Designation: D 3429 – 93 (Reapproved 2002)$^{\epsilon 1}$

Standard Test Method for Solubility of Fixed Gases in Low-Boiling Liquids[1]

This standard is issued under the fixed designation D 3429; 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.

ϵ^1 NOTE—Warnings were moved from notes to section text editorially December 2002.

1. Scope

1.1 This test method covers the determination of the solubilities of nonreactive gases such as nitrogen and helium in liquids that boil below 273 K. This test method is applicable at temperatures from 77 to 300 K from subambient pressure to 6.5 MPa (65 atm). This test method does not provide for analysis of the vapor phase in equilibrium with the liquid (see Section 3 for a description of terms).

1.2 This test method as written describes the procedures to be followed for determination of the solubilities of helium and nitrogen. If suitable modifications are made to the analytical measurements by gas chromatography, solubilities of other gases such as argon, hydrogen, oxygen, etc., can be determined.

1.3 The values stated in SI units are to be regarded as the standard. In cases where materials, products, or equipment are available in inch-pound units only, SI units are omitted.

1.4 *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.* For specific hazard statements, see 6.1.2 and 7.1 and Annex A1.

2. Referenced Documents

2.1 *ASTM Standards:*

E 260 Practice for Packed Column Gas Chromatography[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *carrier gas*, *n*—gas used to sweep samples through the gas chromatograph.

3.1.2 *test gas*, *n*—gas whose solubility is being determined.

3.1.3 *liquid or test liquid*—solvent for test gas.

3.1.4 *vapor*, *n*—vapor phase of test liquid.

3.1.5 *nonreactive gas*, *n*—gas that does not react chemically with the test liquid.

3.1.6 *elution*, *n*—the process of removing a material absorbed on the stationary phase of the gas chromatograph column by displacing it with the flowing carrier gas.

3.1.7 *fractionation*, *n*—change of composition caused by change of pressure.

4. Summary of Test Method

4.1 A sample of test liquid *A* is saturated with test gas *B* at specified temperature and pressure. A portion of the solution is withdrawn and vaporized in an evacuated sample container at room temperature. The concentration of gas *B* in the vaporized sample is determined by gas chromatography. It is necessary that the molar concentration of the gas in the sample container be the same as in the liquid phase. This will be true if fractionation of the sample is avoided while withdrawing it from the liquid phase, if no decomposition or polymerization of the test liquid occurs on vaporization, and if the vapor of the test liquid does not react with the walls of the sample container or connecting lines. It is also necessary that both the test gas and the vapor of the test liquid behave nearly ideally at 101 kPa (1 atm). If the above requirements are met, this test method will give estimates of solubility with an accuracy of ±2 %.

5. Significance and Use

5.1 The solubility of fixed gases in liquids is an important engineering parameter in the design of hydraulic systems. It is a measure of the amount of gas that can be released from solution when a system undergoes changes in pressure and temperature. Theoretical considerations permit approximate values of gas solubility to be computed with reasonable accuracy. Dissolved gases are separated and quantified chromatographically. The test method is restricted to use with low-boiling liquid samples.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.11 on Engineering Sciences of High Performance Fluids and Solids.

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[2] *Annual Book of ASTM Standards*, Vol 03.06.

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