



# Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines<sup>1</sup>

This standard is issued under the fixed designation E 74; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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Note-Section 8.3 and Equation 6 were editorially corrected on April 5, 2002

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*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 The purpose of this practice is to specify procedures for the calibration of force-measuring instruments. Procedures are included for the following types of instruments:

- 1.1.1 Elastic force-measuring instruments, and
- 1.1.2 Force-multiplying systems, such as balances and small platform scales.

NOTE 1—Verification by deadweight loading is also an acceptable method of verifying the force indication of a testing machine. Tolerances for weights for this purpose are given in Practices E 4; methods for calibration of the weights are given in NIST Technical Note 577, Methods of Calibrating Weights for Piston Gages.<sup>2</sup>

1.2 The values stated in SI units are to be regarded as the standard. Other metric and inch-pound values are regarded as equivalent when required.

1.3 This practice is intended for the calibration of static force measuring instruments. It is not applicable for dynamic or high speed force calibrations, nor can the results of calibrations performed in accordance with this practice be assumed valid for dynamic or high speed force measurements.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

E 4 Practices for Force Verification of Testing Machines<sup>3</sup>

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<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.01 on Calibration of Mechanical Testing Machines and Apparatus.

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<sup>2</sup> Available from National Institute for Standards and Technology, Gaithersburg, MD 20899.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>4</sup>

2.2 *American National Standard:*

B46.1 Surface Texture<sup>5</sup>

## ELASTIC FORCE-MEASURING INSTRUMENTS

## 3. Terminology

### 3.1 Definitions:

3.1.1 *elastic force-measuring device*—a device or system consisting of an elastic member combined with a device for indicating the magnitude (or a quantity proportional to the magnitude) of deformation of the member under an applied force.

3.1.2 *primary force standard*—a deadweight force applied directly without intervening mechanisms such as levers, hydraulic multipliers, or the like, whose mass has been determined by comparison with reference standards traceable to national standards of mass.

3.1.3 *secondary force standard*—an instrument or mechanism, the calibration of which has been established by comparison with primary force standards.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *calibration equation*—a mathematical relationship between deflection and force established from the calibration data for use with the instrument in service, sometimes called the calibration curve.

3.2.2 *continuous-reading device*—a class of instruments whose characteristics permit interpolation of forces between calibrated forces.

3.2.2.1 *Discussion*—Such instruments usually have force-to-deflection relationships that can be fitted to polynomial equations. Departures from the fitted curve are reflected in the uncertainty (8.4).

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<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>5</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.