



Standard Practice for the Evaluation of Single-Pan Mechanical Balances¹

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INTRODUCTION

The balance performs two basic functions: (1) it compares an unknown load with one or more weights, and (2) it indicates the difference between the two loads for differences smaller than the smallest weights normally used on the balance. The test procedure given herein measures the precision with which the balance can compare the two loads, and the rates at which systematic errors may affect the observed difference.

1. Scope

1.1 This practice covers testing procedures for evaluating the performance of single-arm balances required by ASTM standards.

1.2 This practice is intended for but not limited to sensitivity ratios of 10^6 or better and on-scale ranges of $1000xd$ or more where d = readability either directly or by estimation.

1.3 This practice can also be applied to other single-pan balances with mechanical weight changing of different capacities or sensitivities with appropriate test loads and calibration weights.

NOTE 1—Mechanical balances of this type have largely been replaced by automatic electronic balances incorporating a variety of operational principles. Nevertheless, some single-pan mechanical balances are still manufactured and many older balances will remain in service for years to come. One type of automatic electronic balance, the so-called “hybrid,” bears considerable similarity to single-pan mechanical balances of the null type. (1)²

1.4 *This standard does not purport to address all of the safety problems, 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. Terminology

2.1 Definitions (1):

2.1.1 *accuracy*—the degree of agreement of the measurements with the true value of the magnitude of the quantity measured (2).

2.1.2 *correction for a weight*—the correction for the error in adjustment is:

$$Cr.W = A - N \quad (1)$$

where:

$Cr.W$ = correction for the error in adjustment to nominal value,
 A = actual value of the weight, and
 N = nominal value.

NOTE 2—In practice it is not possible to adjust weights exactly to their nominal values.

2.1.3 *correction for error in scale indication*—the correction for the scale indication, I , is:

$$Cr.I = A - I \quad (2)$$

NOTE 3—The correction for the scale is taken with reference to the measured value of a weight used as a test load during calibration of the on-scale range.

2.1.4 *index of precision*—the standard deviation, computed in any acceptable manner, for a collection of measurements involving a given pair of mass standards (3).

NOTE 4—The standard deviation is computed from the data provided by the instrument precision test (see Section 7) index of precision.

2.1.5 *null-type balance*—a balance which requires, as the final step in its operation, that the observer restore the angle of the balance beam to its original (or null) position. The least significant figures of the balance indication are obtained from this operation.

2.1.6 *optical-type balance*—in this type the least significant figures of the balance indication are related to the deflection angle of the beam from its original (or null) position. A scale placed on the moving beam is optically projected onto the (stationary) balance case to provide this indication.

2.1.7 *precision*—the repeatability of the balance indication with the same load under essentially the same conditions.

NOTE 5—The more closely the measurements are grouped, the smaller the index of precision will be. The precision must be measured under environmental conditions that represent the conditions under which the balance is normally used.

¹ This practice is under the jurisdiction of ASTM Committee E-41 on Laboratory Apparatus and is the direct responsibility of Subcommittee E41.06 on Weighing Devices.

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² The boldface numbers in parentheses refer to the list of references at the end of this practice.