ASME B89.1.9-2023

[Revision of ASME B89.1.9-2002 (R2012)]

Gage Blocks

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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FOREWORD

The U.S. gage block standard has not changed substantively since Federal Specification GGG-G-15C of 1975. During the intervening years, there have been several very important shifts in the use of gage blocks, a large growth of internationalization in design and manufacture of parts, and even changes to basic concepts like uncertainty and traceability. With all of these factors in mind, the ASME B89.1.9 Committee began to consider a total rewrite of ASME B89.1.9 in the early 1990s. The basic criteria were to adhere as closely as possible to the International Standard ISO 3650 while making necessary additions to adapt ISO 3650 to measuring practice in the United States.

ASME B89.1.9 includes specifications for inch system gage blocks as well as metric system gage blocks. The International Standard defines only rectangular gage blocks, yet the United States also has a significant number of square hole-style blocks. Since the grades in this Standard have some of the same designations as the GGG-G-15C standard, the prefix "AS" (American Standard) was added to the names of Grades 1 and 2 to prevent misidentification. A Grade 00 was also added with tolerances near those of the Grade 1 per GGG-G-15C. While the committee basically agreed with the logic behind the ISO 3650 grade tolerances, it was also recognized that the use of graded sets is deeply embedded in some industries, and the loss of the high-accuracy grade would be a hardship for some users.

ASME B89.1.9 includes nine Nonmandatory Appendices. Most of these appendices have information that is not in the current ISO 3650 but was in GGG-G-15C or previous editions of ASME B89.1.9. The most important of these is Nonmandatory Appendix A, which describes the differences between this Standard and its predecessors.

ASME B89.1.9-2023 significantly revises ASME B89.1.9-2002 (R2012). The discussion of gage block accessories has been moved from an appendix to the body of the Standard. As with other ASME B89 standards, the default decision rule has been implemented, and the measurement uncertainty discussion has been updated to include additional sources of error to provide a more complete example. Additionally, this Standard contains a new Nonmandatory Appendix H covering the contact measuring instrument. The addition of Nonmandatory Appendix H eliminates the reliance of this Standard on ASME B89.1.2M, as all necessary information is now contained in this Standard.

The committee would like to acknowledge the many people who, while not members of the committee, were kind enough to attend an occasional meeting or send comments on the early drafts of this Standard. These interactions increased the committee's knowledge of actual gage block use in industry and were very important in drafting the changes made to ISO 3650 to correspond to U.S. practice.

This Standard was approved by the American National Standards Institute (ANSI) on February 23, 2023.

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Gage Blocks

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(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

(4) to permit the use of a new material or process

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(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Standard and the paragraph, figure, or table number

(4) the editions of the Standard to which the proposed case applies

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

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GAGE BLOCKS

1 INTRODUCTION

Gage blocks are length standards representing specific lengths, traceable to the meter, of the International System of Units (SI). Depending on the kind of application and the required quality, gage blocks are offered in several grades. The calibration of gage blocks includes the measurement of the length value at a specified point of the measuring face and the evaluation of the measurement uncertainty.

2 SCOPE

This Standard specifies the most important design and metrological characteristics of gage blocks with a rectangular or square cross section and a nominal length, l_n, ranging from 0.1 mm to 1 000 mm for metric sizes and 0.004 in. to 40 in. for inch sizes. It is not the intent of this Standard to preclude the use, by contractual agreement, of gage blocks of other shapes, grades, or materials.

Limit deviations and tolerances are stated for the calibration Grade K and the grades 00, 0, AS-1, and AS-2 for various measuring purposes.

NOTE: The characteristics of Grades K, 0, AS-1, and AS-2 are identical to those of the same name in ISO 3650:1998, with the exception that in this Standard, the length of the block is defined when measured in the vertical orientation.

3 NORMATIVE REFERENCES

The following standards contain provisions that, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. The American National Standards Institute (ANSI) maintains registers of currently valid International Standards and U.S. National Standards.

ASME B46.1. Surface Texture (Surface Roughness, Waviness, and Lay). The American Society of Mechanical Engineers.

ASME B89.7.1. Guidelines for Addressing Measurement Uncertainty in the Development and Application of ASME B89 Standards. The American Society of Mechanical Engineers.

ASME B89.7.3.1. Guidelines for Decision Rules: Considering Measurement Uncertainty in Determining Conformance to Specifications. The American Society of Mechanical Engineers.

ASME B89.7.3.2. Guidelines for the Evaluation of Dimensional Measurement Uncertainty. The American Society of Mechanical Engineers.

ASME B89.7.4.1. Measurement Uncertainty and Conformance Testing: Risk Analysis. The American Society of Mechanical Engineers.

ASME B89.7.5. Metrological Traceability of Dimensional Measurements to the SI Unit of Length. The American Society of Mechanical Engineers.

ASME Y14.5. Dimensioning and Tolerancing. The American Society of Mechanical Engineers.

ASTM E18-20. Standard Test Methods for Rockwell Hardness of Metallic Materials. The American Society for Testing and Materials.

ASTM E140-12b(2019)e1. Standard Hardness Conversion Tables for Metals. The American Society for Testing and Materials.

Engineering Metrology Toolbox (2023). National Institute of Standards and Technology. https://emtoolbox.nist.gov

ISO 1. Standard reference temperature for industrial length measurements. International Organization for Standardization.

ISO 3650:1998. Gauge Blocks. International Organization for Standardization.

ISO 6507-1. Metallic materials — Vickers hardness test — Part 1: Test method. International Organization for Standardization.