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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Method of Testing Top-Loading, Direct-Reading Laboratory Scales and Balances¹

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INTRODUCTION

This method is designed to test commonly used laboratory scales that read the entire range of weight up to the capacity without manual operation. In essence, the entire reading range is on-scale and no manipulation of weights, riders, or dials is required; except some scales with optical reading devices may require the operation of a micrometer dial to interpolate the final one or two significant figures.

1. Scope

1.1 This method covers the determination of characteristics of top-loading, direct-reading laboratory scales and balances. Laboratory scales of the top-loading type may have capacities from a few grams up to several kilograms. Resolution may be from 1/1000 of capacity to 1/1 000 000 or more. This method can be used for any of these instruments and will serve to measure the most important characteristics that are of interest to the user. The characteristics to be measured include the following:

- 1.1.1 warm-up,
- 1.1.2 off center errors,
- 1.1.3 repeatability, reproducibility, and precision,
- 1.1.4 accuracy and linearity,
- 1.1.5 hysteresis,
- 1.1.6 settling time,
- 1.1.7 temperature effects,
- 1.1.8 vernier or micrometer calibration, and
- 1.1.9 resistance to external disturbances.

1.2 The types of scales that can be tested by this method are of stabilized pan design wherein the sample pan does not tilt out of a horizontal plane when the sample is placed anywhere on the pan surface. The pan is located generally above the measuring mechanism with no vertical obstruction, except for draft shields. Readings of weight may be obtained from an optical scale, from a digital display, or from a mechanical dial. Weighing mechanisms may be of the deflecting type, using gravity or a spring as the transducer, or may be a force-balance system wherein an electromagnetic, pneumatic, hydraulic, or other force is used to counterbalance the weight of the sample. Other force-measuring devices may be tested by this method as long as a sample placed on a receiving platform produces an

indication that is substantially a linear function of the weight of the sample.

1.3 *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. Summary of Method

2.1 Throughout this method, the instrument is used in the manner for which it is intended. One or more weights are used to test each of the characteristics, and the results are expressed in terms of the least count or ultimate readability of the display.

3. Terminology

*3.1 Definitions of Terms Specific to This Standard:*²

3.1.1 *accuracy*—the degree of agreement of the measurement with the true value of the quantity measured.

3.1.2 *capacity*—the maximum weight load specified by the manufacturer. In most instruments, the maximum possible reading will exceed the capacity by a small amount.

3.1.3 *full-scale calibration*—the indicated reading when a standard weight equal to the full scale indication of the scale is placed on the sample pan after the device has been correctly zeroed. Usually some means is provided by the manufacturer to adjust the full scale indication to match the weight of the standard.

3.1.4 *linearity*—the degree to which a graph of weight values indicated by a scale vs. the true values of the respective test weights approximates a straight line. For a quantitative statement of linearity errors, the concept of terminal-based non-linearity is recommended, such as, the maximum deviation of the calibration curve (average of the readings at increasing and decreasing test load, respectively) from a straight line

¹ This method 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 ANSI/ISA S51.1 “Process Instrumentation Technology”. Available from American National Standards Institute, 1430 Broadway, NY NY 10018.