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MEASUREMENT OF THREAD MEASURING WIRES

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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

ASME will issue written replies to inquiries concerning interpretations of technical aspects of this standard.

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FOREWORD

This Standard is the result of the combined work of members of the ASME B1 Screw Thread Committee and the ASME B89 Dimensional Metrology Committee. It is the responsibility of the B1 Committee to determine how the pitch diameter of threads is measured. The B89 Dimensional Metrology Committee writes standards on specifications and procedures for dimensional measuring equipment. Thread wires differ from most items measured in that they are measured in a deformed condition to approximate the elastic deformation that occurs when they are used to measure pitch diameter.

For this reason when using this Standard it is necessary to ensure that the B1 standards referenced in this document are the latest edition of the B1 standard which specifies the conditions to be used when measuring the pitch diameters of threads.

The measurement of thread measuring balls is included as an appendix to the standard.

This edition of B89.1.17 was approved by the American National Standards Institute on October 24, 2001.

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Dimensional Metrology

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General. ASME Codes and 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, B89 Main Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016

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.

Interpretations. Upon request, the B89 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B89 Main Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B89 Main Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B89 Main Committee.

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MEASUREMENT OF THREAD MEASURING WIRES

1 SCOPE

This Standard is intended to establish uniform practices for the measurement of thread measuring wires. The standard includes methods for the direct measurement of both master and working wires, and methods for the comparison measurement of working wires. The standard includes requirements for geometric qualities of thread measuring wires, the important characteristics of the comparison equipment, environmental conditions, and the means to ensure that measurements are made with an acceptable uncertainty level.

Wires covered by the standard include inch series 60-deg, 29-deg Acme, 7/45-deg Buttress, and metric 60-deg threads.

2 DEFINITIONS

"best-size" wire: the size of a wire that would touch at the pitch cylinder on a thread of zero lead angle.

"C" constant: a constant to be subtracted from the measurement over the wires to give the pitch diameter.

measurement uncertainty: parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand (quantity being measured).

3 REFERENCES

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

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

ASME B1.5, Acme Screw Threads

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

ASME B1.8, Stub Acme Screw Threads

ASME B1.9, Buttress Inch Screw Threads 7°/45° Form With 0.6 Pitch Basic Height of Thread Engagement

ASME B1.16M, Gages and Gaging for Metric M Screw Threads

ASME B1.22M, Gages and Gaging for MJ Series Metric Screw Threads

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

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900

Federal Specification GGG-W-366b, Federal Specification Wire, Measuring: Gear, Thread, and General Purpose, General Services Administration, Washington, DC, May 8, 1967 (canceled)

Guide to the Expression of Uncertainty in Measurement

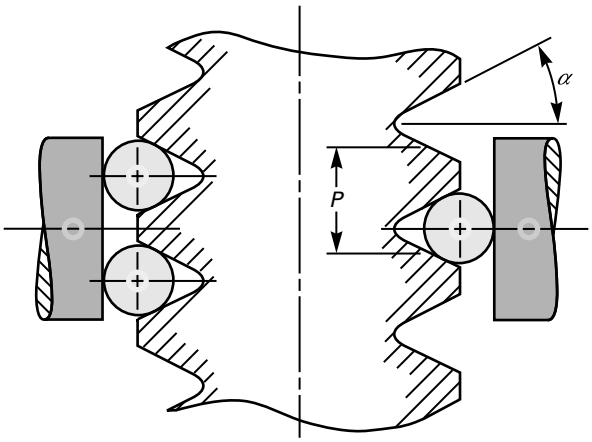
Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève, 20, Switzerland/Suisse

NIST Technical Note 1297, 1994 Edition, Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results

Puttock, M. J. and Thwaite, E. G., "Elastic Compression of Spheres and Cylinders at Point and Line Contact," National Standards Laboratory Technical Paper No. 25, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia, 1969

4 GENERAL

When the pitch diameter of external threads is measured using thread wires, good repeatability is only obtained when a sufficient force is used to push the wires against the sides of the thread flank. Elastic deformation occurs between the wires and thread flanks when the pitch diameter is measured in this manner. The practice in the United States is to measure the wires with a method that approximately reproduces the deformation that occurs between the thread and the wires. For the thread series listed in this Standard, the ASME B1 Committee has standardized the forces to be used when measuring pitch diameter. In measuring the pitch diameter of internal threads, and in some cases external threads, balls rather than wires are used. The use of balls for measuring pitch diameter is discussed in Appendix A.



GENERAL NOTES:
(a) P is the pitch.
(b) α is the half-angle.

FIG. 1 THREADING MEASURING WIRES

5 CLASSIFICATION

Wires may be classified by their use as masters or working wires and by inch or metric series.

5.1 Master Wires

Master wires contain only one wire per pitch. The wires are used to measure working wires or, in some cases, other master wires.

5.2 Working Sets

Wires meant for measuring the pitch diameter of threaded gages or products consist of a three-wire set for each pitch. The wires may be measured either by comparison to a master, which has been measured in accordance with this Standard, or by directly measuring the wires in the manner described in the standard. See Fig. 1.

6 INCH SERIES SPECIFICATIONS

The material and design specifications for all master and working wires are the same, except that the working wires, which are three-wire sets, have a requirement that the variation in diameter among the three wires may not exceed a specified amount. A correction factor ("C" constant) must also be calculated and placed on the label for all except 29-deg Acme wires.

6.1 Material

The wires shall be made from alloy tool steel that has been stabilized to ensure dimensional stability. The wires shall be free from cracks and other detrimental defects. The hardness shall be a minimum of 62 on the Rockwell C scale. The surface finish shall not exceed 2 μin. R_a, using a 0.03-in. cutoff.

6.2 Wire Design

A set of measuring wires shall consist of three wires for each pitch, except for master wires, which contain one wire for each pitch. The length of the thread wires shall be a minimum of 1 in. Variations in the length of the three wires in any set shall not exceed 0.1 in.

6.3 Wire Tolerances

In order to accurately measure the pitch diameter of threaded gages and thread products, it is necessary to have accurate measurements of the wires. For example, an error of one unit in the mean diameter of thread measuring wires will cause an error of three units (for 60-deg threads) when measuring pitch diameter.

6.3.1 Master Wires. Diameters of master wires need to be known, in most cases, with an uncertainty of 5 μin. or less. The diameter of the wires shall be within 20 μin. of the "best-size" as shown in the tables or computed using the formulas in this document. The variations in diameter, including taper and out-of-roundness, shall not exceed 5 μin. over the central 0.5 in. of the wire.

6.3.2 Working Sets. A set of wires shall have the same diameter within 10 μin., and the average diameter shall be within 20 μin. of the specified "best-size" wire. The variations in diameter of each wire, including taper and out-of-roundness, shall not exceed 10 μin. over the central 1 in. of the wire. Each set shall display the TPI (threads per in.) and the average deformed diameter. Except for 29-deg Acme, the calculated wire constant ("C" constant), based on the measured mean diameter, shall also be displayed. The "C" constant for symmetrical threads is computed from the formula

$$C = w\,(1 + \operatorname{cosec}\,\alpha) - [\cot(\alpha)/2n]$$

where
w = the average of the set
α = the half-angle, and
n = the number of threads per in.
For 60-deg threads the formula reduces to