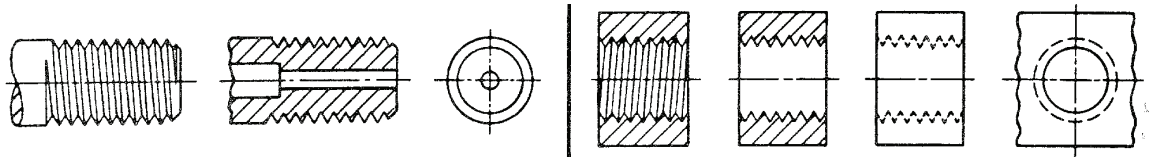
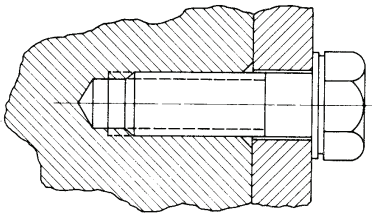


FIGURE 12-3



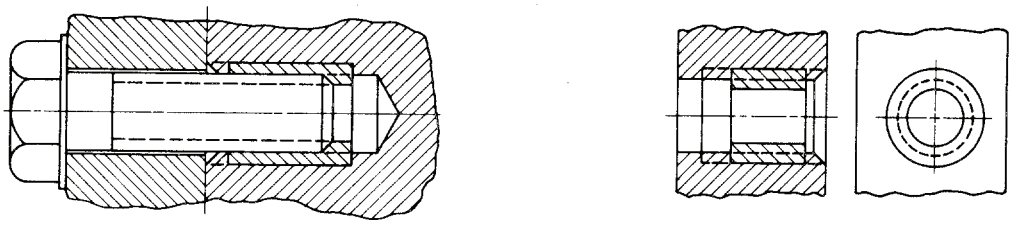
DETAILED THREAD REPRESENTATION
FIGURE 12-4

12.4.1.2 Assembled Straight Thread Representation. An assembly of a male and female straight thread in cross section is shown as in FIGURE 12-5.



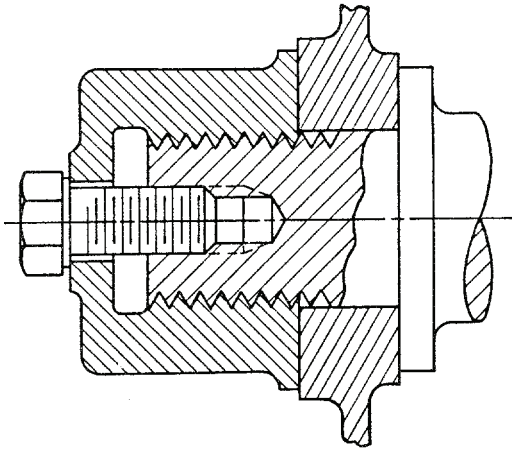
SIMPLIFIED THREAD ASSEMBLY REPRESENTATION
FIGURE 12-5

12.4.1.3 Thread Insert Representation. Thread inserts are shown by the simplified thread representation as shown in FIGURE 12-6.



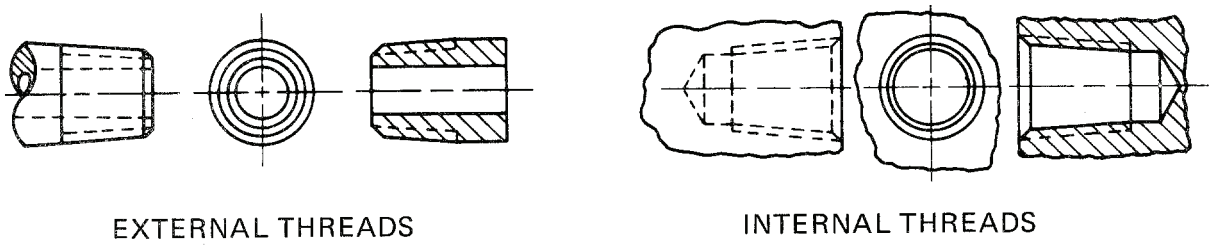
SIMPLIFIED COMBINED ASSEMBLED THREAD REPRESENTATION
FIGURE 12-6

12.4.1.4 Thread Representation Using All Three (3) Conventions Of Figures 12-2, 12-3, And 12-4. For clarity, all three (3) conventions of thread representations may be used on a single drawing view or cross section. See FIGURE 12-7.



MULTIPLE THREAD CONVENTION REPRESENTATION
FIGURE 12-7

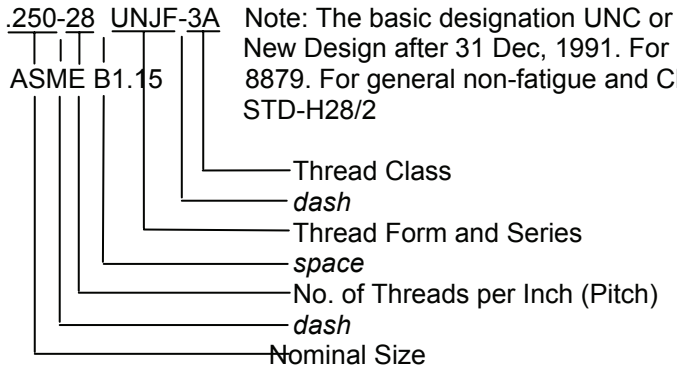
12.4.1.5 Tapered Pipe Thread Representation. Pipe threads shall be drawn at an included angle of approximately 4 degrees. (.125 inch taper on the diameter per inch of length.) See FIGURE 12-8.



PIPE THREAD REPRESENTATION
FIGURE 12-8

12.4.2 Thread Designation (Drawing Callout). In accordance with ASME B1.15 or MIL-S-8879 as applicable. See PARAGRAPH 2.1.2 and 2.1.3. When thread callouts occur on a drawing, the applicable specification shall be placed with the individual callout or placed in the General Notes column.

12.4.2.1 Basic Designation. The necessary information required in the designation of standard series threads consists of the following groups in sequence, each group being separated by a dash: nominal size, number of threads per inch with thread series symbol, as applicable, and the thread class. See example that follows:



Note: The basic designation UNC or UNF as applied by MIL-S-7742 is “Inactive for New Design after 31 Dec, 1991. For New Design use ASME B1.15 replacing MIL-S-8879. For general non-fatigue and Class 2 threads use ASME B1.1 replacing FED-STD-H28/2

12.4.2.1.1 Nominal Size. The nominal size for threads is designated by the decimal equivalent. The decimal in this callout does not denote a tolerance nor is any tolerance applicable. Four place decimals are used except when omitting fourth place ciphers.

Examples:

.250-28 UNJF-3A (external)	.4375-14 UNJC-2A (external)
.250-28 UNJF-3B (internal)	.4375-14 UNJC-2B (internal)

12.4.2.1.2 Number Of Threads. The number of threads, preceded by a dash (-), designates the number of single threads per inch (pitch equal to lead). Multiple threads are specified by pitch and lead or by the number of "starts" affixed to the thread designation.

Examples:

a. **.125-12 UNF-3B-3 START** (use for Unified and American national thread forms only.)
b. **.250-.4P-.8L-ACME-4C** (use for all thread forms other than Unified and American National.)

12.4.2.1.3 Thread Form and Series. First Considerations shall be given in selection of threads in the design of new equipment. Two series of threads chosen for that purpose are Standard UNJ and Special UNJS. The use of fine threads (TABLE 12-4) shall be given preference to facilitate the maximum usage of a limited number of threads. The use of Special UNJS threads in new equipment designs shall be justified by the designer and procuring activity. The UNJ series of threads consists of three series with graded pitches and three series with constant pitches.

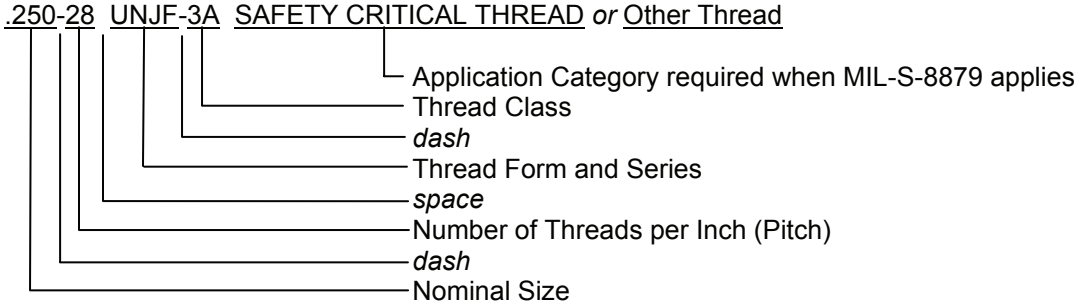
GRADED PITCHES	CONSTANT PITCHES
UNJC COARSE	8 UNJ 8 THREADS PER INCH
UNJF FINE (Preferred)	12 UNJ 12 THREADS PER INCH
UNJEF EXTRA FINE	16 UNJ 16 THREADS PER INCH

SPECIAL UNJ Series (UNJS) 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. See PARAGRAPH 12.4.2.2.

12.4.2.1.4 Thread Class. Classes of threads are distinguished from each other by the amount of tolerance, or the amount of tolerance and allowance. For threads computed to Unified formulation, Classes 1A, 2A, 3A apply to external threads and Classes 1B, 2B, 3B apply to internal threads. For the American National series, the class of thread is designated for external and internal threads by a number only, preceded by a dash, e.g.,-2, -3.

12.4.2.1.5 Thread Application Categories. Thread application categories shall be determined and specified in either the thread designation, a general note, referenced account or the purchase order for the threaded product made in accordance with MIL-S-8879. These application categories determine the level of inspection requirements. The application categories are "Safety Critical Thread" and "Other thread". "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 Thread".

Example:



12.4.2.1.6 Thread Application Category Assignment Responsibility When MIL-S-8879 Applies. When applicable, the designer specifies which characteristics are inspected and verified for "Safety Critical Threads" or "Other Threads". 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	"GO" functional diameter size (See note 1)
Thread	Pitch diameter size (See note1)
	Major diameter size (external threads only)
	Minor diameter size
	Root radius (external threads only)
	Flank angle (See note 1)
	Lead (including helix variations) (See note 1)
	Circularity
	Taper
	Runout
	Surface roughness
Other Thread (See note 3)	"GO" functional diameter (See note 2)
	Pitch diameter size
	Major diameter size (external threads only)
	Minor diameter size (See note 2)
	Root radius (external threads only)

NOTES:

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.

Whenever the Thread Application Category has not been specified, the "Other Thread" category will apply.

12.4.2.1.7 Hand Designation. Screw threads are interpreted to mean right hand unless LH, for left hand, is included in the callout.

Example:

.250-20 UNJC-2A-LH
ASME B1.15

12.4.2.1.8 Controlled Radius Root Threads. Are designated as shown below:

(external)
.250-28 UNJF-3A
ASME B1.15

AND

(internal)
.250-28 UNJF-3B
ASME B1.15

12.4.2.1.9 Modified Crests. It is occasionally necessary to modify the limits of size of the major diameter of an external thread or the minor diameter of an internal thread. This modification is within the maximum material condition established for standard series and special threads, but without change to the class of thread or pitch diameter limits. Such threads will be designated in the standard callout followed by the designation MOD for modifying the major diameter of the external thread or the minor diameter of the internal thread.

Examples:

(external) .375-24 UNF-3A MOD
MAJOR DIA .3648 - .3720 MOD

(internal) 1.500-10UNS-2B MOD
MINOR DIA 1.398 - 1.408 MOD
PD 1.4350 - 1.4412

12.4.2.2 Special Threads. This term is generally applied to threads of unified form when either the pitch or nominal diameter or both do not conform to sizes in the standard or unified series. Formulas or dimensions and tolerances and general information on these threads may be found in ASME B1 series replacing FED-STD-H28.

12.4.2.2.1 Designating Unified Special Threads. The following is the method of designating unified special threads (unified formula formulations) on the field of drawing:

Examples:

EXTERNAL THREAD	INTERNAL THREAD
(a.) .250-24 UNS-3A MAJOR DIA .2428 - .2500 PD .2201 - .2229	1.200-10UNS -2B MINOR DIA 1.092 - 1.113 PD 1.350 - 1.432
(b.) .495-20 UNS 3A MAJOR DIA .4869 - .4950 PD .4593 - .4625	

12.4.2.2.2 Other Special Threads. Inclusion of other threads such as Unified Form Special, Multiple Start Threads, Special Form Threads, Miniature Screw Threads, etc. are covered in detail by ANSI Y14.6 and FED-STD-H28.

12.4.2.2.3 Lesser Known Threads. In addition to the more common screw threads, ASME B1 series and FED-STD-H28 also includes data on the lesser known international Metric, Buttress, Acme, Stub Acme and other threads. Additional data on still other threads - such as British Standards, Whitworth, Trapezoidal Metric, Dardelot Self - locking, etc., - may be found in the SAE Handbook.

12.4.2.2.4 Identification Of Lesser Known Threads. The drawing callout for the lesser known threads included in ASME B1 series and FED-STD-H28 will include the “Identification Designation” and other information necessary to establish the specific requirements. Any other screw thread not included in ASME B1 series or FED-STD-H28 will require either a complete drawing delineation or an appropriate reference to an acceptable established standard.

Example:

THREAD 18mm-1.5
PITCH DIA .6645 - .6695

SPARK PLUG THREAD PER SAE HANDBOOK.

12.4.3 Coated Threads. Coatings, as defined herein, is interpreted to mean an additive protective metallic coating. Methods of specifying coated threads necessarily vary with the intended applications as described in ASME B1 series replacing FED-STD-H28. Examples of designations for coated threads follow:

12.4.3.1 Class 2A-Coated (External)

Examples:

a. For general purpose application.

.750-10 UNC-2A OTHER THREAD

*MAJOR DIA .7500 MAX
*PITCH DIA .6850 MAX — AFTER COATING (Plating)

b. For critical applications where uncoated thread and coating buildup must be closely controlled.

.750-10 UNC-2A OTHER THREAD

*MAJOR DIA .7500 MAX
*PITCH DIA .6850 MAX — AFTER COATING (Plating)

**MAJOR DIA .7353 - .7482
**PITCH DIA .6773 - .6832 — BEFORE COATING (Plating)

12.4.3.2 Class 3A-Coated (External)

Examples:

a. For general purpose application.

.250-28 UNF-3A OTHER THREAD

*MAJOR DIA .2500 MAX
*PITCH DIA .2268 MAX — AFTER COATING (Plating)

b. For critical applications where uncoated thread and coating buildup must be controlled.

.250-28 UNF-3A

*MAJOR DIA .2500 MAX
*PITCH DIA .2268 MAX — AFTER COATING (Plating)

***MAJOR DIA .2427 - .2488 SPL
**PITCH DIA .2236 - .2256 SPL — BEFORE COATING (Plating)

NOTE: * Major and pitch dia limits are those selected from table for Class 3A.
** Major and pitch dia limits are those selected from table for Class 2A.
*** Calculated by reducing the amount of the Class 2A allowance whenever this is adequate.

12.4.3.3 Class 2B-Coated (Internal)

Examples:

a. For general purpose application.

.750-10 UNC-2B

*MINOR DIA .6420 MIN
*PD .6850 MIN — AFTER COATING (Plating)

b. For critical applications where uncoated thread and coating buildup must be closely controlled.

.750-10 UNC-2B

*MINOR DIA .6420 MIN
*PD .6850 MIN — AFTER COATING (Plating)

*** MINOR DIA .6440 - .6650 SPL
*** PD .6868 - .6945 SPL — BEFORE COATING (Plating)

12.4.3.4 CLASS 3B-Coated (Internal)

Examples:

a. For general purpose application.

.750-10 UNC-3B

*MINOR DIA .6420 MIN
*PD .6850 MIN — AFTER COATING (Plating)

b. For critical applications where uncoated thread and coating buildup must be controlled.

.750-10 UNC-3B

*MINOR DIA .6420 MIN
*PD .6850 MIN — AFTER COATING (Plating)

*** MINOR DIA .6438 -.6563 SPL
*** PD .6868 -.6925 SPL — BEFORE COATING (Plating)

NOTE: * Minor and pitch dia limits are those selected from Table for Class 3A.
** Minor and pitch dia limits are those selected from Table for Class 2A.
*** Calculated by increasing the amount of the Class 2A allowance whenever this is adequate.

12.4.4 Thread Inserts. An example of a drawing callout for two (2) threaded holes with each hole to receive a thread insert from Military Standards (example: MS122083) with a .375-16 UNC-3B threaded hole, and a one diameter length of insert with tang removed, is as follows:

Example: 2X Ø.390 – 398 ↧.75

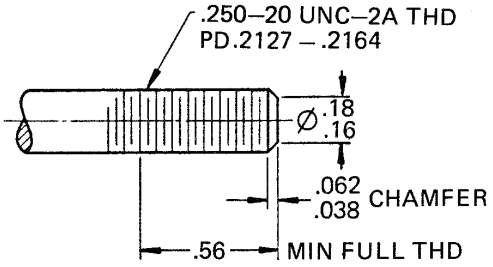
⌵ Ø.440 - .480 X 120°±5°

.375-16 UNC-3B ↧.400 MIN

HELICAL COIL INSERT MS122083

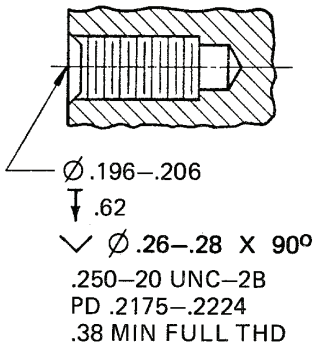
INSTALL PER MS33537 TANG REMOVED

12.4.5 Thread Callouts Including Additional Information In Note Form. Additional information may be included in the thread designation callout - such as pitch diameter limits, hole size, hole depth, counterbore, countersink, etc. - or dimensioned separately on appropriate views. See FIGURES 12-9, 12-10, 12-11 and 12-12.



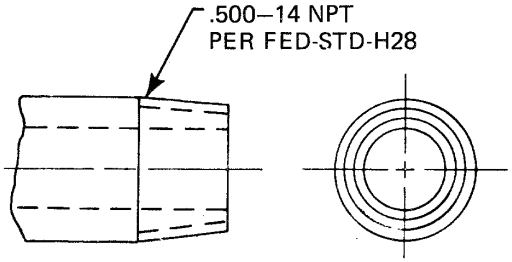
INCH	METRIC
.038	0.96
.062	1.57
.16	4.1
.18	4.6
.56	14.2

MALE THREAD CALLOUT
FIGURE 12-9

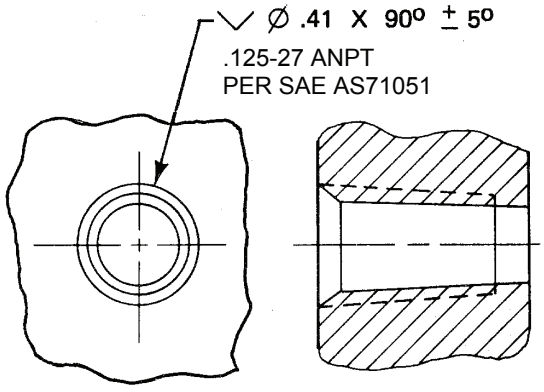


INCH	METRIC
.196	4.98
.206	5.23
.38	9.6
.62	15.7

FEMALE THREAD CALLOUT
FIGURE 12-10



NATIONAL TAPER PIPE THREAD
CALLOUT
FIGURE 12-11



AERONAUTICAL TAPER PIPE THREAD
CALLOUT
FIGURE 12-12

12.4.6 Thread Dimensioning.

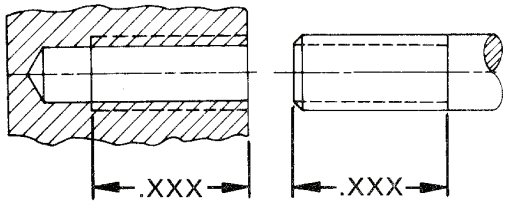
12.4.6.1 General Applications.

12.4.6.1.1 Dimensional Limits For Standard Series Threads. For Standard series threads, identified in PARAGRAPH 12.3.12, the dimensional limits are obtained from Table 12-2 herein or by reference to ASME B1.1, replacing FED-STD-H28/2 except those dimensions pertaining to length of engagement, chamfers, reliefs, and depth.

12.4.6.1.2 Dimensional Limits For Controlled Radius Root Threads. Controlled radius root threads are prepared to the dimensional limits of TABLE 12-4 herein as specified in ASME B1.15 replacing MIL-S-8879.

12.4.6.1.3 Dimensional Limits For Pipe Threads. Drawing representations of pipe threads, identified in PARAGRAPHS 12.3.2, 12.3.4 and 12.3.7, are prepared as shown in TABLE 12-9 herein. An appropriate callout, as shown in FIGURES 12-11 and 12-12, establishes the dimensional values used in design computations or fabrication and acceptance requirements as specified in ASME B1.20.1 or SAE AS71051, as applicable.

12.4.6.2 Full Form Threads. The length of fully formed threads is dimensioned. When only one dimension is used to specify the length of threads, it is interpreted to mean the length of fully formed threads, excluding runout. Where a chamfer not exceeding 2 pitch in length exists at the entering end of the thread, it is included in the length of fully formed threads. FIGURE 12-13 shows methods of delineating with no limit on runout.

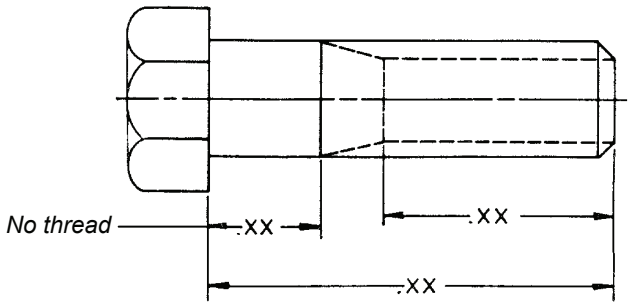


THREAD LENGTH
FIGURE 12-13

12.4.6.3 Incompletely Formed Threads. The length of incompletely formed threads is not dimensioned. This length may vary according to the method of manufacture. Whenever the number of incompletely formed threads allowed on the entering end is more restrictive than that permitted by ASME Y14.6 dimensions. The restrictions shall be specified as follows:

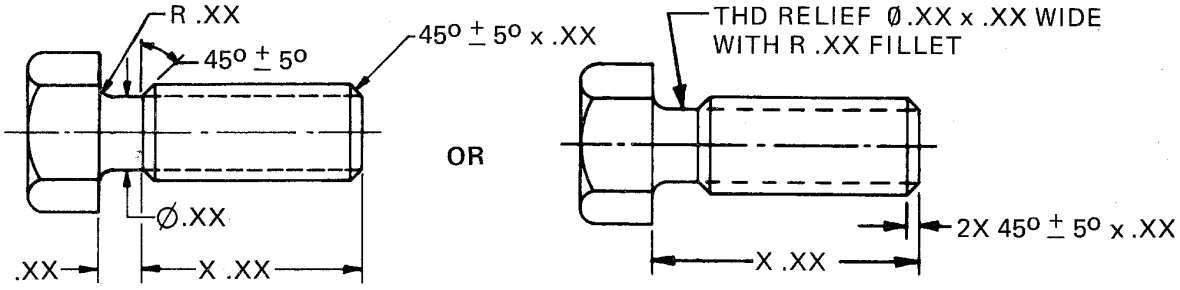
.XX MAX TO FULL FORM THREAD

12.4.6.4 Controlled Length And Run-Out Of Full Form Threads. FIGURE 12-14 illustrates an alternate method of drawing when both the length of full form threads and runout must be controlled.

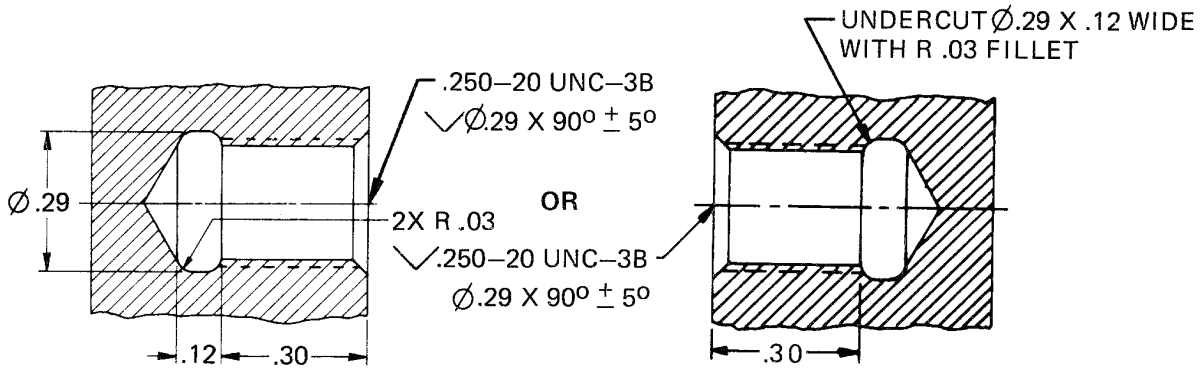


CONTROLLED THREAD RUN-OUT
FIGURE 12-14

12.4.6.5 Reliefs. External and internal thread reliefs, when required, may be dimensioned as shown in FIGURES 12-15 AND 12-16. For relief data, see TABLE 12-1.



EXTERNAL THREAD RELIEF AND CHAMFER
FIGURE 12-15



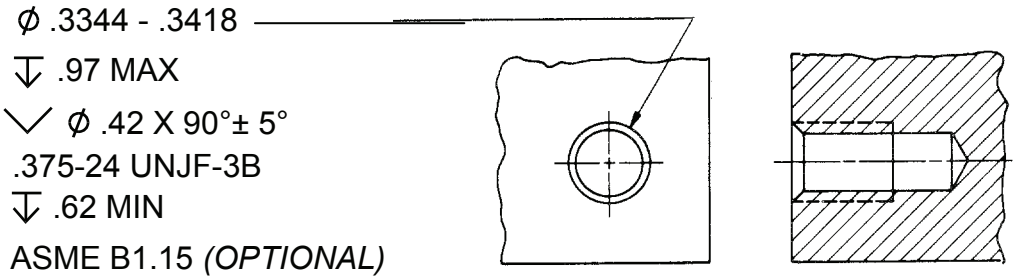
INTERNAL THREAD RELIEF AND COUNTERSINK
FIGURE 12-16

12.4.6.6 Chamfers. Chamfers are specified on the drawing as shown in FIGURE 12-15. Whenever practicable, the chamfer angle shall be $45^{o} + 5^{o}$. The chamfer specified must be a minimum of one-half of the value of relief constant B, TABLE 12-1, rounded-off to two decimal places.

12.4.6.7 Countersinks. Countersinks are designated by an angle and a diameter as shown in FIGURE 12-16. It is recommended that the minimum countersink diameter be the nominal major diameter plus relief constant A of TABLE 12-1.

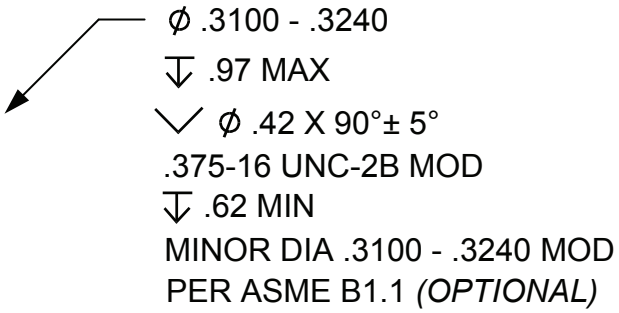
12.4.6.8 Blind Holes. If a blind hole is unavoidable, the allowance for tool chamfer, partial threads, and tap clearance at the bottom of the hole should not be less than that suggested in TABLE 12-1.

12.4.6.9 Tap Drill Size And Depth (Also Combined Dimensioning). Except when required by specific design considerations, neither the size nor depth of the tap drill is included in the thread callout. Where the depth of the tap drill must be controlled, it may be dimensioned or called out in the note form (See FIGURE 12-17). When the size of the tap drill is specified on the drawing, the internal minor diameter limits (shown in TABLE 12-4 herein for selected threads by MIL-S-8879, and additional threads from TABLE III of MIL-S-8879) shall be used and held to the same number of decimal places as shown in the tables.



NOTE FOR THREADED HOLE DIMENSIONING
FIGURE 12-17

If any other limits are used, the thread must be designated “MOD”, For example.

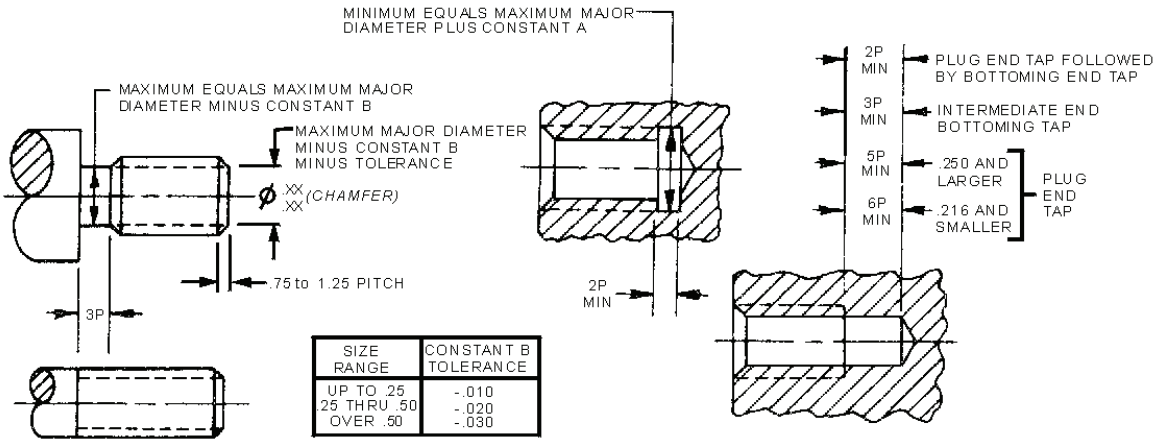


12.4.7 Drawing Notes. Drawings reference the documents used for interpreting thread dimensions and designations. This reference is in the form of either a local note on the field of drawing, or a General Note.

Example:

THREADS PER ASME B1.15 (or SAE AS71051, MIL-S-8879, MIL-S-7742, etc., as applicable.)

THREADS PER INCH	LENGTH OF RELIEF OR ALLOWANCE BEYOND FULL FORM THREADS					RELIEF CONSTANT	
	PITCH INTERVAL					INTERNAL CONSTANT **A** INCHES	EXTERNAL CONSTANT **B** INCHES
	1P INCHES	2P INCHES	3P INCHES	5P INCHES	6P INCHES		
80	.012	.025	.038	.062	.075	.005	.020
72	.014	.028	.042	.069	.083	.006	.021
64	.016	.031	.047	.078	.094	.006	.024
56	.018	.036	.054	.089	.107	.007	.027
48	.021	.042	.062	.104	.125	.007	.031
44	.023	.045	.068	.114	.136	.008	.034
40	.025	.050	.075	.125	.150	.008	.037
36	.028	.056	.083	.139	.167	.009	.041
32	.031	.062	.094	.156	.188	.010	.046
28	.036	.071	.107	.179	.214	.011	.053
24	.042	.083	.125	.208	.250	.013	.061
20	.050	.100	.150	.250	.300	.014	.072
18	.056	.111	.167	.278	.333	.016	.081
16	.062	.125	.188	.312	.375	.018	.090
14	.071	.143	.214	.357	.429	.020	.103
13	.077	.154	.231	.385	.462	.021	.110
12	.083	.167	.250	.417	.500	.023	.120
11	.091	.182	.273	.455	.545	.025	.130
10	.100	.200	.300	.500	.600	.027	.143
9	.111	.222	.333	.556	.667	.030	.158
8	.125	.250	.375	.625	.750	.033	.178
7	.143	.286	.429	.714	.857	.038	.203
6	.167	.333	.500	.833	1.000	.044	.237
5	.200	.400	.600	1.000	1.200	.052	.283
4.5	.222	.444	.667	1.111	1.333	.058	.314
4	.250	.500	.750	1.250	1.500	.064	.353



SUGGESTED SCREW THREAD RELIEFS
TABLE 12-1

MIL-S-7742 selected series from FED-STD-H28/2 standard series limits of size – Unified Screw Threads
*based on length of engagement equal to 1 to 1.5 diameters
INACTIVE FOR NEW DESIGNS DEC 31,1991: SEE NOTES.

NOMINAL SIZE & THREADS PER INCH	SERIES DESIGNATION	EXTERNAL								INTERNAL					MAJOR DIAMETER
		CLASS	ALLOWANCE	MAJOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS		MINOR DIAMETER	CLASS	MINOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS			
				MAX	MIN	MAX	MIN	TOL				MIN	MAX	TOL	MIN
				INCHES	INCHES	INCHES	INCHES	INCHES		INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
.060-80 (#0-80)	UNF	2A	0.0005	0.0595	0.0563	0.0514	0.0496	0.0018	2B	0.0465	0.0514	0.0519	0.0542	0.0023	0.0600
		3A	.0000	.0600	.0568	.0519	.0506	.0013	3B	.0465	.0514	.0519	.0536	.0017	.0600
.073-64 (#1-64)	UNC	2A	.0006	.0724	.0686	.0623	.0603	.0020	2B	.0561	.0623	.0629	.0655	.0026	.0730
		3A	.0000	.0730	.0692	.0629	.0614	.0015	3B	.0561	.0623	.0629	.0648	.0019	.0730
.086-56 (#2-56)	UNC	2A	.0006	.0854	.0813	.0738	.0717	.0021	2B	.0667	.0737	.0744	.0772	.0028	.0860
		3A	.0000	.0860	.0819	.0744	.0728	.0016	3B	.0667	.0737	.0744	.0765	.0021	.0860
.099-48 (#3-48)	UNC	2A	.0007	.0983	.0938	.0848	.0825	.0023	2B	.0764	.0845	.0855	.0885	.0030	.0990
		3A	.0000	.0990	.0945	.0855	.0838	.0017	3B	.0764	.0845	.0855	.0877	.0022	.0990
.112-40 (#4-40)	UNC	2A	.0008	.1112	.1061	.0950	.0925	.0025	2B	.0849	.0939	.0958	.0991	.0033	.1120
		3A	.0000	.1120	.1069	.0958	.0939	.0019	3B	.0849	.0939	.0958	.0982	.0024	.1120
.138-32 (#6-32)	UNC	2A	.0008	.1372	.1312	.1169	.1141	.0028	2B	.1041	.1140	.1177	.1214	.0037	.1380
		3A	.0000	.1380	.1320	.1177	.1156	.0021	3B	.1040	.1140	.1177	.1204	.0027	.1380
.164-32 (#8-32)	UNC	2A	.0009	.1631	.1571	.1428	.1399	.0029	2B	.1301	.1389	.1437	.1475	.0038	.1640
		3A	.0000	.1640	.1580	.1437	.1415	.0022	3B	.1300	.1389	.1437	.1465	.0028	.1640
.190-32 (#10-32)	UNF	2A	.0009	.1891	.1831	.1688	.1658	.0030	2B	.1561	.1641	.1697	.1736	.0039	.1900
		3A	.0000	.1900	.1840	.1697	.1674	.0023	3B	.1560	.1641	.1697	.1726	.0029	.1900
.250-28	UNF	1A	.0010	.2490	.2392	.2258	.2208	.0050	1B	.2110	.2200	.2268	.2333	.0065	.2500
		2A	.0010	.2490	.2425	.2258	.2225	.0033	2B	.2110	.2200	.2268	.2311	.0043	.2500
		3A	.0000	.2500	.2435	.2268	.2243	.0025	3B	.2110	.2190	.2268	.2300	.0032	.2500
.3125-24	UNF	1A	.0011	.3114	.3006	.2843	.2788	.0055	1B	.2670	.2770	.2854	.2925	.0071	.3125
		2A	.0011	.3114	.3042	.2843	.2806	.0037	2B	.2670	.2770	.2854	.2902	.0048	.3125
		3A	.0000	.3125	.3053	.2854	.2827	.0027	3B	.2670	.2754	.2854	.2890	.0036	.3125
.375-24	UNF	1A	.0011	.3739	.3631	.3468	.3411	.0057	1B	.3300	.3400	.3479	.3553	.0074	.3750
		2A	.0011	.3739	.3667	.3468	.3430	.0038	2B	.3300	.3400	.3479	.3528	.0049	.3750
		3A	.0000	.3750	.3678	.3479	.3450	.0029	3B	.3300	.3372	.3479	.3516	.0037	.3750
.4375-20	UNF	1A	.0013	.4362	.4240	.4037	.3974	.0063	1B	.3830	.3950	.4050	.4131	.0081	.4375
		2A	.0013	.4362	.4281	.4037	.3995	.0042	2B	.3830	.3950	.4050	.4104	.0054	.4375
		3A	.0000	.4375	.4294	.4050	.4019	.0031	3B	.3830	.3916	.4050	.4091	.0041	.4375
.500-20	UNF	1A	.0013	.4987	.4865	.4662	.4598	.0064	1B	.4460	.4570	.4675	.4759	.0084	.5000
		2A	.0013	.4987	.4906	.4662	.4619	.0043	2B	.4460	.4570	.4675	.4731	.0056	.5000
		3A	.0000	.5000	.4919	.4675	.4643	.0032	3B	.4460	.4537	.4675	.4717	.0041	.5000
.5625-18	UNF	1A	.0014	.5611	.5480	.5250	.5182	.0068	1B	.5020	.5150	.5264	.5353	.0089	.5625
		2A	.0014	.5611	.5524	.5250	.5205	.0045	2B	.5020	.5150	.5264	.5323	.0059	.5625
		3A	.0000	.5625	.5538	.5264	.5230	.0034	3B	.5020	.5106	.5264	.5308	.0044	.5625
.625-18	UNF	1A	.0014	.6236	.6105	.5875	.5805	.0070	1B	.5650	.5780	.5889	.5980	.0091	.6250
		2A	.0014	.6236	.6149	.5875	.5828	.0047	2B	.5650	.5780	.5889	.5949	.0060	.6250
		3A	.0000	.6250	.6163	.5889	.5854	.0035	3B	.5650	.5730	.5889	.5934	.0045	.6250

EQUIVALENT SIZE NUMBERS FOR REFERENCE ONLY

TABLE 12-2 (Continued on next page)

MIL-S-7742 selected series from FED-STD-H28/2 standard series limits of size – Unified Screw Threads
*based on length of engagement equal to 1 to 1.5 diameters.

NOMINAL SIZE & THREADS PER INCH	SERIES DESIGNATION	EXTERNAL									INTERNAL						MAJOR DIAMETER MIN
		CLASS	ALLOWANCE	MAJOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS		TOL	MINOR DIAMETER	CLASS	MINOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS		TOL	
				MAX	MIN	MAX	MIN				MIN	MAX	MIN	MAX		
				INCHES	INCHES	INCHES	INCHES	INCHES	INCHES		INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
.750-16	UNF	1A	.0015	.7485	.7343	.7079	.7004	.0075	.6718	1B	.6820	.6960	.7094	.7192	.0098	.7500
		2A	.0015	.7485	.7391	.7079	.7029	.0050	.6718	2B	.6820	.6960	.7094	.7159	.0065	.7500
		3A	.0000	.7500	.7406	.7094	.7056	.0038	.6733	3B	.6820	.6908	.7094	.7143	.0049	.7500
.875-14	UNF	1A	.0016	.8734	.8579	.8270	.8189	.0081	.7858	1B	.7980	.8140	.8286	.8392	.0106	.8750
		2A	.0016	.8734	.8631	.8270	.8216	.0054	.7858	2B	.7980	.8140	.8286	.8356	.0070	.8750
		3A	.0000	.8750	.8647	.8286	.8245	.0041	.7874	3B	.7980	.8068	.8286	.8339	.0053	.8750
1.000-12	UNF	1A	.0018	.9982	.9810	.9441	.9353	.0088	.8960	1B	.9100	.9280	.9459	.9573	.0114	1.0000
		2A	.0018	.9982	.9868	.9441	.9382	.0059	.8960	2B	.9100	.9280	.9459	.9535	.0076	1.0000
		3A	.0000	1.0000	.9886	.9459	.9415	.0044	.8978	3B	.9100	.9198	.9459	.9516	.0057	1.0000
1.125-12	UNF	1A	.0018	1.1232	1.1060	1.0691	1.0601	.0090	1.0210	1B	1.0350	1.0530	1.0709	1.0826	.0117	1.1250
		2A	.0018	1.1232	1.1118	1.0691	1.0631	.0060	1.0210	2B	1.0350	1.0530	1.0709	1.0787	.0078	1.1250
		3A	.0000	1.1250	1.1136	1.0709	1.0664	.0045	1.0228	3B	1.0350	1.0448	1.0709	1.0768	.0059	1.1250
1.250-12	UNF	1A	.0018	1.2482	1.2310	1.1941	1.1849	.0092	1.1460	1B	1.1600	1.1780	1.1959	1.2079	.0120	1.2500
		2A	.0018	1.2482	1.2368	1.1941	1.1879	.0062	1.1460	2B	1.1600	1.1780	1.1959	1.2039	.0080	1.2500
		3A	.0000	1.2500	1.2386	1.1959	1.1913	.0046	1.1478	3B	1.1600	1.1698	1.1959	1.2019	.0060	1.2500
1.375-12	UNF	1A	.0019	1.3731	1.3559	1.3190	1.3096	.0094	1.2709	1B	1.2850	1.3030	1.3209	1.3332	.0123	1.3750
		2A	.0019	1.3731	1.3617	1.3190	1.3127	.0063	1.2709	2B	1.2850	1.3030	1.3209	1.3291	.0082	1.3750
		3A	.0000	1.3750	1.3636	1.3209	1.3162	.0047	1.2728	3B	1.2850	1.2948	1.3209	1.3270	.0061	1.3750
1.500-12	UNF	1A	.0019	1.4981	1.4809	1.4440	1.4344	.0096	1.3959	1B	1.4100	1.4280	1.4459	1.4584	.0125	1.5000
		2A	.0019	1.4981	1.4867	1.4440	1.4376	.0064	1.3959	2B	1.4100	1.4280	1.4459	1.4542	.0083	1.5000
		3A	.0000	1.5000	1.4886	1.4459	1.4411	.0048	1.3978	3B	1.4100	1.4198	1.4459	1.4522	.0063	1.5000
1.750-12	UN	2A	.0018	1.7482	1.7368	1.6941	1.6881	.0060	1.6460	2B	1.660	1.678	1.6959	1.7037	.0078	1.7500
		3A	.0000	1.7500	1.7386	1.6959	1.6914	.0045	1.6478	3B	1.6600	1.6698	1.6959	1.7017	.0058	1.7500
2.000-12	UN	2A	.0018	1.9982	1.9868	1.9441	1.9380	.0061	1.8960	2B	1.910	1.928	1.9459	1.9538	.0079	2.0000
		3A	.0000	2.0000	1.9886	1.9459	1.9414	.0045	1.8978	3B	1.9100	1.9198	1.9459	1.9518	.0059	2.0000
2.250-12	UN	2A	.0018	2.2482	2.2368	2.1941	2.1880	.0061	2.1460	2B	2.160	2.178	2.1959	2.2038	.0079	2.2500
		3A	.0000	2.2500	2.2386	2.1959	2.1914	.0045	2.1478	3B	2.1600	2.1698	2.1959	2.2018	.0059	2.2500
2.500-12	UN	2A	.0019	2.4981	2.4867	2.4440	2.4378	.0062	2.3959	2B	2.410	2.428	2.4459	2.4540	.0081	2.5000
		3A	.0000	2.5000	2.4886	2.4459	2.4413	.0046	2.3978	3B	2.4100	2.4198	2.4459	2.4519	.0060	2.5000
2.750-12	UN	2A	.0019	2.7481	2.7367	2.6940	2.6878	.0062	2.6459	2B	2.660	2.678	2.6959	2.7040	.0081	2.7500
		3A	.0000	2.7500	2.7386	2.6959	2.6913	.0046	2.6478	3B	2.6600	2.6698	2.6959	2.7019	.0060	2.7500
3.000-12	UN	2A	.0019	2.9981	2.9867	2.9440	2.9377	.0063	2.8959	2B	2.910	2.928	2.9459	2.9541	.0082	3.0000
		3A	.0000	3.0000	2.9886	2.9459	2.9412	.0047	2.8978	3B	2.9100	2.9198	2.9459	2.9521	.0062	3.0000
3.250-12	UN	2A	.0019	3.2481	3.2367	3.1940	3.1877	.0063	3.1459	2B	3.160	3.178	3.1959	3.2041	.0082	3.2500
		3A	.0000	3.2500	3.2386	3.1959	3.1912	.0047	3.1478	3B	3.1600	3.1698	3.1959	3.2021	.0062	3.2500
3.500-12	UN	2A	.0019	3.4981	3.4867	3.4440	3.4376	.0064	3.3959	2B	3.410	3.428	3.4459	3.4543	.0084	3.5000
		3A	.0000	3.5000	3.4886	3.4459	3.4411	.0048	3.3978	3B	3.4100	3.4198	3.4459	3.4522	.0063	3.5000

TABLE 12-2 (Continued on next page)

MIL-S-7742 selected series from FED-STD-H28/2 standard series limits of size – Unified Screw Threads
*based on length of engagement equal to 1 to 1.5 diameters.

NOMINAL SIZE & THREADS PER INCH	SERIES DESIGNATION	EXTERNAL								INTERNAL						MAJOR DIAMETER MIN INCHES
		CLASS	ALLOWANCE	MAJOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS			MINOR DIAMETER INCHES	CLASS	MINOR DIAMETER LIMITS		*PITCH DIAMETER LIMITS			
				MAX INCHES	MIN INCHES	MAX INCHES	MIN INCHES	TOL INCHES	MIN INCHES		MIN INCHES	MAX INCHES	MIN INCHES	MAX INCHES	TOL INCHES	
3.750-12	UN	2A	.0019	3.7481	3.7367	3.6940	3.6876	.0064	3.6459	2B	3.660	3.678	3.6959	3.7043	.0084	3.7500
		3A	.0000	3.7500	3.7386	3.6959	3.6911	.0048	3.6478	3B	3.6600	3.6698	3.6959	3.7022	.0063	3.7500
4.000-12	UN	2A	.0020	3.9980	3.9866	3.9439	3.9374	.0065	3.8958	2B	3.910	3.928	3.9459	3.9544	.0085	4.0000
		3A	.0000	4.0000	3.9886	3.9459	3.9410	.0049	3.8978	3B	3.9100	3.9198	3.9459	3.9523	.0064	4.0000
4.250-12	UN	2A	.0020	4.2480	4.2366	4.1939	4.1874	.0065	4.1458	2B	4.160	4.178	4.1959	4.2044	.0085	4.2500
		3A	.0000	4.2500	4.2386	4.1959	4.1910	.0049	4.1478	3B	4.1600	4.1698	4.1959	4.2023	.0064	4.2500
4.500-12	UN	2A	.0020	4.4980	4.4866	4.4439	4.4374	.0065	4.3958	2B	4.410	4.428	4.4459	4.4544	.0085	4.5000
		3A	.0000	4.5000	4.4886	4.4459	4.4410	.0049	4.3978	3B	4.4100	4.4198	4.4459	4.4523	.0064	4.5000
4.75-12	UN	2A	.0020	4.7480	4.7366	4.6939	4.6872	.0067	4.6458	2B	4.660	4.673	4.6959	4.7046	.0087	4.7500
		3A	.0000	4.7500	4.7386	4.6959	4.6909	.0050	4.6478	3B	4.6600	4.6698	4.6959	4.7025	.0066	4.7500
5.000-12	UN	2A	.0020	4.9980	4.9866	4.9439	4.9372	.0067	4.8958	2B	4.910	4.928	4.9459	4.9546	.0087	5.0000
		3A	.0000	5.0000	4.9886	4.9459	4.9409	.0050	4.8978	3B	4.9100	4.9198	4.9459	4.9525	.0066	5.0000
5.250-12	UN	2A	.0020	5.2480	5.2366	5.1939	5.1872	.0067	5.1458	2B	5.160	5.178	5.1959	5.2046	.0087	5.2500
		3A	.0000	5.2500	5.2386	5.1959	5.1909	.0050	5.1478	3B	5.1600	5.1698	5.1959	5.2025	.0066	5.2500
5.500-12	UN	2A	.0020	5.4980	5.4866	5.4439	5.4372	.0067	5.3958	2B	5.410	5.428	5.4459	5.4546	.0087	5.5000
		3A	.0000	5.5000	5.4886	5.4459	5.4409	.0050	5.3978	3B	5.4100	5.4198	5.4459	5.4525	.0066	5.5000
5.750-12	UN	2A	.0021	5.7479	5.7365	5.6938	5.6869	.0069	5.6457	2B	5.660	5.678	5.6959	5.7049	.0090	5.7500
		3A	.0000	5.7500	5.7386	5.6959	5.6907	.0052	5.6478	3B	5.6600	5.6698	5.6959	5.7026	.0067	5.7500
6.000-12	UN	2A	.0021	5.9979	5.9865	5.9438	5.9369	.0069	5.8957	2B	5.910	5.928	5.9459	5.9549	.0090	6.0000
		3A	.0000	6.0000	5.9886	5.9459	5.9407	.0052	5.8978	3B	5.9100	5.9198	5.9459	5.9526	.0067	6.0000

NOTES:

1. PROCUREMENT: THIS TABLE IS TO BE USED FOR REPROCUREMENT OF THREADED PRODUCTS USED IN DESIGNS RELEASED PRIOR TO DEC 31, 1991.

2. NEW DESIGNS: FOR NEW DESIGNS THE FOLLOWING APPLIES:

   a. USE ASME B1.15 AS A REPLACEMENT FOR MIL-S-7742.

   b. USE ASME B1.1 REPLACING FED-STD-H28/2 FOR GENERAL NON-FATIGUE APPLICATIONS.

   c. USE ASME B1.10 REPLACING FED-STD-H28/5 FOR THREAD SIZES SMALLER THAN .060 INCH.

TABLE 12-2

ASME B1.15 SELECTED COURSE THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - UNJC

BASIC SIZE			EXTERNAL THREAD – UNJC CLASS 3A								INTERNAL THREAD – UNJC CLASS 3B					
			MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		ROOT RADIUS		MINOR DIAMETER		PITCH DIAMETER		MAJOR DIA
PRI-MARY	SEC OND-ARY	THDS PER INCH	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
		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
0.0860		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
	0.0900	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
0.1120															
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	0.11661	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	0.0393	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

TABLE 12-3

ASME B1.15 SELECTED FINE THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - UNJF

BASIC SIZE (NOMINAL)	THDS PER INCH	EXTERNAL THREAD – UNJF CLASS 3A						INTERNAL THREAD – UNJF CLASS 3B				INTERNAL THREAD – UNJF CLASS 3BG			
		MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER	ROOT RADIUS	MINOR DIAMETER		PITCH DIAMETER	MAJOR DIA	MINOR DIAMETER		PITCH DIAMETER	MAJOR DIA
		MIN	MAX	MIN	MAX	MIN	MIN MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN MAX	MIN
0.0600 (# 0-80)	80	0.0568	0.0600	0.0506	0.0519	0.0435	0.0019 0.0023	0.0479	0.0511	0.0519	0.0536	0.0489	0.0521	0.0529 0.0456	0.0610
0.1120 (# 4-48)	48	0.1075	0.1120	0.0967	0.0985	0.0849	0.0031 0.0038	0.0917	0.0971	0.0985	0.1008	0.0927	0.0981	0.0995 0.1018	0.1130
0.1380 (# 6-40)	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	0.1147	0.1212	0.1228 0.1253	0.1390
0.1640 (# 8-36)	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	0.1380	0.1452	0.1470 0.1497	0.1650
0.1900 (#10-32)	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	0.1626	0.1705	0.1727 0.1756	0.1930
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	0.2182	0.2259	0.2298 0.2330	0.2530
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	0.2749	0.2829	0.2884 0.2920	0.3135
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	0.3374	0.3448	0.3509 0.3546	0.3780
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	0.3918	0.4000	0.4080 0.4121	0.4405
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	0.4543	0.4621	0.4705 0.4747	0.5030
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	0.5114	0.5196	0.5294 0.5338	0.5655
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	0.5739	0.5818	0.5919 0.5964	0.6280
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	0.6922	0.7007	0.7124 0.7173	0.7530
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	0.8085	0.8182	0.8316 0.8369	0.8780
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	0.9219	0.9329	0.9489 0.9546	1.0030
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	1.0469	1.0569	1.0739 1.0798	1.1280
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	1.1719	1.1819	1.1989 1.2049	1.2530
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	1.2969	1.3069	1.3239 1.3300	1.3780
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	1.4219	1.4319	1.4489 1.4552	1.5030

SEE NOTE 1

TABLE 12-4

EQUIVALENT SIZE NUMBERS FOR REFERENCE ONLY

NOTES:

1. MIL-S-8879 IS INACTIVE FOR NEW DESIGNS AFTER AUG 12,1997. USE ASME B1.15-1995.
2. DOD MAY USE MIL-STD-8879 FOR PROCUREMENT OF PREVIOUSLY DESIGNED ITEMS FOR FATIQUE APPLICATIONS IDENTIFIED AS “SAFETY CRITICAL” OR “OTHER THREAD” TO DETERMINE LEVEL OF INSPECTION.
3. INTERNAL THREADS OF .1900 OR SMALLER SHOULD NOT BE SELECTED FOR SAFETY CRITICAL APPLICATIONS.

ASME B1.15 EXTRA FINE THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - UNJEF

BASIC SIZE			EXTERNAL THREAD - UNJEF CLASS 3A							INTERNAL THREAD - UNJEF CLASS 3B			
			MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		ROOT RADIUS	MINOR DIAMETER		PITCH DIAMETER	MAJOR DIA
PRI-MARY	SEC OND-ARY	THDS PER INCH	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
	0.216	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
		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
0.2500		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
0.3125		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
0.3750															
		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
0.4375		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
0.5000		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
0.5625		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
0.6250															
	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

TABLE 12-5

ASME B1.15 EIGHT THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - 8UNJF

	EXTERNAL THREAD – 8UNJ CLASS 3A ROOT RADIUS 0.0188 MIN 0.0226 MAX							INTERNAL THREAD – 8UNJ CLASS 3B					
BASIC SIZE		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	
	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	0.0432	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	

TABLE 12-6

ASME B1.15 TWELVE THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - 12UNJ

BASIC SIZE		EXTERNAL THREAD –12UNJ CLASS 3A ROOT RADIUS 0.0125 MIN 0.0150 MAX						INTERNAL THREAD – 12 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	
0.6250		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 12-7 (Continued on next page)

ASME B1.15 TWELVE THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - 12NJ

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

TABLE 12-7

ASME B1.15 SIXTEEN THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS - 16UNJ

	EXTERNAL THREAD - 16 UNJ CLASS 3A ROOT RADIUS 0.0094 MIN 0.0113 MAX					INTERNAL THREAD - 16 UNJ CLASS 3B					
BASIC SIZE		MAJOR DIAMETER		PITCH DIAMETER		MINOR DIAMETER		MINOR DIAMETER		PITCH DIAMETER	MAJOR DIA
PRIMARY	SECONDARY	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	0.8125	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

TABLE 12-8 (Continued on next page)

ASME B1.15 SIXTEEN THREAD SERIES
STANDARD LIMITS OF SIZE – UNIFIED SCREW THREADS – 16UNJ

		EXTERNAL THREAD – 16 UNJ CLASS 3A ROOT RADIUS 0.0094 MIN 0.0113 MAX				INTERNAL THREAD – 16 UNJ CLASS 3B					
BASIC SIZE		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
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

TABLE 12-8

NOMINAL PIPE SIZE	THREAD SIZE & PITCH	PIPE OUTSIDE DIA	PIPE INSIDE DIA	DIMENSION A THREAD DESIGNATION				DIMENSION B THREAD DESIGNATION		DIMENSION C (Note 3)
				NPT ANPT	NPTF	PTF-SAE SHORT	NPSF NPSI (Note 2)	NPT ANPT NPTF	PTF-SAE SHORT	
1/16	.062-27	.3125	---	.400	.385	.364	.312	.390	.327	.271
1/8	.125-27	.405	.269	.401	.384	.365	.312	.392	.329	.291
1/4	.250-18	.540	.364	.587	.555	.533	.469	.595	.495	.367
3/8	.375-18	.675	.493	.599	.561	.546	.500	.601	.501	.407
1/2	.500-14	.840	.622	.782	.751	.713	.656	.782	.651	.534
3/4	.750-14	1.050	.824	.801	.758	.732	.656	.794	.663	.553
1	1.00-11.5	1.315	1.049	.963	.916	.878	.656	.985	.823	.661
1-1/4	1.25-11.5	1.660	1.380	.983	.943	.898		1.008	.847	.681
1-1/2	1.50-11.5	1.900	1.610	.983	.957	.898		1.025	.864	.681
2	2.00-11.5	2.375	2.067	.999	.972	.914		1.058	.897	.697
2-1/2	2.50-8	2.875	2.469	1.366	1.435	1.369		1.571	1.335	1.057
3	3.00-8	3.500	3.068	1.500	1.519	1.454		1.634	1.398	1.141

NOTES:
1. Values shown are for drawing representation only, see applicable document for design values.
2. NPSF and NPSI are straight, internal threads and value shown is minimum used for design.
3. Value shown for Dimension C based on three threads wrench make-up allowance. When showing 2.50-8 NPT or 3.00-8 NPT, deduct .125 from Dimension C to compensate for the two thread normal wrench make-up allowance for these threads.

A = Length of internal thread, including imperfect thread, to point of vanish.
B = Length of external thread, including imperfect thread, to point of vanish.
C = Length of engaged thread, wrench tight.

DIMENSIONS FOR DRAWING REPRESENTATION OF PIPE THREADS
TABLE 12-9

Nominal Pipe Size	Thread Size & Pitch	Internal Thread				External Thread 45° Chamfer
		Tap Hole			90° ± 5° CSK DIA $^{+.03}_{-.00}$	
		Diameter		Depth		
		Min	Max	Min		
1/16	.062-27	.233	.239	.609	.312	.03-.05
1/8	.125-27	.327	.334	.625	.406	.03-.05
1/4	.250-18	.421	.428	.812	.562	.04-.07
3/8	.375-18	.561	.570	.843	.688	.04-.07
1/2	.500-14	.686	.695	1.062	.875	.05-.08
3/4	.750-14	.889	.900	1.062	1.062	.05-.08
1	1.000-11.5	1.124	1.137	1.312	1.312	.06-.09
1-1/4	1.250-11.5	1.467	1.480	1.312	1.641	.06-.09
1-1/2	1.500-11.5	1.702	1.715	1.343	1.906	.06-.09
2	2.000-11.5	2.186	2.196	1.343	2.500	.06-.09
2-1/2	2.500-8	2.592	2.602	1.875	2.906	.08-.11
3	3.00-8	3.217	3.227	1.937	3.531	.08-.11

AERONAUTICAL NATIONAL TAPER PIPE THREAD (ANPT) DATA
REF: SAE AS71051 (Replacing MIL-P_7105)
TABLE 12-10

12.5 METRIC THREADS IN ACCORDANCE WITH ISO 68-1 (International Organization for Standardization) FOR BASIC PROFILE.

12.5.1 Thread Designation. Selected Diameter/Pitch combinations from ASME B1.13M ("M" Profile) and ASME B1.21M ("MJ" Profile) listed herein are the preferred sizes for general use and those selected by Federal Services. ASME Diameter/Pitch combinations were selected from ISO 261 using the basic profile known as ISO 68-1 with the minor diameter of the internal thread modified to accommodate the rounded root radius (MJ) of the external thread. See PARAGRAPH 12.5.1.6.

FED-STD-H28/21 8 FEB 95 High Fatigue Strength	**ASME B1.21M-1997** **MJ** Profile	**ASME B1.13M-2005** **M** Profile
Selected thread size for Federal Service from ASME B1.21M Example Class: 4h6h (External thd) 4H5H (Internal thd)	High Fatigue Strength Applications Mandatory Rounded Root Radius Similar to INCH CLASS 3A/3B Example Thd & Class callout: MJ6 X 1-4h6h (External thd) MJ6 X 1-4H5H (Internal thd)	General & Commercial Applications Non-Mandatory Rounded Root Radius Similar to INCH CLASS 2A/2B Example Thd & Class callout: M6 X 1-6g (External thd) M6 X 1-6H (Internal thd)

12.5.1.1 Basic Thread Designation. ISO Metric Threads are designated by the letter "M" followed by the NOMINAL SIZE in millimeters, and the PITCH in millimeters, separated by the sign "X ".

Example: M16 X 1.5

Above designation format is followed for all thread series.

12.5.1.2 Coarse Thread Designation. Coarse Pitch ISO Metric Threads may be designated by only the letter "M" with the NOMINAL SIZE in millimeters.

Example: M16

This is a 16 millimeter diameter, 2 millimeter pitch ISO metric thread. Although the ISO standards use the above designations for coarse pitch, USA practice has been to include the pitch value even for the coarse pitch series. The inclusion of the pitch symbol will serve to eliminate confusion and should not create any problems.

e.g. M16 X 2

12.5.1.3 "M" Profile Threads of Tolerance Class 6H/6g. "M" Profile Threads are intended for metric applications where inch class 2A/2B have been used. At the minimum material condition (LMC) limits, the 6H/6g results in a looser fit than the 2A/2B. Also including is tabular data for providing a tighter tolerance fit external thread of class 4g/6g which is approximately equivalent to the Inch 3A but with an allowance applied.

12.5.1.4 Designation for Identical Tolerances. If the two tolerance class designations for a thread are identical, it is not necessary to repeat the symbols. See FIGURE 12-21.

12.5.1.5 Other Thread Designations. Additional designations and special designations are listed in ASME B1.13M for "M" Profile and ASME B1.21M for "MJ" Profile.

12.5.1.6 Assembly. Internal Threads conforming to the "M" Profile (ASME B1.13M) and the "MJ" Profile External Thread (ASME B1.21M) are not interchangeable because of interference between the "MJ" external thread minor diameter and the "M" Internal Thread minor diameter. However, the "MJ" Internal Thread will assemble with the "M" External Thread.

12.5.2 Tolerance System. The ISO Metric Screw Thread Tolerance System provides for allowances and tolerances defined by tolerance grades, tolerance positions, and tolerance classes briefly defined as follows:

12.5.2.1 Tolerance Grade. Basically, there are three Metric Tolerance Grades recommended by ISO: Grades 4, 6 and 8 which reflect the SIZE of the tolerance.

a. Grade 6 Tolerance is the closest ISO recommendation to Unified Class 2A and 2B fits and is most frequently used since this grade is recommended for "medium" quality and normal lengths of engagement or General Purpose Threads. Grade 4 Tolerance is closest to Unified Class 3A and 3B fits.

b. Tolerances below Grade 6 are smaller than Grade 6 and recommended for "fine" quality or short lengths of engagement.

c. Tolerances above Grade 6 are larger than Grade 6 and recommended for "coarse" quality or long lengths of engagement.

12.5.2.2 Tolerance Position. ISO has established "amounts of allowance" by a series of tolerance position symbols, as follows:

External Threads (Bolts):	**Internal Threads (Nuts)**
small "e" = large allowance	Large "G" = small allowance
small "g" = small allowance	Large "H" = no allowance
small "h" = no allowance	

The above symbols are used after the Tolerance Grade, such as: 6G, which designates a "Medium" Tolerance Grade with small allowance for an external thread.

12.5.2.3 Tolerance Classes. ISO Tolerance classes of fit are determined by selecting one of the three qualities, (Fine, Medium or Coarse) combined with one of the three lengths of engagement (Short (S), Normal (N) or Long (L)) and then applying the proper allowance. TOLERANCE POSITIONS "g" for external threads and "H" for internal threads are preferred. ASME B1.13M also establishes "6h" as a preferred thread class for external threads.

12.5.3 Basic Metric Screw Threads For General Applications, M Profile.

12.5.3.1 Comparable Metric To Inch Tolerance Class (Commercial). The M profile threads of tolerance class 6H/6g are intended for metric applications where inch class 2A/2B has been used. At the minimum material limits, the 6H/6g results in a looser fit than 2A/2B. See FIGURES 12-18 and 12-19.

12.5.3.1.1 Size Restrictions. Only the diameter/pitch combinations listed in TABLES 12-11 and 12-12 are applicable for the Federal Services unless prior approval has been granted by the Procurement authority to deviate from them. Sizes listed in TABLE 12-11 are preferred and should be given first choice in selection.

12.5.3.1.1 (Continued)

SELECTED "M" (COMMERCIAL) SIZES FROM ASME B1.13M

NOMINAL SIZE (mm)	PITCH (mm)	NOMINAL SIZE (mm)	PITCH (mm)
1.6	0.35	20	2.5
2	0.4	22	2.5 (1)
2.5	0.45	24	3
3	0.5	27	3 (1)
3.5	0.6	30	3.5
4	0.7	36	4
5	0.8	42	4.5
6	1	48	5
8	1.25	56	5.5
10	1.5	64	6
12	1.75	72	6
14	2	80	6
16	2	90	6
		100	6

NOTE:
(1) For high strength structural steel fasteners only.

STANDARD COURSE PITCH "M" PROFILE GENERAL PURPOSE AND MECHANICAL FASTENER SERIES

TABLE 12-11M

NOMINAL SIZE (mm)	PITCH (mm)	NOMINAL SIZE (mm)	PITCH (mm)
8	1	55	1.5
10	0.75 1.25	56	2
12	1.5(1) 1.25	60	1.5
14	1.5	64	2
15	1	65	1.5
16	1.5	70	1.5
17	1	72	2
18	1.5	75	1.5
20	1 1.5	80	1.5 2
22	1.5	85	2
24	2	90	2
25	1.5	95	2
27	2 1	100	2
30	1.5 2	105	2
33	2	110	2
35	1.5	120	2
36	2	130	2
39	2	140	2
40	1.5	150	2
42	2	160	3
45	1.5	170	3
48	2	180	3
50	1.5	190	3
		200	3

NOTE: (1) Only for wheel studs and nuts.

STANDARD FINE PITCH "M" PROFILE SCREW THREADS

TABLE 12-12M

12.5.3.2 Comparable Metric To Inch Tolerance Class (Aerospace). The "MJ" profile threads of tolerance class 4H5H/4h6h are intended for metric applications where inch class 3A/3B has been used. See FIGURES 12-22 and 12-23 which also include the controlled root radius feature preferred for aerospace applications.

12.5.3.2.1 Size Restrictions. Only the diameter/pitch combinations listed in TABLES12-11MJ and 12-12MJ are applicable for the **Federal Services** unless prior approval has been granted by the Procurement authority to deviate from them. Sizes listed in TABLE 12-11MJ are preferred and should be given first choice in selection.

SELECTED "MJ" (AEROSPACE) SIZES FROM ASME B1.21M

NOMINAL SIZE (mm)	PITCH (mm) COARSE	FINE	NOMINAL SIZE (mm)	PITCH (mm) COARSE	FINE	NOMINAL SIZE (mm)	PITCH (mm) COARSE	FINE
1.6	0.35	-	10	1.5	1.25	33	2	
2	0.4	-	12	1.75	1.25	36	4	2
2.5	0.45	-	14	2	1.5	39	-	2
3	0.5	-	16	2	1.5	42	4.5	2
3.5	0.6	-	18	-	1.5	48	5	2
4	0.7	-	20	2.5	1.5	56	5.5	2
5	0.8	-	22	-	1.5	64	6	2
6	1	-	24	3	2	72	6	2
7	1(a)	-	27	-	2	80	6	2
8	1.25	1	30	3.5	2	90	6	2
						100	6	2

NOTE: (a) For special Aerospace applications only.

STANDARD "MJ" PROFILE FASTENER THREADS

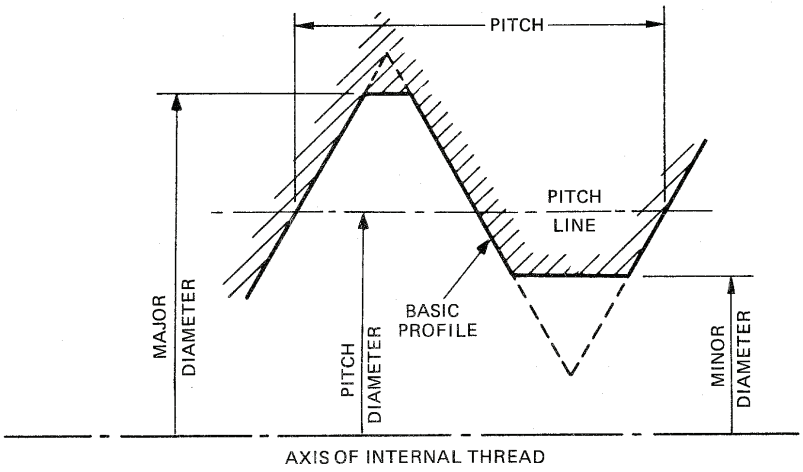
FIGURE 12-11MJ

12.5.3.2.1 (Continued)

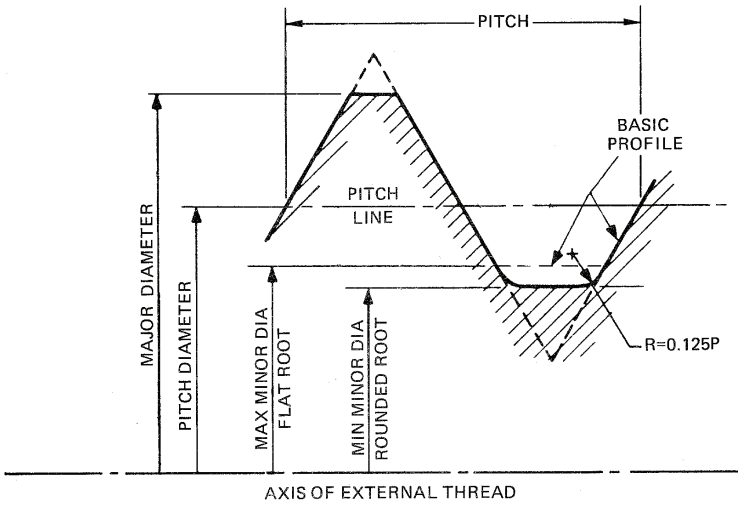
NOMINAL SIZE (mm)	PITCH (mm) FINE	NOMINAL SIZE (mm)	PITCH (mm) FINE	NOMINAL SIZE (mm)	PITCH (mm) FINE
10	0.75	45	1.5	105	2
11	1.25(a)	50	1.5	110	2
12	1	55	1.5	120	2
15	1	60	1.5	130	2
17	1	65	1.5	140	2
20	1	70	1.5	150	2
25	1.5	75	1.5	160	3
30	1.5	80	1.5	170	3
35	1.5	85	2	180	3
40	1.5	95	2	190	3
				200	3

NOTE: (a) Only for aircraft control cable fittings.

STANDARD “MJ” PROFILE SCREW THREADS
FIGURE 12-12MJ



METRIC INTERNAL THREAD, DESIGN “M” PROFILE
FOR DIMENSIONS SEE TABLE 12-13 HEREIN AND ASME B1.13M TABLE 14
FIGURE 12-18

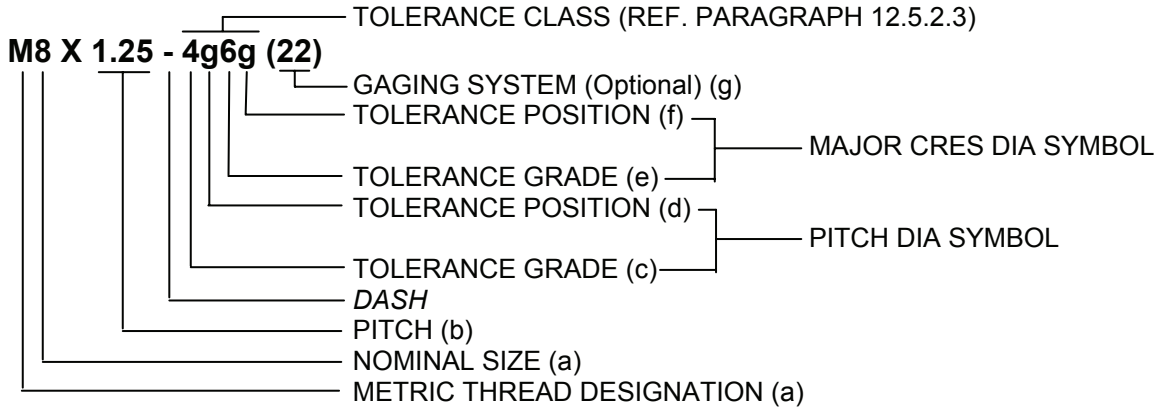


METRIC EXTERNAL THREAD, DESIGN “M” PROFILE
FOR DIMENSIONS SEE TABLE 12-13 HEREIN AND ASME B1.13M TABLE 15
FIGURE 12-19

12.5.4 Thread Callout On Drawings. A complete designation for an ISO Metric screw thread is comprised of:

a. Basic designation including nominal size
b. Pitch
c. Tolerance Grade for Pitch Diameter
d. Tolerance Position for Pitch Diameter
e. Tolerance Grade for Crest Diameter
f. Tolerance Position for Crest Diameter
g. Thread Gaging System requirements may be added to the thread callout or as a General Note on the Drawing, Specification or Applicable Document in accordance with ASME B1.3

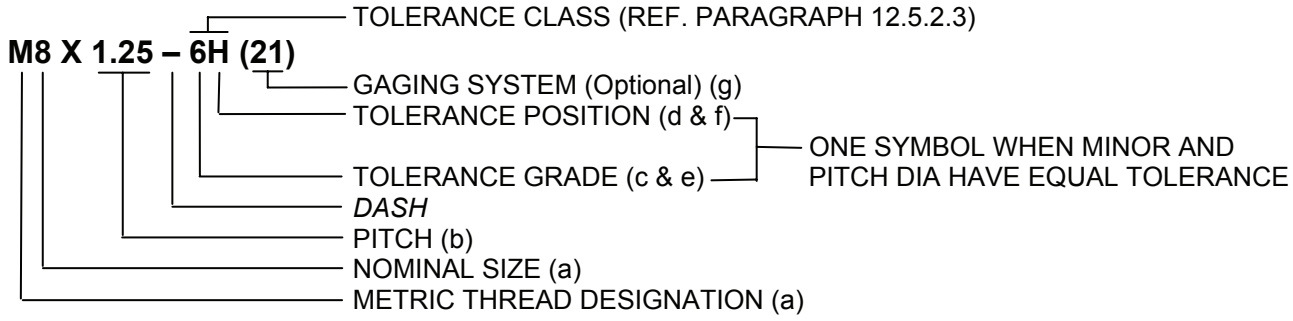
12.5.4.1 External Thread Callout, Commercial Quality. (Similar To Class 2A). See FIGURE 12-20.



NOTE: When using a computer or teletype facility without lower case capability, indicate all tolerance positions with capital letters and the applicable EXT or INT following the tolerance class designations.

EXTERNAL THREAD CALLOUT (COMMERCIAL QUALITY)
FIGURE 12-20

12.5.4.2 Internal Thread Callout, Commercial Quality (Similar To Class 2B). See FIGURE 12-21.



INTERNAL THREAD CALLOUT (COMMERCIAL QUALITY)
FIGURE 12-21

12.5.5 Length Of Engagement Designations. Where considered necessary, the length of engagement group symbol may be added to the tolerance class designation where:

S = THREAD ENGAGEMENT SHORT.
N = THREAD ENGAGEMENT NORMAL. (omission would indicate normal)
L = THREAD ENGAGEMENT LONG.

For Example: **M20 X 2-7g6g L**

LENGTH OF ENGAGEMENT GROUP SYMBOL

12.5.6 Commercial Preferred Diameter, Pitch Combination Threads. For general thread (See TABLES 12-13 and 12-14) applications, the tolerance classes recommended for:

1. External threads: **6g**

2. Internal threads: **6H**

This compares approximately with 2A and 2B class for inch threads.

12.5.7 Crest and Root Forms "M" Profile. The "M" thread profile permits rounded crest and root forms at the major and minor diameters in both the external and internal threads. The profile shall have a continuous smoothly blended non-reversing curve, no part of which shall have a radius of less than 0.125P, which is tangential to the thread flank. The profile may comprise tangent flank arcs that are joined by a tangential flat at the root. See FIGURE 12-19. The limit values of the root radius "r" are specified in TABLE 12-12.1

P	**Root Radius 0.125*P* Min.**	***P***	**Root Radius 0.125*P* Min.**
0.2	0.025	1.25	0.156
0.25	0.031	1.5	0.188
0.3	0,038	1.75	0.219
0.35	0.044	2	0.250
0.4	0.050	2.5	0.313
0.45	0.056	3	0.375
0.5	0.063	3.5	0.438
0.6	0.075	4	0.500
0.7	0.088	4.5	0.563
0.75	0.094	5	0.625
0.8	0.100	5.5	0.688
1	0.125	6	0.750
		8	1.000

LIMIT VALUES FOR "M" PROFILE MINIMUM ROUNDED ROOT RADIUS
TABLE 12-12.1

METRIC THREADS
M PROFILE
(mm)

CHOICE						External Thread (Bolt)							Internal Thread (Nut)						
Nominal Size Diameter		Pitch	Basic Thread Desig-	Tol	Allow-	Major Diameter		Pitch Diameter			Minor Diameter		Tol	Minor Diameter		Pitch Diameter			Major Dia
1st	2nd	P	nation	Class	ance	Max	Min	Max	Min	Tol	Max[a]	Min[b]	Class	Min	Max	Min	Max	Tol	Min
1.6		0.35	M1.6	6g	0.019	1.581	1.496	1.354	1.291	0.063	1.151	1.063	6H	1.221	1.321	1.373	1.458	0.085	1.600
	1.8	0.35	M1.8	6g	0.019	1.781	1.696	1.554	1.491	0.063	1.351	1.263	6H	1.421	1.521	1.573	1.658	0.085	1.800
2		0.4	M2	6g	0.019	1.981	1.886	1.721	1.654	0.067	1.490	1.394	6H	1.567	1.679	1.740	1.830	0.090	2.000
	2.2	0.45	M2.2	6g	0.020	2.180	2.080	1.888	1.817	0.071	1.628	1.525	6H	1.713	1.838	1.908	2.003	0.095	2.200
2.5		0.45	M2.5	6g	0.020	2.480	2.380	2.188	2.117	0.071	1.928	1.825	6H	2.013	2.138	2.208	2.303	0.095	2.500
3		0.5	M3	6g	0.020	2.980	2.874	2.655	2.580	0.075	2.367	2.256	6H	2.459	2.599	2.675	2.775	0.100	3.000
	3.5	0.6	M3.5	6g	0.021	3.479	3.354	3.089	3.004	0.085	2.742	2.614	6H	2.850	3.010	3.110	3.222	0.112	3.500
4		0.7	M4	6g	0.022	3.978	3.838	3.523	3.433	0.090	3.119	2.979	6H	3.242	3.422	3.545	3.663	0.118	4.000
	4.5	0.75	M4.5	6g	0.022	4.478	4.338	3.991	3.901	0.090	3.558	3.414	6H	3.688	3.878	4.013	4.131	0.118	4.500
5		0.8	M5	6g	0.024	4.976	4.826	4.456	4.361	0.095	3.994	3.841	6H	4.134	4.334	4.480	4.605	0.125	5.000
6		1	M6	6g	0.026	5.974	5.794	5.324	5.212	0.112	4.747	4.563	6H	4.917	5.153	5.350	5.500	0.150	6.000
	7	1	M7	6g	0.026	6.974	6.794	6.324	6.212	0.112	5.747	5.563	6H	5.917	6.153	6.350	6.500	0.150	7.000
8		1.25	M8	6g	0.028	7.972	7.760	7.160	7.042	0.118	6.439	6.231	6H	6.647	6.912	7.188	7.348	0.160	8.000
8		1	M8x1	6g	0.026	7.974	7.794	7.324	7.212	0.112	6.747	6.563	6H	6.917	7.153	7.350	7.500	0.150	8.000
10		1.5	M10	6g	0.032	9.968	9.732	8.994	8.862	0.132	8.127	7.879	6H	8.376	8.676	9.026	9.206	0.180	10.000
10		1.25	M10x1.25	6g	0.028	9.972	9.760	9.160	9.042	0.118	8.439	8.231	6H	8.647	8.912	9.188	9.348	0.160	10.000
12		1.75	M12	6g	0.034	11.966	11.701	10.829	10.679	0.150	9.819	9.543	6H	10.106	10.441	10.863	11.063	0.200	12.000
12		1.25	M12x1.25	6g	0.028	11.972	11.760	11.160	11.028	0.132	10.439	10.217	6H	10.647	10.912	11.188	11.368	0.180	12.000
	14	2	M14	6g	0.038	13.962	13.682	12.663	12.503	0.160	11.508	11.204	6H	11.835	12.210	12.701	12.913	0.212	14.000
	14	1.5	M14x1.5	6g	0.032	13.968	13.732	12.994	12.854	0.140	12.127	11.879	6H	12.376	12.676	13.026	13.216	0.190	14.000
16	16	2	M16	6g	0.038	15.962	15.682	14.663	14.503	0.160	13.508	13.204	6H	13.835	14.210	14.701	14.913	0.212	16.000
16	16	1.5	M16x1.5	6g	0.032	15.968	15.732	14.994	14.854	0.140	14.127	13.879	6H	14.376	14.676	15.026	15.216	0.190	16.000
	18	2.5	M18	6g	0.042	17.958	17.623	16.334	16.164	0.170	14.891	14.541	6H	15.294	15.744	16.376	16.600	0.224	18.000
	18	1.5	M18x1.5	6g	0.032	17.968	17.732	16.994	16.854	0.140	16.127	15.879	6H	16.376	16.676	17.026	17.216	0.190	18.000
20		2.5	M20	6g	0.042	19.958	19.623	18.334	18.164	0.170	16.891	16.541	6H	17.294	17.744	18.376	18.600	0.224	20.000
20		1.5	M20x1.5	6g	0.032	19.968	19.732	18.994	18.854	0.140	18.127	17.879	6H	18.376	18.676	19.026	19.216	0.190	20.000
	22	2.5	M22	6g	0.042	21.958	21.623	20.334	20.164	0.170	18.891	18.541	6H	19.294	19.744	20.376	20.600	0.224	22.000
	22	1.5	M22x1.5	6g	0.032	21.968	21.732	20.994	20.854	0.140	20.127	19.879	6H	20.376	20.676	21.026	21.216	0.190	22.000
24		3	M24	6g	0.048	23.952	23.577	22.003	21.803	0.200	20.271	19.855	6H	20.752	21.252	22.051	22.316	0.265	24.000
24		2	M24x2	6g	0.038	23.962	23.682	22.663	22.493	0.170	21.508	21.194	6H	21.835	22.210	22.701	22.925	0.224	24.000
	27	3	M27	6g	0.048	26.952	26.577	25.003	24.803	0.200	23.271	22.855	6H	23.752	24.252	25.051	25.316	0.265	27.000
	27	2	M27x2	6g	0.038	26.962	26.682	25.663	25.493	0.170	24.508	24.194	6H	24.835	25.210	25.701	25.925	0.224	27.000
30		3.5	M30	6g	0.053	29.947	29.522	27.674	27.462	0.212	25.653	25.189	6H	26.211	26.771	27.727	28.007	0.280	30.000
30		2	M30x2	6g	0.038	29.962	29.682	28.663	28.493	0.170	27.508	27.194	6H	27.835	28.210	28.701	28.925	0.224	30.000
	33	3.5	M33	6g	0.053	32.947	32.522	30.674	30.462	0.212	28.653	28.189	6H	29.211	29.771	30.727	31.007	0.280	33.000
	33	2	M33x2	6g	0.038	32.962	32.682	31.663	31.493	0.170	30.508	30.194	6H	30.835	31.210	31.701	31.925	0.224	33.000
36		4	M36	6g	0.060	35.940	35.465	33.342	33.118	0.224	31.033	30.521	6H	31.670	32.270	33.402	33.702	0.300	36.000
36		3	M36x3	6g	0.048	35.952	35.577	34.003	33.803	0.200	32.271	31.855	6H	32.752	33.252	34.051	34.316	0.265	36.000
	39	4	M39	6g	0.060	38.940	38.465	36.342	36.118	0.224	34.033	33.521	6H	34.670	35.270	36.402	36.702	0.300	39.000
	39	3	M39x3	6g	0.048	38.952	38.577	37.003	36.803	0.200	35.271	34.855	6H	35.752	36.252	37.051	37.316	0.265	39.000

a Design form.
b Required for high strength applications where rounded root is specified.

METRIC SCREW THREADS
Limiting Dimensions of Standard Series Threads for Commercial Screws, Bolts and Nuts (mm)
TABLE 12-13

METRIC THREADS
M PROFILE
(INCH CONVERSION)

CHOICE Nominal Size Diameter (mm)		Pitch P	Basic Thread Desig-	Tol	Allow-	External Thread (Bolt)							Internal Thread (Nut)						
						Major Diameter		Pitch Diameter			Minor Diameter		Tol	Minor Diameter		Pitch Diameter			Major Dia
1st	2nd	(mm)	nation	Class	ance	Max	Min	Max	Min	Tol	Max[a]	Min[b]	Class	Min	Max	Min	Max	Tol	Min
1.6		0.35	M1.6	6g	0.0008	0.0622	0.0589	0.0533	0.0509	0.0024	0.0453	0.0419	6H	0.0481	0.0520	0.0541	0.0574	0.0033	0.0630
	1.8	0.35	M1.8	6g	0.0008	0.0701	0.0668	0.0611	0.0588	0.0023	0.0531	0.0498	6H	0.0560	0.0598	0.0620	0.0652	0.0032	0.0709
2		0.4	M2	6g	0.0009	0.0779	0.0743	0.0677	0.0652	0.0025	0.0586	0.0549	6H	0.0617	0.0661	0.0686	0.0720	0.0034	0.0788
	2.2	0.45	M2.2	6g	0.0009	0.0858	0.0819	0.0743	0.0716	0.0027	0.0640	0.0601	6H	0.0675	0.0723	0.0752	0.0788	0.0033	0.0867
2.5		0.45	M2.5	6g	0.0009	0.0976	0.0938	0.0861	0.0834	0.0027	0.0759	0.0719	6H	0.0793	0.0841	0.0870	0.0906	0.0036	0.0985
3		0.5	M3	6g	0.0009	0.1173	0.1132	0.1045	0.1016	0.0029	0.0931	0.0889	6H	0.0969	0.1023	0.1054	0.1092	0.0038	0.1182
	3.5	0.6	M3.5	6g	0.0009	0.1369	0.1321	0.1216	0.1183	0.0033	0.1079	0.1030	6H	0.1123	0.1185	0.1225	0.1268	0.0043	0.1378
4		0.7	M4	6g	0.0009	0.1566	0.1512	0.1387	0.1352	0.0034	0.1227	0.1173	6H	0.1277	0.1347	0.1396	0.1442	0.0046	0.1575
	4.5	0.75	M4.5	6g	0.0010	0.1762	0.1708	0.1571	0.1536	0.0035	0.1400	0.1345	6H	0.1452	0.1526	0.1580	0.1626	0.0046	0.1772
5		0.8	M5	6g	0.0010	0.1959	0.1900	0.1754	0.1717	0.0037	0.1572	0.1513	6H	0.1628	0.1706	0.1764	0.1812	0.0048	0.1969
6		1	M6	6g	0.0012	0.2351	0.2282	0.2096	0.2052	0.0044	0.1868	0.1797	6H	0.1936	0.2028	0.2107	0.2165	0.0058	0.2363
	7	1	M7	6g	0.0011	0.2745	0.2675	0.2489	0.2446	0.0043	0.2262	0.2191	6H	0.2330	0.2422	0.2500	0.2559	0.0059	0.2756
8		1.25	M8	6g	0.0012	0.3138	0.3056	0.2818	0.2773	0.0045	0.2535	0.2454	6H	0.2617	0.2721	0.2830	0.2892	0.0062	0.3150
8		1	M8x1	6g	0.0011	0.3139	0.3069	0.2883	0.2840	0.0043	0.2656	0.2584	6H	0.2724	0.2816	0.2894	0.2952	0.0058	0.3150
10		1.5	M10	6g	0.0013	0.3924	0.3832	0.3540	0.3489	0.0051	0.3199	0.3102	6H	0.3298	0.3415	0.3554	0.3624	0.0070	0.3937
10		1.25	M10x1.25	6g	0.0012	0.3925	0.3843	0.3606	0.3560	0.0046	0.3322	0.3241	6H	0.3404	0.3508	0.3618	0.3680	0.0062	0.3937
12		1.75	M12	6g	0.0014	0.4711	0.4607	0.4263	0.4205	0.0058	0.3865	0.3758	6H	0.3979	0.4110	0.4277	0.4355	0.0078	0.4725
12		1.25	M12x1.25	6g	0.0012	0.4713	0.4630	0.4393	0.4342	0.0051	0.4109	0.4023	6H	0.4192	0.4295	0.4405	0.4475	0.0070	0.4725
	14	2	M14	6g	0.0016	0.5496	0.5387	0.4985	0.4923	0.0062	0.4530	0.4412	6H	0.4660	0.4807	0.5001	0.5083	0.0082	0.5512
	14	1.5	M14x1.5	6g	0.0013	0.5499	0.5407	0.5115	0.5061	0.0054	0.4774	0.4677	6H	0.4873	0.4990	0.5129	0.5203	0.0074	0.5512
16		2	M16	6g	0.0016	0.6284	0.6175	0.5772	0.5710	0.0062	0.5318	0.5199	6H	0.5447	0.5594	0.5788	0.5871	0.0083	0.6300
16		1.5	M16x1.5	6g	0.0014	0.6286	0.6194	0.5903	0.5849	0.0054	0.5561	0.5465	6H	0.5660	0.5777	0.5916	0.5990	0.0074	0.6300
	18	2.5	M18	6g	0.0017	0.7070	0.6939	0.6430	0.6364	0.0066	0.5862	0.5725	6H	0.6022	0.6198	0.6448	0.6535	0.0087	0.7087
	18	1.5	M18x1.5	6g	0.0013	0.7074	0.6982	0.6690	0.6636	0.0054	0.6349	0.6252	6H	0.6448	0.6565	0.6704	0.6777	0.0073	0.7087
20		2.5	M20	6g	0.0018	0.7857	0.7726	0.7218	0.7152	0.0066	0.6649	0.6513	6H	0.6809	0.6985	0.7235	0.7322	0.0087	0.7875
20		1.5	M20x1.5	6g	0.0014	0.7861	0.7769	0.7477	0.7423	0.0054	0.7136	0.7039	6H	0.7235	0.7352	0.7491	0.7565	0.0074	0.7875
	22	2.5	M22	6g	0.0018	0.8644	0.8513	0.8005	0.7939	0.0066	0.7437	0.7300	6H	0.7597	0.7773	0.8023	0.8110	0.0087	0.8662
	22	1.5	M22x1.5	6g	0.0014	0.8648	0.8556	0.8265	0.8211	0.0054	0.7924	0.7827	6H	0.8023	0.8140	0.8278	0.8352	0.0074	0.8662
24		3	M24	6g	0.0020	0.9429	0.9283	0.8662	0.8584	0.0078	0.7980	0.7817	6H	0.8171	0.8366	0.8682	0.8785	0.0103	0.9449
24		2	M24x2	6g	0.0016	0.9433	0.9324	0.8922	0.8856	0.0066	0.8467	0.8345	6H	0.8597	0.8744	0.8938	0.9025	0.0087	0.9449
	27	3	M27	6g	0.0019	1.0611	1.0464	0.9843	0.9765	0.0078	0.9161	0.8999	6H	0.9352	0.9548	0.9863	0.9966	0.0103	1.0630
	27	2	M27x2	6g	0.0016	1.0614	1.0505	1.0103	1.0037	0.0066	0.9648	0.9526	6H	0.9778	0.9925	1.0119	1.0206	0.0087	1.0630
30		3.5	M30	6g	0.0022	1.1790	1.1623	1.0895	1.0812	0.0083	1.0099	0.9917	6H	1.0220	1.0539	1.0917	1.1026	0.0109	1.1812
30		2	M30x2	6g	0.0016	1.1796	1.1686	1.1284	1.1218	0.0066	1.0829	1.0707	6H	1.0959	1.1106	1.1300	1.1387	0.0087	1.1812
	33	3.5	M33	6g	0.0022	1.2971	1.2804	1.2076	1.1993	0.0083	1.1280	1.1099	6H	1.1501	1.1720	1.2098	1.2207	0.0109	1.2993
	33	2	M33x2	6g	0.0016	1.2977	1.2867	1.2465	1.2399	0.0066	1.2011	1.1888	6H	1.2140	1.2287	1.2481	1.2568	0.0087	1.2993
36		4	M36	6g	0.0025	1.4149	1.3963	1.3126	1.3039	0.0087	1.2217	1.2017	6H	1.2469	1.2704	1.3151	1.3268	0.0117	1.4174
36		3	M36x3	6g	0.0020	1.4154	1.4007	1.3386	1.3309	0.0077	1.2705	1.2542	6H	1.2895	1.3091	1.3406	1.3510	0.0104	1.4174
	39	4	M39	6g	0.0025	1.5330	1.5144	1.4307	1.4220	0.0087	1.3398	1.3198	6H	1.3650	1.3885	1.4332	1.4449	0.0117	1.5355
	39	3	M39x3	6g	0.0020	1.5335	1.5188	1.4568	1.4490	0.0078	1.3886	1.3723	6H	1.4076	1.4272	1.4587	1.4691	0.0104	1.5355

a Design form.
b Required for high strength applications where rounded root is specified.

METRIC SCREW THREADS
Limiting Dimensions of Standard Series Threads for Commercial Screws, Bolts and Nuts (inches)
TABLE 12-14

12.5.7 Aerospace Metric Threads (Controlled Root Radius) Identified as "MJ" Thread Profile In Accordance With ASME B1.21M. For Aerospace thread (See TABLE 12-16) applications, the tolerance class recommended for:

a. External threads is 4h6h.

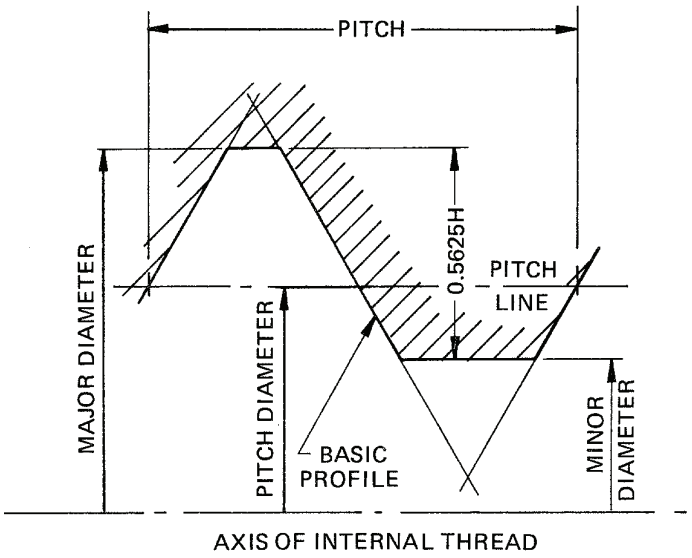
b. Internal threads for sizes 1 thru 5 mm is 4H6H. Internal threads for sizes 6 mm and larger is 4H5H. This compares approximately with 3A and 3B class for inch threads. (similar to ASME B1.15 controlled root radius - inch).

12.5.7.1 Internal Thread Root. For internal threads the profile of the actual root of the thread shall at no point be below the basic profile or above the maximum major diameter. No root radius is specified. See FIGURE 12-22.

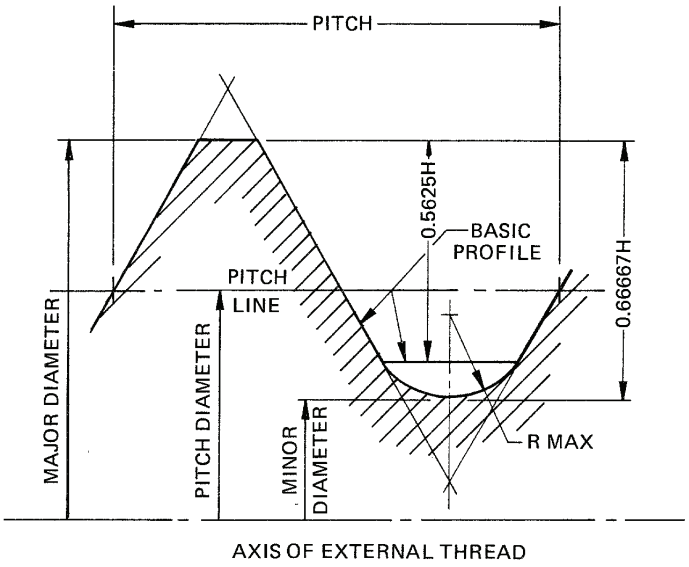
12.5.7.2 External Thread Root Contour. The root of the external thread shall have a controlled radius as defined by the American Society of Mechanical Engineers standard ASME B1.21M Metric Screw Threads - MJ Profile for use in the aerospace industry. See FIGURE 12-23. The limit values of root radius R are specified in TABLE 12-15. Greater Pitch and larger root radii are listed in ASME B1.13M. The radius shall be smooth and blend into the profile within the max-min tolerance limits. See FIGURE 12-23.

PITCH P (mm)	ROOT RADIUS, **R** (mm)	
	MINIMUM	MAXIMUM
	0.15011P	0.18042P
0.35	0.053	0.063
0.4	0.060	0.072
0.045	0.068	0.081
0.5	0.075	0.090
0.6	0.090	0.108
0.7	0.105	0.126
0.075	0.113	0.135
0.8	0.120	0.144
1	0.150	0.180
1.25	0.188	0.226
1.5	0.225	0.271
1.75	0.263	0.316
2	0.300	0.301

LIMIT VALUES, EXTERNAL THREAD ROOT RADIUS, R "MJ" PROFILE
(millimeters)
TABLE 12-15



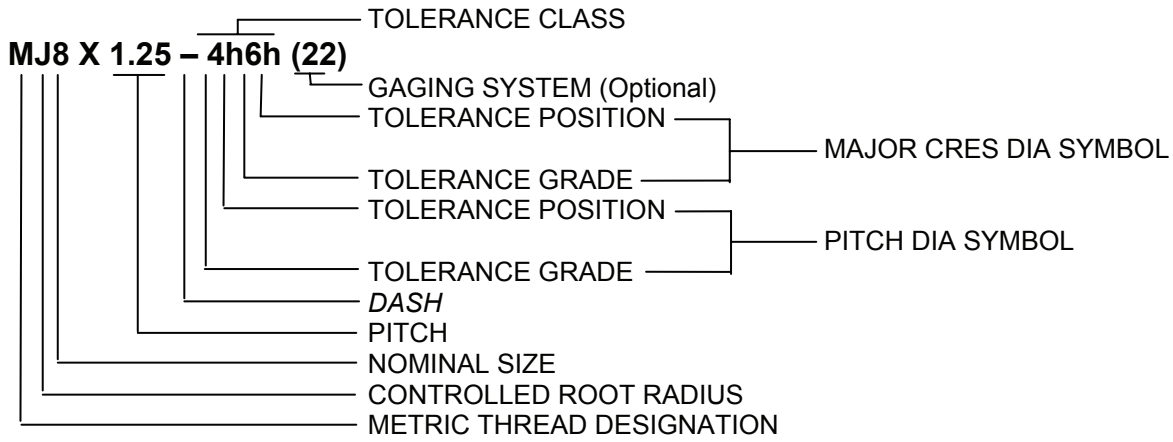
METRIC INTERNAL THREAD PROFILE (MJ)
FOR DIMENSIONS SEE TABLE 12-16 HEREIN AND ASME B1.21M TABLE 7
FIGURE 12-22



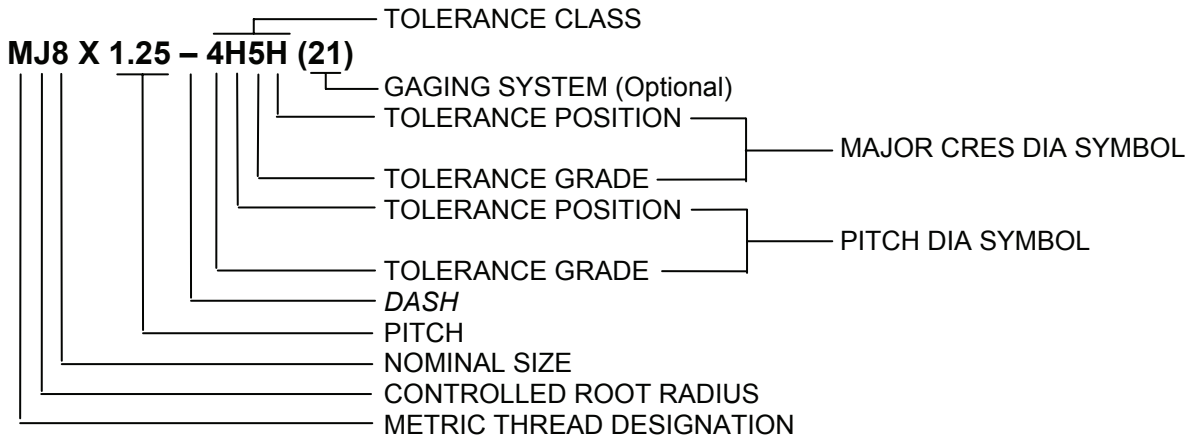
METRIC EXTERNAL THREAD PROFILE (MJ)
FOR DIMENSIONS SEE TABLE 12-16 HEREIN AND ASME B1.21M TABLE 6
FIGURE 12-23

12.5.8 Designation Of Controlled Root Radius Thread. See FIGURES 12-24 and 12-25. (Similar to ASME B1.15 Class 3A and 3B respectively.)

12.5.8.1 Gaging System Designation. The gaging system designator as shown in FIGURE 12-24 and 12-25 in accordance with ASME B1.3, may be designated at each thread callout or as a General Note on the drawing, specification or applicable document.



METRIC EXTERNAL THREAD CALLOUT (AEROSPACE QUALITY)
FIGURE 12-24



METRIC INTERNAL THREAD CALLOUT (AEROSPACE QUALITY)
FIGURE 12-25

12.5.9 Aerospace Preferred Diameter-Pitch Combinations. TABLE 12-16 lists the preferred diameter-pitch combinations for metric module bolts and nuts for use in the aerospace industry. For additional aerospace Metric Screw Thread Standard and Special Sizes, see ASME B1.21M Metric Screw Threads - MJ Profile.

12.5.10 Additional Metric Thread Information. Other product information may also be conveyed by the ISO metric thread designations. Complete Specifications and product limits may be found in the standard ASME B1.13M Metric Screw Threads - “M Profile”.

METRIC THREADS
MJ PROFILE (mm) (REF.ASME B1.21M)
STANDARD LIMITS OF SIZE – SELECTED METRIC SCREW THREADS FOR AEROSPACE

Nominal Size Dia	Pitch P	Basic Thread Designation	External Thread (Bolt)								Internal Thread (Nut)							
			Tol Class	Major Diameter		Pitch Diameter		Minor Diameter		Tol Class	Minor Diameter		Pitch Diameter		Tol	Major Diameter		
				Max	Min	Max	Min	Max	Min		Min	Max	Min	Max		Min	Max	
1.6	0.35	MJ1.6	4h6h	1.600	1.515	1.373	1.333	1.196	1.135	4H6H	1.259	1.359	1.373	1.426	0.053	1.600	1.704	
2	0.4	MJ2	4h6h	2.000	1.905	1.740	1.698	1.538	1.472	4H6H	1.610	1.722	1.740	1.796	0.056	2.000	2.114	
2.5	0.45	MJ2.5	4h6h	2.500	2.400	2.208	2.163	1.981	1.908	4H6H	2.062	2.187	2.208	2.268	0.060	2.500	2.625	
3	0.5	MJ3	4h6h	3.000	2.894	2.675	2.627	2.422	2.344	4H6H	2.513	2.653	2.675	2.738	0.063	3.000	3.135	
3.5	0.6	MJ3.5	4h6h	3.500	3.375	3.110	3.057	2.807	2.718	4H6H	2.915	3.075	3.110	3.181	0.071	3.500	3.657	
4	0.7	MJ4	4h6h	4.000	3.860	3.545	3.489	3.191	3.093	4H6H	3.318	3.498	3.545	3.620	0.075	4.000	4.176	
5	0.8	MJ5	4h6h	5.000	4.850	4.480	4.420	4.076	3.967	4H6H	4.221	4.421	4.480	4.560	0.080	5.000	5.195	
6	1	MJ6	4h6h	6.000	5.820	5.350	5.279	4.845	4.713	4H5H	5.026	5.216	5.350	5.445	0.095	6.000	6.239	
7	1	MJ7	4h6h	7.000	6.820	6.350	6.279	5.845	5.713	4H5H	6.026	6.216	6.350	6.445	0.095	7.000	7.239	
8	1	MJ8	4h6h	8.000	7.820	7.350	7.279	6.845	6.713	4H5H	7.026	7.216	7.350	7.445	0.095	8.000	8.239	
10	1.25	MJ10	4h6h	10.000	9.788	9.188	9.113	8.557	8.406	4H5H	8.782	8.994	9.188	9.288	0.100	10.000	10.280	
12	1.25	MJ12	4h6h	12.000	11.788	11.188	11.103	10.557	10.396	4H5H	10.782	10.994	11.188	11.300	0.112	12.000	12.292	
14	1.5	MJ14	4h6h	14.000	13.764	13.026	12.936	12.268	12.087	4H5H	12.539	12.775	13.026	13.144	0.118	14.000	14.335	
16	1.5	MJ16	4h6h	16.000	15.764	15.026	14.936	14.268	14.087	4H5H	14.539	14.775	15.026	15.144	0.118	16.000	16.335	
18	1.5	MJ18	4h6h	18.000	17.764	17.026	16.936	16.268	16.087	4H5H	16.539	16.775	17.026	17.144	0.118	18.000	18.335	
20	1.5	MJ20	4h6h	20.000	19.764	19.026	18.936	18.268	18.087	4H5H	18.539	18.775	19.026	19.144	0.118	20.000	20.335	
22	1.5	MJ22	4h6h	22.000	21.764	21.026	20.936	20.268	20.087	4H5H	20.539	20.775	21.026	21.144	0.118	22.000	22.335	
24	2	MJ24	4h6h	24.000	23.720	22.701	22.595	21.691	21.463	4H5H	22.051	22.351	22.701	22.841	0.140	24.000	24.429	
27	2	MJ27	4h6h	27.000	26.720	25.701	25.595	24.691	24.463	4H5H	25.051	25.351	25.701	25.841	0.140	27.000	27.429	
30	2	MJ30	4h6h	30.000	29.720	28.701	28.595	27.691	27.463	4H5H	28.051	28.351	28.701	28.841	0.140	30.000	30.429	
33	2	MJ33	4h6h	33.000	32.720	31.701	31.595	30.691	30.463	4H5H	31.051	31.351	31.701	31.841	0.140	33.000	33.429	
36	2	MJ36	4h6h	36.000	35.720	34.701	34.595	33.691	33.463	4H5H	34.051	34.351	34.701	34.841	0.140	36.000	36.429	
39	2	MJ39	4h6h	39.000	38.720	37.701	37.595	36.691	36.463	4H5H	37.051	37.351	37.701	37.841	0.140	39.000	39.429	

NOTE: For threads smaller than 1.6 nominal size, use miniature screw threads (ASME B1.10M)

METRIC SCREW THREADS MJ PROFILE (mm)
TABLE 12-16