



Designation: F2340 – 05

# Standard Specification for Developing and Validating Prediction Equation(s) or Model(s) Used in Connection with Livestock, Meat, and Poultry Evaluation Device(s) or System(s) to Determine Value<sup>1</sup>

This standard is issued under the fixed designation F2340; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers methods to collect and analyze data, document the results, and make predictions by any objective method for any characteristic used to determine value in any species using livestock, meat, and poultry evaluation devices or systems.

1.2 *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 requirements prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

F2463 Terminology for Livestock, Meat, and Poultry Evaluation Systems

## 3. Terminology

3.1 For definitions of terms used in this specification, refer to Terminology F2463.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *accuracy, n*—statement of the exactness with which a measurement approaches the true measure for that characteristic; accuracy is contrasted with precision, which is concerned with the repeatability of the measurements. Therefore, with a large bias, a measurement may be of high precision, but of low accuracy.

3.2.2 *calibration data set, n*—data set used to develop the initial prediction equations; same as developmental or prediction data set.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F10 on Livestock, Meat, and Poultry Evaluation Systems and is the direct responsibility of Subcommittee F10.40 on Predictive Accuracy.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.3 *coefficient of determination, n*—percentage of variability in the response (dependent) variable that can be explained by the prediction equation.

$$R^2 = 1 - \frac{\sum(y - \hat{y})^2}{\sum(y - \bar{y})^2}$$

3.2.4 *root mean square error for calibration, n*—square root of the sum of squared residuals divided by  $n_c - (k + 1)$ , where  $n_c$  is the sample size for the calibration data set, and  $k$  is the number of explanatory variables in the prediction equation.

$$\sqrt{\frac{\sum(y - \hat{y})^2}{n_c - (k + 1)}}$$

3.2.5 *root mean square error for validation, n*—square root of the sum of squared residuals divided by  $n_v$ , where  $n_v$  is the sample size for the validation data set.

$$\sqrt{\frac{\sum(y - \hat{y})^2}{n_v}}$$

3.2.6 *validation data set, n*—the data set used to test the predictive accuracy of the equations developed from the calibration data set.

3.2.7 *value, commerce, n*—measure of economic worth in commerce.

## 4. Significance and Use

4.1 The procedures in this specification are to be used by all parties interested in predicting composition or quality, or both, for the purpose of establishing value based upon device or system measurements. Whenever new prediction equations are established, or when a change is experienced that could affect the performance of existing equations, these procedures shall be used.

## 5. Procedure

5.1 *Experimental Design:*

5.1.1 *Define the Population for Development of a Prediction Equation:*