This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D4483 – 20

Standard Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries[1]

This standard is issued under the fixed designation D4483; 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.

INTRODUCTION

The primary precision standard for ASTM test method standards is Practice E691; a generic standard that presents the fundamental statistical approach and calculation algorithms for evaluating repeatability and reproducibility precision. However, certain parts of Practice E691 are not compatible with precision as evaluated in the rubber manufacturing and carbon black industries over the past four decades. Thus a separate standard is required for precision in these two industries. This practice is being issued as a major revision of Practice D4483, which has been used for precision evaluation by Committee D11 since 1985. The basic Practice D4483 precision calculation algorithms, the same as in Practice E691, are unchanged. This new revised Practice D4483, organized to accommodate the requirements of the rubber and carbon black manufacturing industries, has three new features that provide for a more formal and structured analysis of interlaboratory test program (ITP) data.

First it addresses the overriding issues with precision evaluation over the past several decades—the frequent discovery that reproducibility for many test methods is quite poor. Experience has shown that frequently poor reproducibility is caused by only a few laboratories that differ from the remainder that give good agreement. A new procedure designated as *robust analysis* provides an improved method for detecting outliers that cause poor precision, especially poor between laboratory agreement. Second, after outlier detection the new standard provides two options; (*1*) outlier deletion or (*2*) outlier replacement. When outliers are deleted the revised standard provides a way to retain the non-outlier laboratory data. This allows for a broader database for precision calculation. The current ASTM Committee E11 computer program for calculating precision does not allow for outlier deletion in this way. Third, when exercising outlier Option 2, the standard gives a procedure for calculating special replacement values for deleted outliers in ITPs that have only a few participating laboratories. The replacement values are obtained in a way that preserves the observed data distribution of the non-outlier data. This is important since many ITPs are in the *limited number of participating laboratories* category.

1. Scope

1.1 This practice covers guidelines for evaluating precision and serves as the governing practice for interlaboratory test programs (ITP) used to evaluate precision for test methods as used in the rubber manufacturing and the carbon black industries. This practice uses the basic one way analysis of variance calculation algorithms of Practice E691. Although bias is not evaluated in this practice, it is an essential concept in understanding precision evaluation.

1.2 This practice applies to test methods that have test results expressed in terms of a quantitative continuous variable. Although exceptions may occur, it is in general limited to test methods that are fully developed and in routine use in a number of laboratories.

1.3 Two precision evaluation methods are given that are described as *robust statistical* procedures that attempt to eliminate or substantially decrease the influence of outliers. The first is a *General Precision* procedure intended for all test methods in the rubber manufacturing industry, and the second is a specific variation of the general precision procedure designated as *Special Precision*, that applies to carbon black testing. Both of these procedures use the same uniform level experimental design and the Mandel h and k statistics to review the precision database for potential outliers. However, they use

[1] This practice is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.16 on Application of Statistical Methods.

Current edition approved June 1, 2020. Published June 2020. Originally approved in 1985. Last previous edition approved in 2018 as D4483 – 18. DOI: 10.1520/D4483-20.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States