AMERICAN NATIONAL STANDARD

for

Calibration Systems

AMERICAN SOCIETY FOR QUALITY CONTROL
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[Reaffirmation of ANSI/ASQC M1-1987]

Prepared by
American Society for Quality Control Standards Committee
for
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An American National Standard Approved on February 26, 1996

Abstract: This standard delineates the requirements for systems to calibrate measuring instruments to specific accuracies. The requirements have been developed based on two alternate approaches of traditionally established practices or objective measurement techniques.

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ASQC Mission: To facilitate continuous improvement and increase customer satisfaction by identifying, communicating, and promoting the use of quality principles, concepts, and technologies; and thereby be recognized throughout the world as the leading authority on, and champion for, quality.

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Contents

Foreword

(This Foreword is not part of ANSI/ASQC M1-1996, *American National Standard for Calibration Systems.*)

Providing services or manufacturing products of specified quality frequently requires the use of measuring instruments. The calibration of such measuring instruments is required to assure their performance as intended. This standard delineates the requirements for systems to calibrate measuring instruments to specified accuracies. This document is a reaffirmation of the 1987 version, ANSI/ASQC M1-1987.

At the request of many organizations and individuals concerned with quality control, production, or the providing of other services, the American Society for Quality Control (ASQC) decided in 1978 to embark on a project to develop a consensus standard for calibration systems and measurements. Under the auspices of the ASQC Metrology Technical Committee, a Writing Group was formed in 1979 consisting of volunteers from a wide variety of industrial and governmental organizations to draft a Standard for Calibration Systems followed by a Standard of Measurements.

The ASQC mandated that the standard be based on the "truth in measurements" principles paralleling the principles of quality control at the time of the drafting of this standard. It was recognized, however, that the large majority of existing calibration systems operate under guidelines which may be described as "program controls." Therefore, this standard also includes, as one option for the potential user of the standard, the program controls method of operation of calibration organizations.

The italicized *Comments* contained in this standard are explanatory material and are **not** considered to be part of this standard.

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The authors are indebted to the numerous members of the Writing Group who have contributed to the standard their time, knowledge, effort, and experience.

Calibration Systems

1. SCOPE

This standard specifies general requirements for assuring the quality of calibration in accordance with established practices or objective quality control techniques. This standard delineates the requirements for systems to calibrate measuring instruments to specified accuracies; it is intended to cover only the operation of organizations engaged in the calibration of measuring instruments, but not the application or control of the instruments they calibrate, except for the measuring instruments each calibration organization utilizes within its own operation. This standard, however, covers all calibrations the calibration organization performs. Control and application of measuring instruments other than those utilized by calibration organization is the subject of a separate quality standard for measurements. This standard may be applied by any organization or part of an organization engaged in the performance of calibrations.

Comments:

The comments are not part of this standard and contain no requirements. They are provided for guidance and information purposes only.

2. DEFINITIONS

2.1 References

The terms used in this standard conform to the definitions provided by the following documents:

1. ANSI/ASQC A1, *Definitions, Symbols, Formulas, and Tables for Control Charts* (superceded in part by ANSI/ISO/ASQC A3534-1 and ANSI/ISO/ASQC A3534-2).
2. ANSI/ASQC A2, *Terms, Symbols and Definitions for Acceptance Sampling* (superceded in part by ANSI/ISO/ASQC A3534-1 and ANSI/ISO/ASQC A3534-2).
3. ANSI/ASQC A3, *Quality Systems Terminology* (superceded by ANSI/ISO/ASQC A8402).

2.2 Accepted Standard

An artifact or calibration ensemble embodying the accepted value of a unit of measurement.

2.3 Accepted Value

The value of an artifact or calibration ensemble expressed as a multiple of a unit of measurement. Accepted values are based upon in the following order of priority:

a. *Legal values.* Values defined and mandated by applicable law.

b. *Consensus values.* Values defined by a consensus of users such as professional or trade organizations.

c. *Agreement values.* Other values expressly agreed upon by the affected parties of a calibration.

Comments:

Examples of accepted values are as follows:

a. Legal values. *U.S. legal volt as maintained by the National Institute of Standards and Technology. Note that some legal values are defined in terms of natural physical constants, e.g., the meter.*

b. Consensus values. *Rockwell Hardness Standards.*

2.4 Accuracy

The extent to which the measured value of a quantity agrees with the accepted value for that quantity.

2.5 Accuracy Ratio

The ratio of the tolerance of the instrument being calibrated to the uncertainty of the standard.

2.6 Calibration

The comparison of an ensemble of unverified uncertainty to a calibration ensemble of quantified uncertainty to detect or correct any deviation from required performance specifications.

2.7 Calibration Ensemble

An ensemble used to perform a calibration (see section 2.10).

Comments:

Calibration ensembles are controlled in accordance with this standard.