ASME B89.1.6-2002
(Revision of ASME B89.1.6M-1984)

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MEASUREMENT OF PLAIN INTERNAL DIAMETERS FOR USE AS MASTER RINGS OR RING GAGES

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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FOREWORD

The American National Standards Committee B89 on Dimensional Metrology was established in February 1963 under the sponsorship of the American Society of Mechanical Engineers. The first organization meeting was held at the United Engineering Center in New York City. The scope of the Committee was defined as follows:

Calibration and the specific conditions relating thereto. It shall encompass the inspection and the means of measuring the characteristics of the various geometrical configurations such as lengths, plane surfaces, angles, circles, cylinders, cones, and spheres.

Among the six Subcommittees originally established to carry out this mandate was B89.1 - Length, whose chairman authorized the formation of B89.1.6 to prepare a standard on the measurement of internal diameters for use as master rings and ring gages. The standard was approved by ANSI as an American National Standard on June 10, 1976.

The B89 Committee was reorganized as an ASME Standards Committee on July 8, 1981. The ASME B89 Committee revised the Standard which included specifications that extend qualifications of rings up to 21 in. (533 mm), consolidated information into tables from within the original standard and from other sources, and related surface texture to tolerance rather than class. The revised Standard was approved by the American National Standards Institute on June 18, 1984.

In October of 1997, the B89.1.6 Committee began rewriting and revising the Standard because of many advances in measurement technology and standardization among laboratories both in the United States and abroad. Several changes have been made to the Standard to reflect a more up-to-date approach to internal diameter measurement, and to include information needed by laboratories for purposes of standardization, accreditation, etc. This revision was approved by the American National Standards Institute on October 29, 2002.

ASME B89 COMMITTEE
Dimensional Metrology

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

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CORRESPONDENCE WITH THE B89 COMMITTEE

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

Proposed 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 B89 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B89 Standards Committee.

MEASUREMENT OF PLAIN INTERNAL DIAMETERS FOR USE AS MASTER RINGS OR RING GAGES

1 SCOPE

This Standard is intended to establish uniform practices for the measurement of master rings or ring gages using horizontal methods. The standard includes requirements for geometric qualities of master rings or ring gages, the important characteristics of the comparison equipment, environmental conditions, and the means to assure that measurements are made with an acceptable level of accuracy.

This Standard does not include measurement methods for rings below 1 mm (0.040 in.). The measurement method on these very small rings should be agreed upon prior to manufacture or calibration between the manufacturer/laboratory and customer.

2 DEFINITIONS

bilateral tolerance: application of one half of the tabulated tolerance plus and minus from the specified size.

circularity (roundness): circularity is a condition of a surface of revolution where:

(a) for a cylinder or cone, all points of the surface intersected by any plane perpendicular to a common axis are equidistant from that axis

(b) for a sphere, all points of the surface intersected by any plane passing through a common center are equidistant from that center

cosine error: the measurement error in the measurement direction caused by angular misalignment between a measuring system and the gage or part being measured.

cylindricity: cylindricity is a condition of a surface of revolution in which all points of the surface are equidistant from a common axis.

diameter: the length of a straight line through the center of a circular cross-section of an object. In the case of a cylinder, the line is considered to be perpendicular to the axis.

dimensional stability: ability of an object (e.g. measuring instrument or work piece) to maintain its metrological characteristics with time.

NOTES:

(1) Where stability with respect to a quantity other than time is considered, this should be stated explicitly.

(2) Stability may be quantified in several ways, for example: in terms of the time in which a metrological characteristic changes by a stated amount, or in terms of the change in a characteristic over a stated time.

discrimination (threshold): largest change in a stimulus that produces no detectable change in the response of a measuring instrument, the change in the stimulus taking place slowly and monotonically.

elastic deformation: the non-permanent (reversible) change in the size or geometry of a part due to an applied force.

gage block: a length standard with rectangular, round or square cross section, having flat, parallel opposing gaging faces.

NOTE: The surface finish of the gaging faces should be such as to allow gages to be wrung together.

Go ring: an internal diameter gage manufactured to the part tolerance high limit with a unilateral minus tolerance, therefore accepting the manufactured part when in size.

index of refraction: for a given wavelength, the ratio of the velocity of light in a vacuum to the velocity of light in a refractive material.

NOTE: As used in this Standard, the material is air.

line contact: the zone of contact between a flat surface and a cylinder.

lobing: systematic variations in the radius around a part (measured in the cross section perpendicular to the axis).

master ring: an internal diameter standard used to set other gaging equipment. Master rings are manufactured to a bilateral tolerance.

max. (maximum) master ring: an internal diameter standard used to set other gaging equipment. Max. master rings are manufactured to a unilateral *Minus* tolerance on the part tolerance high limit.

mean master ring: An internal diameter standard used to set other gaging equipment. Mean master rings are manufactured to a bilateral tolerance.

measurand: measurement of a well defined physical quantity.

Example: Diameter of a cylindrical gage at 20°C.

measurement force: the amount of force exerted upon the