



Standard Practice for Utilization of Test Data to Determine Conformance with Specifications¹

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INTRODUCTION

The properties of commercial petroleum products are measured by standardized laboratory test methods to assess their conformance to specifications. Two or more measurement results obtained by performing the same test method for the same property of a specific sample usually will not be numerically identical. Therefore, the test methods generally include a paragraph on the precision of results. This precision (or, a more appropriate term is imprecision) is an expression of the degree of agreement that can be expected between the aforementioned measurements.

Many difficulties that arise in assessing conformance to specifications are due to test imprecision. Because of this, a true value of a property can never be determined exactly; and it is necessary to infer from measured values the range within which the “true value” is likely to lie. The main purpose of this practice is to indicate how test imprecision should be interpreted relative to specification limit values.

1. Scope*

1.1 This practice covers guidelines and statistical methodologies with which two parties (see **Note 1**) can compare and combine independently obtained test results to obtain an Assigned Test Value (ATV) for the purpose of resolving a dispute over product property conformance with specification.

NOTE 1—Application of this practice is usually, but not limited to, between supplier and receiver of a product.

1.2 This practice defines a technique for establishing an Acceptance Limit (AL) and Assigned Test Value (ATV) to resolve the dispute over a property conformance with specification by comparing the ATV to the AL.

1.3 This practice applies only to those test methods which specifically state that the repeatability and reproducibility values conform to the definitions herein.

1.4 The statistical principles and methodology outlined in this practice can also be used to obtain an ATV for specification conformance decision when multiple results are obtained for the same batch of product within a single laboratory. For this application, site precision (R') as defined in Practice **D6299** shall be used in lieu of test method published reproducibility (R).

¹ This practice is under the jurisdiction of ASTM Committee **D02** on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of **D02.94** on Coordinating Subcommittee on Quality Assurance and Statistics.

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1.5 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.

2. Referenced Documents

2.1 ASTM Standards:²

- D1319** Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- D4177** Practice for Automatic Sampling of Petroleum and Petroleum Products
- D6299** Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance
- D6300** Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants
- D6792** Practice for Quality Management Systems in Petroleum Products, Liquid Fuels, and Lubricants Testing Laboratories

² 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.

*A Summary of Changes section appears at the end of this standard

D7372 Guide for Analysis and Interpretation of Proficiency Test Program Results

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *ISO Standard*.³

ISO 4259 Determination and Application of Precision Data in Relation to Methods of Test

3.1.12 *reproducibility (a.k.a. Reproducibility Limit) (R)*, *n*—a quantitative expression for the random error associated with the difference between two independent results obtained under reproducibility conditions that would be exceeded with an approximate probability of 5 % (one case in 20 in the long run) in the normal and correct operation of the test method.

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3.1.13 *reproducibility conditions*, *n*—conditions where independent test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.

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3.1.14 *result*, *n*—the value obtained by following the complete set of instructions of a test method. It may be obtained from a single determination or several determinations, depending on the instruction of the test method.

3.1.15 *supplier*, *n*—any individual or organization responsible for the quality of a product just before it is taken over by the receiver.

3.1.16 *supplier's risk*, *n*—the probability of rejecting a product that meets the specification.

3.1.17 *true value (μ)*, *n*—for practical purposes, the value towards which the average of single results obtained by *N* laboratories using the same standard test method tends, when *N* becomes very large. Consequently, this definition of true value is associated with the particular test method employed.

4. Significance and Use

4.1 This practice provides a means whereby the parties can resolve disputes over specification conformance for those product properties which can be tested and expressed numerically.

4.1.1 This practice can be used to ensure that such properties are correctly stated on labels or in other descriptions of the product.

4.1.2 This practice can be implemented in those cases where a supplier uses an in-house or a commercial testing laboratory to sample and test a product prior to releasing the product to a shipper (intermediate receiver) and the ultimate receiver also uses an in-house or commercial testing laboratory to sample and test the product upon arrival at the destination. The *ATV* would still be determined according to 8.3.

4.2 This practice can be applied in the determination of tolerances from specification limits based on a mutually agreed probability between parties for making the conformance to specification decision if the true value of a property is sufficiently close to the specification limit. Such tolerances are bounded by an *acceptance limit (AL)*. If the *ATV* value determined by applying this practice falls on the *AL* or on the acceptable side of the *AL*, the product property can be considered to have met the specification; otherwise it shall be considered to have failed to meet the specification.

4.3 Application of this practice requires the *AL* be determined prior to actual commencement of testing. Therefore, the degree of criticality of the specification, as determined by the Probability of Acceptance (P value) that is required to calculate

3. Terminology

3.1 Definitions:

3.1.1 *acceptance limit (AL)*, *n*—a numerical value that defines the point between making the property conformance or non-conformance to a specification decision.

3.1.1.1 *Discussion*—The *AL* is not necessarily the specification limit. It is a value that takes into account the specification limit, the test method precision, and the desired probability of making the conformance to specification decision if the true value (see 3.1.17) of the property is at the specification limit.

3.1.2 *assigned test value (ATV)*, *n*—the average of all results obtained in the several laboratories which are considered acceptable based on the reproducibility of the test method.

3.1.3 *determination*, *n*—the process of carrying out the series of operations specified in the test method whereby a single value is obtained.

3.1.4 *dispute*, *n*—when there is a question as to product property conformance to specification because a test value obtained falls outside the specification limit(s).

3.1.5 *dispute adjudication sample*, *n*—a mutually agreed sample between the parties in dispute to be used for the purpose of arriving at the *ATV* for the property that is in dispute with regards to its specification conformance status.

3.1.6 *operator*, *n*—a person who normally and regularly carries out a particular test.

3.1.7 *precision*, *n*—the degree of agreement between two or more test results on the same property obtained using the same test method on identical test material. In this practice, precision statements are framed in terms of the published repeatability and reproducibility of the test method.

3.1.8 *receiver*, *n*—any individual or organization who receives or accepts the product delivered by the supplier.

3.1.9 *receiver's risk*, *n*—the probability of accepting a product that fails to meet the specification.

3.1.10 *repeatability (a.k.a. Repeatability Limit) (r)*, *n*—the quantitative expression for the random error associated with the difference between two independent results obtained under repeatability conditions that would be exceeded with an approximate probability of 5 % (one case in 20 in the long run) in the normal and correct operation of the test method. **D6300**

3.1.11 *repeatability conditions*, *n*—conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time.

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³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.