



Designation: D1133 – 13 (Reapproved 2021)

## Standard Test Method for Kauri-Butanol Value of Hydrocarbon Solvents<sup>1</sup>

This standard is issued under the fixed designation D1133; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope

1.1 This test method covers the determination of the relative solvent power of hydrocarbon solvents used in paint and lacquer formulations. This test method is suitable for use with solvents having an initial boiling point over 40 °C and a dry point under 300 °C when determined in accordance with the procedures in [Note 1](#).

NOTE 1—Test Method [D86](#) is used to determine the initial boiling point and dry point for mineral spirits and similar petroleum solvents. Test Method [D1078](#) is used for pure compounds and narrow boiling range cuts.

1.2 For purposes of determining conformance of an observed or a calculated value using this test method to relevant specifications, test result(s) shall be rounded off “to the nearest unit” in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice [E29](#).

1.3 For specific hazard information and guidance, consult the supplier’s Material Safety Data Sheet.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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:<sup>2</sup>

- [D86](#) Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- [D304](#) Specification for *n*-Butyl Alcohol (Butanol)
- [D841](#) Specification for Nitration Grade Toluene
- [D1078](#) Test Method for Distillation Range of Volatile Organic Liquids
- [E29](#) Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *kauri-butanol value,  $n$* —of a solvent, the volume in millilitres at 25 °C of the solvent, corrected to a defined standard, required to produce a defined degree of turbidity when added to 20 g of a standard solution of kauri resin in normal butyl alcohol.

3.1.1.1 *Discussion*—The kauri resin solution is standardized against toluene, which has an assigned value of 105, and a mixture of 75 % *n*-heptane and 25 % toluene on a volume basis, which has an assigned value of 40.

### 4. Significance and Use

4.1 The kauri-butanol value is used as a measure of solvent power of hydrocarbon solvents. High kauri-butanol values indicate relatively strong solvency.

### 5. Apparatus

5.1 *Water Bath*, capable of being maintained at 25 °C  $\pm$  5 °C. Alternatively, a temperature controlled environment maintained at 25 °C  $\pm$  5 °C may be used.

5.2 *Volumetric Flask*, 200-mL capacity.

5.3 *Erlenmeyer Flask*, 250-mL capacity.

5.4 *Sample Dispensing Device*, Buret, of at least 50-mL capacity, or equivalent, that is capable of accurately determining the volume dispensed to the nearest 0.1 mL.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D01](#) on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee [D01.35](#) on Solvents, Plasticizers, and Chemical Intermediates.

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



**5.5 Print Specimen**—A sheet of white paper having on it black 10 or 12 point print, No. 31 Bruce old style type.

NOTE 2—Text in this published standard is satisfactory to use as print specimen.

## 6. Reagents

**6.1 Purity of Reagents**—Reagent grade chemicals shall be used in all tests unless otherwise specified. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.<sup>3</sup> Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

**6.2 Kauri-Butanol Solution**<sup>4</sup>—Place in a 3-L flask 400 g of clean, pale, bold kauri resin of Grade XXXX, XXX, or XX ground to pea-size or smaller. Add, while agitating vigorously, 2000 g of *n*-butyl alcohol, (conforming to Specification D304). Shake on a mechanical shaker until the resin goes into solution, warming to about 55 °C, if necessary to aid solution. If a mechanical shaker is not available, fit the flask with a reflux condenser and heat on a steam bath until all of the kauri resin is dissolved. Permit the solution to stand 48 h and then clarify by filtering through a Büchner funnel with suction, using double filter paper and changing as frequently as necessary.

**6.3 Standard Toluene** conforming to Specification D841 for use as a high-solvency standard.

**6.4 Heptane-Toluene Blend** consisting of 25 %  $\pm$  0.1 % toluene and 75 %  $\pm$  0.1 % *n*-heptane on a volume basis, for use as a low-solvency standard. The heptane shall be spectroscopic, HPLC, or knock test grade.

NOTE 3—The blend of 25 %  $\pm$  0.1 % toluene and 75 %  $\pm$  0.1 % heptane can be prepared in any way that will give the desired accuracy. The following technique is adequate: Bring the toluene and heptane and a calibrated 200-mL volumetric flask to the same temperature, preferably in a constant-temperature room or thermostat. Run 50 mL of toluene into the 200-mL volumetric flask, using a buret or pipet calibrated to deliver 50 mL of toluene at the chosen temperature (preferably 25 °C). Fill the volumetric flask to slightly below the calibration line with *n*-heptane, insert the ground-glass stopper of the volumetric flask, and mix carefully by repeatedly inverting the flask. Allow to stand for a few minutes; then bring to the 200-mL calibration mark with heptane and again carefully mix.

## 7. Standardization

**7.1** Weigh or transfer 20 g  $\pm$  0.10 g of kauri-butanol solution in a 250-mL Erlenmeyer flask. Check that the temperature of the KB solution in the flask is 25 °C  $\pm$  5 °C. If not,

place the Erlenmeyer flask and its contents in a water bath or temperature controlled environment maintained at 25 °C  $\pm$  5 °C and allow to equilibrate for at least 30 min. If the flask was placed in a water bath, remove the flask from the water bath. Titrate the contents of the flask with the standard toluene. Swirl the contents of the flask during titration, periodically stopping to observe the clarity of the print beneath the flask. Gradually reduce the successive amounts of toluene added as the end point is approached. The end point is reached when the sharp outlines of 10-point print placed directly beneath the Erlenmeyer flask and observed through the liquid are first perceived to be obscured or blurred. The point where the print becomes illegible is past the end point. Check the temperature in the flask immediately after the end point has been reached, and if over 30 °C or under 20 °C, repeat the titration.

**7.2** The volume of toluene used, in millilitres, represents the actual titer for the particular kauri-butanol solution at hand. This value should lie reasonably close to 105 mL, but not over 110 nor under 100 mL. If these limits are exceeded, adjust the concentration of the kauri-butanol solution to bring the total volume of toluene within them. Designate the final value using toluene as *A*.

**7.3** Weigh or transfer 20 g  $\pm$  0.10 g of the kauri-butanol solution (adjusted as described in 7.2) in a 250-mL Erlenmeyer flask and place in the water bath. Titrate with the heptane-toluene blend in the same manner as described in 7.1. Designate the volume, in millilitres, of the blend used in this titration as *B*.

NOTE 4—If the composition of the blend is known to differ from 25 %  $\pm$  1.0 % toluene, but is within the range from 22 % to 28 % toluene, the constant in the blend factor equation will differ from 40.0 by 0.60 units for each 1 % toluene. For example, at 28 % toluene, the constant is 41.8 instead of 40.0.

NOTE 5—Freshly prepared kauri-butanol solution may change in standardization from day to day. It is, therefore, desirable to permit the solution to age before initial standardization and, in any case, the standardization should be rechecked on successive days until the toluene factor and blend factor remain constant.

## 8. Procedure

**8.1** Weigh or transfer 20 g  $\pm$  0.10 g of the adjusted kauri-butanol solution into a 250-mL Erlenmeyer flask. Check that the temperature of the KB solution in the flask is 25 °C  $\pm$  5 °C. If not, place the Erlenmeyer flask and its contents in a water bath or temperature controlled environment maintained at 25 °C  $\pm$  5 °C and allow to equilibrate for at least 30 min. If the flask was placed in a water bath, remove the flask from the water bath. Fill the sample dispensing device with the solvent being tested. Titrate the contents of the flask with the solvent. Swirl the contents of the flask during the titration, periodically stopping to observe the clarity of the print beneath the flask. Gradually reduce the successive amounts of solvent added as the end point is approached. The end point is reached when the sharp outlines of 10-point print (see 5.5) placed directly beneath the Erlenmeyer flask and observed through the liquid are first perceived to be obscured or blurred. The point where the print becomes illegible is past the end point. Check the temperature in the flask immediately after the end point has been reached and if over 30 °C or under 20 °C, repeat the

<sup>3</sup> ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

<sup>4</sup> The sole source of supply of prepared kauri-butanol solutions known to the committee at this time is the Chemical Service Laboratories, 5543 Dyer St., Dallas, TX 75206. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.



titration. Designate the volume of solvent, in millilitres, to produce turbidity as *C*.

## 9. Calculation

9.1 Calculate the kauri-butanol value, *V*, as follows:

$$V = [65(C - B)/(A - B)] + 40 \quad (1)$$

where:

- A* = toluene required to titrate 20 g of kauri-butanol solution (7.2), mL,
- B* = heptane-toluene blend required to titrate 20 g of kauri-butanol solution (7.3), mL, and
- C* = solvent under test required to titrate 20 g of kauri-butanol solution (Section 8), mL.

## 10. Report

10.1 Report the calculated kauri-butanol value to the nearest 0.5 KB unit.

## 11. Precision and Bias

11.1 The following criteria should be used for judging the acceptability of the results in the range from 30 to 90 at the 95 % confidence level.

11.1.1 *Repeatability*—Two results, each the mean of duplicates, obtained by the same operator on different days should be considered suspect if they differ by more than  $0.01 K - 0.1$ , where *K* = mean kauri-butanol value.

11.1.2 *Reproducibility*—Two results, each the mean of duplicates, obtained by two laboratories should not be considered suspect unless they differ by more than  $0.03 K + 1.0$  where *K* = mean kauri-butanol value.

11.2 *Bias*—Test bias can result if the kauri-butanol solution is not carefully standardized and adjusted (see 7.2 and 7.3). The test method has no definitive bias statement because the value of the test result is defined only in terms of the test method.

## 12. Keywords

12.1 kauri-butanol value; hydrocarbon solvents; solvency power

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