ASME B1.15-1995

Unified Inch Screw Threads

(UNJ Thread Form)

AN ASME STANDARD

The American Society of Mechanical Engineers

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ASME B1.15-1995

The American Society of
Mechanical Engineers

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

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This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this Edition.

Errata
to
ASME B1.15-1995
Unified Inch Screw Threads
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The Errata corrections listed below and appearing herein apply to ASME B1.15-1995, Unified Inch Screw Threads (UNJ Thread Form). Corrections are incorporated directly into the affected pages and are indicated by a margin note, **(E)**. The pages show the corrections given below. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	Location	Change
1	1.1	*In fourth line,* 0.600 *changed to* 0.060
4	Fig. 2	*(1)* D_1 max. *changed to* D_2 max. *(2)* D_1 min. = D_2 bsc *changed to* D_2 min. = D_2 bsc *(3)* $TD_1/2$ *changed to* $TD_2/2$
5	Fig. 3	*(1)* d_1 max. = d_1 bsc *changed to* d_2 max. = d_2 bsc *(2)* d_1 min. *changed to* d_2 min. *(3)* $Td_1/2$ *changed to* $Td_2/2$ *(4) In General Note,* "(See para. 5.3)" *changed to read:* "(See para. 2.3)"
	Fig. 4	*Sentence added to Note (1) reading:* "X equal or greater than 0.15011*P*."
9	4.1	*In fourth line,* "length" *changed to read:* "lengths"
	4.3	*In second line, delete* (*T*)
10	4.4.2(b)	*In second Example, fourth line, Lead tolerance of* 0.009 in. *changed to* 0.0009 in.
11	4.4.2(c)	*In Example, fourth line,* 0.009 *changed to* 0.0009
51	A2	*Under MINOR DIAMETER:* *(1)* "d_1 basic minor diameter" *changed to* "d_1 bsc basic minor diameter" *(2)* "d_1 maximum minor diameter" *changed to* "d_1 max maximum minor diameter"

MARCH 1997

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 East 47th Street, New York, NY 10017

N0131E

FOREWORD

(This Foreword is not part of ASME B1.15-1995.)

This Standard is similar to Military Specification MIL-S-8879 and equivalent to ISO-3161-1977 for thread Classes 3A and 3B. British Standard BS 4084:1978 including Amendment 1 is technically identical to ISO-3161-1977 except for Appendix A which provides information for a 20 UNJ constant pitch series for diameters through 3 inches.

The UNJ thread form, having the enlarged root radius in the external thread, was introduced for applications requiring high fatigue strength where working stress levels are high, in order to minimize size and weight in parts, as in aerospace applications and also for other designs in commercial products where stresses are critical. To meet these requirements, the UNJ external thread root radius is designed between $0.15011P$ to $0.18042P$ and the minor diameter of the mating internal thread is increased to ensure the necessary clearance.

This Standard includes Classes 2A and 2B UNJ screw threads. Either Class 3 or Class 2 UNJ threads are appropriate for commercial applications commensurate with the fatigue and stress levels required.

It is not recommended that Classes 2A and 2B threads be used for aerospace applications. Only UNJ thread Classes 3A and 3B meet the requirements of Military Specification MIL-S-8879.

NOTE: In what follows, the symbols H and h are used. H is defined as the height of the sharp vee thread formed by extending the thread flanks until they meet. H is equal to 0.866025 times the pitch, P. The symbol h is equal to 0.75 times H and represents the theoretical height of the American National thread form. It is still used as the basis for the value called *percent of thread.*

The UNJ thread form is the UN thread form modified to $^{9}/_{16}$ H or 75% h basic thread depth which allows the $0.18042P$ maximum root radius in the external thread. The first known U.S. standard of similar thread form was the Society of Automotive Engineers Aeronautical Standard AS 82 published in March 1942, which is a modified American National thread form to 75% h basic thread depth and specifying $0.108P$–$0.180P$ root radius in the external thread. This thread was symbolized NR, National Round, and was developed for aircraft engine applications.

Tension-tension fatigue testing of aircraft fasteners in 1942 demonstrated the importance of the external thread root contour in the fatigue life of a screw thread rolled after heat treatment. Fatigue testing isolated the following elements of good external thread root design:

- The root should be radiused, not sharp.
- Theoretically, it should be a continuous circular arc, blending smoothly with the thread flanks.
- The radius should be as large as possible within the allowable design form.
- The root contour should be smooth throughout, free of any imperfections, tool marks, or other minor notches.

Recognizing the need for improved 160,000 psi tensile strength bolts, the Military Services published in April 1952, MIL-B-7838A bolt procurement specification for aircraft applications based on the Unified thread form having $83\frac{1}{3}\%$ h Unified thread form. Thus, larger external root radius requires a shallower internal thread depth to clear the flank tangency point. Although the Unified internal thread standards for tap drill sizes permit depths of more than 75% h, production rarely used these drills because deeper tapping of internal threads is generally not considered economically practical. A few internal threads have depths as great as 70% h, but the vast majority lie between 60% and 68% h.

Since internal threads are generally less than 75% h basic thread depth, the root radius of the external thread was increased to $0.150P$ min. and $0.180P$ max. for the 180,000 psi and higher tensile strength bolts. This external thread form was developed in 1955 by the aerospace fastener industry and was known as the "Hi R" thread form.

Through the coordinated effort with the Aerospace Engine and Propeller Utility Standards parts Committee E25 of SAE and the AIA National Aerospace Standards Committee NASC, the Air Force and Navy developed and published in September 1960, the thread specification MIL-S-8879 which features the "Hi R" thread root radius in the external thread and the internal thread modified to $\frac{9}{16}$ H basic or 75% h thread depth.

With the advent of aircraft gas turbine engines, the high temperature threaded fasteners developed better elevated temperature performance using MIL-S-8879 UNJ thread root radius, in that the stress-rupture life of bolts was greatly improved.

The UNJ thread form has been adopted by the aerospace industry as the all-purpose thread standard, with the exception of electrical hardware and thread sizes 0.138 and smaller, which may use the UN thread form.

Suggestions for improvement of this Standard will be welcome. They should be sent to The American Society of Mechanical Engineers, Att: Secretary, B1 Main Committee, 345 East 47th Street, New York, NY 10017.

This Standard was approved as an ASME Standard on June 22, 1993.

ASME STANDARDS COMMITTEE B1
Standardization and Unification of Screw Threads

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UNIFIED INCH SCREW THREADS (UNJ THREAD FORM)

SECTION 1 GENERAL

(E) ### 1.1 Scope

This Standard establishes the basic triangular profile for the UNJ thread form, provides a system of designations, lists the standard series of diameter–pitch combinations for diameters from 0.060 to 6.000 in., and specifies limiting dimensions and tolerances.

It specifies the characteristics of the UNJ inch series of threads having 0.15011P to 0.18042P designed radius at the root of the external thread, and also having the minor diameter of the external and internal threads increased above the ASME B1.1 UN and UNR thread forms to accommodate the external thread maximum root radius.

1.2 Field of Application

The UNJ screw thread is designed for aerospace inch threaded parts, or for use on other highly stressed applications requiring high fatigue strength. For aerospace applications, only Classes 3A and 3B should be used.

1.3 Assembly

Threads conforming to the UN profile (ASME B1.1) and the UNJ profile are not interchangeable because of possible interference between the UNJ external thread minor diameter and the UN internal thread minor diameter. However, the UNJ internal thread will assemble with the UN external thread.

1.4 Federal Government Use

When this Standard is approved by the Department of Defense and federal agencies and is incorporated into FED-STD-H28/4, Screw Thread Standards for Federal Services, Section 4, the use of this Standard by the federal government is subject to all the requirements and limitations of FED-STD-H28/4.

1.5 References

The latest issues of the following documents form a part of this Standard to the extent specified herein.

American National Standards

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.3M, Screw Thread Gaging Systems for Dimensional Acceptability

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

ASME B1.23[1], Gages and Gaging for Unified Inch J Series Screw Threads

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

[1] Proposed ASME Standard under development by The American Society of Mechanical Engineers.