ASME B1.10M-2004
(Revision of ASME B1.10M-1997)

STABILIZED 2024

UNIFIED MINIATURE SCREW THREADS

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Mechanical Engineers

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Date of Issuance: March 5, 2004

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FOREWORD

The standardization of threads for miniature fastening screws and similar purposes has been under study since 1927, when the National Screw Thread commission prepared a compilation of the practices of American manufacturers and various foreign standards. The latter included the Swiss standard NHS 56100, which first appeared in 1923. However, for want of sufficient interest, no further action was taken in the United States until 1943, when the demands of modern warfare awakened both the need for domestic standardization and the desirability of international standardization, particularly among the inch-using countries. For the consideration of this dual problem, together with other thread matters confined principally to the instrument industry, the American Standards Association established, in 1944, ASA War Committee B1.7 on Instrument Screw Threads.

The first significant progress toward standardization and unification of miniature threads was achieved at the American-British-Canadian Conference on the Unification of Engineering Standards held in Ottawa in 1945, when the delegations of these three countries joined in recommending the adoption of the NHS thread series in the size range of 0.30 mm to 0.90 mm having a 50 deg thread angle, and the development of a series closely following the NHS series for sizes larger than 0.90 mm with a 60 deg thread angle.

In June 1946, the War Committee was converted to Subcommittee No. 4 on Instrument Screw Threads of ASME Sectional Committee B1. Shortly thereafter it was learned that Swiss manufacturers were not adhering entirely to NHS 56100, but that the 60 deg thread angle made essentially in accordance with the Unified Thread Form was being widely used for the sizes below 1 mm. From this information and the results of subsequent experimental work by watch and instrument manufacturers both here and abroad, there developed a consensus favoring the 60 deg thread angle for all sizes.

At a meeting in June 1952 of Technical Committee No. 1, Screw Threads, of the International Organization for Standardization, a diameter-pitch series covering the range from 0.25 mm to 1.40 mm was adopted for recommendation to all national standardizing bodies. The Committee also agreed that further studies should be made regarding the use of the ISO Basic Profile (or Unified Thread Form) in this range.

In the United States, where subsequent studies revealed no need, either current or anticipated, for sizes below 0.30 mm, it was established that the 60 deg angle for all sizes was feasible. It was also determined that the minor diameter of internal threads must be, and invariably is, kept above the minimum value established by the Unified Thread Form to avoid excessive tapping difficulties. From this conclusion and the calculation problems presented by the need for dimensioning this Standard in both metric and inch units, a simple plan evolved based on the coefficient of 0.52 in place of 0.54127 for basic thread height. These findings resulted in the formulation of the following recommendations by Subcommittee No. 4 for the American standard:

(a) that the series consist of all sizes from 0.30 mm to 1.400 mm in the ISO recommendation

(b) that the 60 deg thread angle be adopted over the entire range

(c) that the design thread forms be based on the simplified value of 0.52*P*, instead of 0.54127*P*, for the basic thread height

The American views were presented at both the American-British-Canadian Conference in April 1955 and the plenary session of ISO in June 1955. The latter session developed Draft ISO recommendation No. 84 covering a metric series from 0.25 mm to 5.00 mm, with the ISO Basic Thread Profile, having a 60 deg angle and a thread height of 0.54127*P*, applied over the entire range.

American sentiment was strongly in favor of the simplified coefficients for the thread sizes 1.400 mm and below, and the previous issue of this Standard was formulated to incorporate the original American recommendation on thread height. Despite this deviation, complete interchangeability with product made to ISO recommendation No. 84 was regarded as a certainty in view of common practice on internal threads.

Tolerances given in this Standard were entirely of national origin, as recommendations on this phase had not yet been formulated by other bodies.

A preliminary draft of this Standard, approved by Subcommittee No. 4 on June 12, 1956, was distributed to industry for comment and criticism in October 1956. This draft was then revised and submitted to the Sectional Committee B1 for letter ballot in April 1957. In response to comments received with the letter ballot, the draft was further modified at a meeting of Subcommittee No. 4 on March 6, 1958. Following the acceptance of these modifications by the Sectional Committee, the proposal was submitted to and approved by the sponsor organizations and ASA, and was formally designated as an American Standard on August 18, 1958.

This Standard remained virtually unchanged from 1958 to 1995, while the use of miniature threads diminished considerably due to electronic components, replacing many of the mechanical devices used in watches and instrumentation. There still remains, however, an active use of miniature screw threads in spacecrafts and aircrafts, as components are miniaturized for weight considerations. Attempts were made to revise the Standard between 1979 and 1983, but unresolved negative votes defeated the proposed revisions. Efforts to revise the Standard were undertaken again in 1989.

The current Standard now has a thread height of $0.554H$ ($0.48P$), which is in agreement with FED-STD-H28/5 and ISO/R1501, and which allows for interchangeability with threads produced to the previous standard ASA B1.10-1958. The dimensions and symbology are in line with current screw thread practices. This revision of Unified Miniature Screw Threads lists all dimensions in metric units. Inch conversions of these values have been placed in the Appendix Section of this Standard.

ASME B1.10M-1997 was approved by the American National Standards Institute on July 11, 1997.

ASME B1.10M-1997 was revised again in 2003 to correct printing errors and update symbology to be in line with current screw thread practice. Many of the values that are expressed with P have been expanded to seven decimal places. This has been done to improve calculation accuracy in accordance with ASME B1.30. In addition thread values that were derived from a function of H have been changed to a function of P.

ASME B1.10M-2004 was approved by the American National Standards Institute on January 14, 2004.

ASME STANDARDS COMMITTEE B1
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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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B1 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Attending Committee Meetings. The B1 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B1 Standards Committee.

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UNIFIED MINIATURE SCREW THREADS

1 GENERAL

1.1 Scope

This Standard specifies the thread form, series, tolerance, and designation for the Unified Miniature Screw Threads. The series covers a diameter range of 0.30 mm to 1.40 mm, extending the metric M-Profile and unified thread series that begin at 1.6 mm.

1.2 Unified Miniature Screw Thread Standards

The fourteen sizes published in this Standard were endorsed by the American-British-Canadian conference of April 1955 as the basis of the unified standard among inch-using countries, and to correspond with the range of sizes in the ISO. The sizes are shown in Table 1. In interest of standardization and where design permits, selection of size should be confined to those indicated in bold type in Table 1. For more restrictive conditions, those sizes indicated in regular type in Table 1 may be used.

1.3 Designation

Unified Miniature Thread sizes of this series shall be designated on engineering drawings, in specifications, and on tools and gages (space permitting) by their nominal diameter in hundredths of a millimeter followed by the symbol "UNM" (e.g., 0.80 UNM).

On internal threads, the full limits of minor diameter, as given in Table 2, shall normally be considered applicable. Where this is not permissible, the designation shall be supplemented by the minor diameter limits.

1.4 Reference Documents[1]

The following is a list of publications referenced in this Standard.

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

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

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/R1501[2], ISO Miniature Screw Threads

Publisher: International Organization for Standardization, 3 rue de Varembé, 1211 Genève 20, Switzerland/Suisse

1.5 Acceptability

Additional recommended methods for determining the acceptability of miniature screw threads will be included as further experience with this thread standard is reported. Until such time, agreements must be reached between purchaser and vendor regarding the basis for determining acceptance, since practices are likely to differ considerably, particularly for external threads. Where a free choice is possible, the procedures given below, which are being used with considerable success by some producers, are suggested.

1.5.1 External Threads. The major diameter of the external thread is measured by either contact gaging, optical projection, or laser inspection equipment. All other dimensions, such as pitch diameter, lead, thread form, and minor diameter may be inspected by optical projection methods, with a magnification of 100X recommended. A suggested chart for this method is shown in Appendix A. The thread plug gages and the tap are inspected in a similar manner to externally threaded parts. Contact gaging, such as the use of "GO" and "NOT GO" ring gages, measuring wires, and set plug gages may be used for sizes 0.70 UNM and above.

1.5.2 Internal Threads. The minor diameter of the internal thread is gaged with "GO" and "NOT GO" plain cylindrical plug gages. All other elements are checked only for assemble-ability limits by means of a "GO" thread plug gage, taking extreme care not to damage the thread. For the minimum material limits of the internal threads, the accuracy and performance of the tap is relied upon. This implies that the major and pitch diameters of the tap do not exceed the maximum internal thread limits for these elements, and disregards over cutting, which is rarely incurred because of the flexibility of these small taps and the manner in which they are generally fluted.

It is recommended that the minor diameter of the internal thread be gaged with one insertion of the "NOT GO" plain cylindrical plug gage first. The "NOT GO"

[1] When the American National Standards referred to in this Standard are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

[2] May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.