ASME B1.1-2003
[Revision of ASME B1.1-1989 (R2001)]

Unified Inch Screw Threads

(UN and UNR Thread Form)

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The 2004 edition of this Standard is being issued with an automatic addenda subscription service. The use of addenda allows revisions made in response to public review comments or committee actions to be published as necessary. This Standard will be revised when the Society approves the issuance of a new edition.

There will be no written interpretations of the requirements of this Standard issued to this edition.

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

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FOREWORD

This Standard is the outgrowth of and supersedes previous editions that were published as B1-1924, B1.1-1935, B1.1-1949, B1.1-1960, B1.1-1974, B1.1-1982, and B1.1-1989. Throughout such development, special attention has been given to the practical aspects of thread standardization, and many details of the current Standard result from studies and tests based on user problems. For example, there was disclosed the need for free assembly in high-production industries and the desirability of making some provision for threads that require a coating. The tolerance classes 2A/2B were developed to meet these two major requirements as well as to provide a general standard for externally and internally threaded fasteners. Thread symbols and nomenclature were changed to be expressed according to ASME B1.7. Thread acceptability now refers to ASME B1.3.

This issue includes the following changes to ASME B1.1-1989:

(a) The revision of some of the values in Table 2. These revisions are the result of the application of the consistent eight place decimal and rounding rules established in ASME B1.30-1992 that were mandated for use in all new and future revisions of ASME B1 documents. ASME B1.30 was developed under the direction of the B1 Committee as the basis for rounding of decimal values associated with the computation of screw thread dimensions. Using the thread calculation formulas in paras. 5 and 8 of this document and following the rounding rules of B1.30 all parties using a calculator or standard computer spreadsheet program will derive precisely the same values.

Table E-1 of Nonmandatory Appendix E identifies the thread sizes in Table 2 that have been revised and lists the dimensions from the ASME B1.1-1989 standard. The majority of the dimensional changes are within ± 0.0001 in.

Paragraph 8.2.1 states that both the values in Tables 2 and E-1 should be considered acceptable until a future revision of this standard makes the values in Table 2 the only acceptable values.

(b) Former Table 3B has been moved to Nonmandatory Appendix D. This table provides calculated values for various UNS (Unified Specials). ASME B1 strongly urges the adoption of the standard thread sizes in Table 2 whenever possible instead of those listed in Table D-1.

(c) Former Tables 20 through 30 have been eliminated because the allowances and tolerances contained in them was determined to be redundant with data provided in Table 2.

(d) Former Tables 31 through 40 have been moved to Nonmandatory Appendix D and were renamed Tables D-2 through D-11. These tables were used in the past for the quick calculation of special threads. In some cases the derived values resulted in values that differ from those derived by use of the formulas in paras. 5 and 8 of ASME B1.1. All future special threads should be based on calculations in paras. 5 and 8 in this document using the rounding rules in ASME B1.30 to ensure uniformity and consistency.

(e) All references to percent of thread engagement have been eliminated from this document. Past changes in the thread form designation of the "basic" thread height from $0.750H$ to $0.625H$ confused the calculation of percent of thread engagement. This calculation has been used in the past for threaded products users to determine drill size selection. It is now recommended that users select a drill size that will result in a hole size that lies between the maximum and minimum size of the internal thread's minor diameter shown in the tables included in this Standard.

(f) The definition of "functional diameter" has been included in this document and the term has been added in Table 2 in the same column as "pitch diameter" since both characteristics have the same limits of size.

(g) The effects of coating on threads have been explained in more depth in para. 7.

The Unified Screw Threads Standard is an integrated system of threads for fastening purposes in mechanisms and structures. Its outstanding characteristic is general interchangeability of threads, achieved through the standardization of thread form, diameter-pitch combinations, and limits of size.

The Standard has as its original basis the work done more than a century ago by William Sellers in the United States and Sir Joseph Whitworth in Great Britain. Throughout the intervening

years there have been many further developments and revisions, culminating in the system of Unified Threads approved and adopted for use by all inch-using countries.

The achievements represented by ASME B1.1 in development, standardization, and unification are the result of cooperation and coordination of many organizations, including The American Society of Mechanical Engineers, Society of Automotive Engineers, National Institute of Science and Technology (formerly National Bureau of Standards), Committee B1, the former National Screw Thread Commission, the former Interdepartmental Screw Thread Committee, British Standards Institution, Canadian Standards Association, and American National Standards Institute.

Unification of screw thread standards received its impetus from the need for interchangeability among the billions of fasteners used in the complex equipment of modern technology and made in different countries. Equally important, however, are international trade in mechanisms of all kinds and the servicing of transportation equipment which moves from country to country. These have made unification not only highly advantageous, but practically essential. In sizes $\frac{1}{4}$ in. and larger, complete unification of certain thread series and six tolerance classes was signaled by the signing of an accord on November 18, 1948. Since that time, further unification has been extended into smaller sizes. Working through Technical Committee No. 1 of the International Organization for Standardization (ISO), the unified standard was adopted as an ISO inch screw thread standard, ISO 5864, parallel to the ISO metric screw thread system. Both systems have a common basic profile. The standard was subject to Quadripartite Standardization Agreement (QSTAG) 247, in the ABCA Army Standardization Program of America, Britain, Canada, and Australia.

Suggestions for improvement of this Standard will be welcomed. They should be sent to the American Society of Mechanical Engineers at ASME International, Three Park Avenue, New York, NY 10016-5990, U.S.A.

ASME B1.1-2003 was approved by the American National Standards Institute (ANSI) on March 27, 2003.

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Standardization and Unification of Screw Threads

(The following is the roster of the Committee at the time of approval of this Standard.)

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UNIFIED INCH SCREW THREADS

(UN AND UNR THREAD FORM)

1 GENERAL

1.1 Scope

This Standard specifies the thread form, series, class, allowance, tolerance, and designation for unified screw threads. (In order to emphasize that unified screw threads are based on inch modules, they may be denoted unified inch screw threads.) Several variations in thread form have been developed for unified threads; however, this Standard covers only UN and UNR thread forms.

For easy reference, a metric translation of this Standard has been incorporated as Nonmandatory Appendix C. Nonmandatory Appendices A through E contain useful information that is supplementary to the sections of this Standard.

1.2 Unified Screw Thread Standards

The standards for unified screw threads published in this Standard are in agreement with formal standards of the International Organization for Standardization for diameter-pitch combinations, designations, and tolerances for 60 deg triangular form inch screw threads. Unified screw threads had their origin in an accord signed in Washington, D.C., on November 18, 1948, by representatives of standardizing bodies of Canada, the United Kingdom, and the United States, and have subsequently superseded American National screw threads.

1.3 UN and UNR Screw Threads

UNR applies only to external threads; the difference between UN and UNR threads, in addition to designation, is that a flat or optional rounded root contour is specified for UN threads, while only a rounded root contour is specified for UNR threads.

1.4 Interchangeability

Unified (UN/UNR) and its predecessor, American National screw threads, have substantially the same thread form, and threads of both standards having the same diameter and pitch are mechanically interchangeable. The principal differences between these standards relate to the application of allowances, the variation of tolerances with size, differences in the amounts of pitch diameter tolerances for external and internal threads, and differences in thread designations. Unified inch and ISO metric screw threads are not mechanically interchangeable.

1.5 Designations

Unified thread sizes (specific combinations of diameter and pitch) are identified by the letter combination "UN" in the thread symbol. In the unified standards, the pitch diameter tolerances for external threads differ from those for internal threads; for this reason the letter "A" is used in the thread symbol to denote an external thread and the letter "B," an internal thread. Where the letters "U," "A," or "B" do not appear in the thread designation, the threads conform to the outdated American National screw threads. Details regarding thread designations are given in para. 6.

1.6 Reference Documents

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

When the following American National Standards referred to in this Standard are superseded by a revision approved by the American National Standards Institute, Inc., the revision should apply.

ASME B1.2, Gages and Gaging for Unified Inch Screw Threads

ASME B1.3, Screw Thread Gaging Systems for Dimensional Acceptability — Inch and Metric Screw Threads

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

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

ASME B47.1, Gage Blanks

ASME B94.11, Twist Drills

ASME Y14.5, Dimensioning and Tolerancing

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

ISO 68, General Purpose Screw Threads — Basic Profile

Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse