



Designation: D 4650 – 93 (Reapproved 1998)

Standard Specification for Normal Butane Thermophysical Property Tables¹

This standard is issued under the fixed designation D 4650; 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.

1. Scope

1.1 The normal butane thermophysical property tables are for use in the calculation of the pressure-volume-temperature (PVT), thermodynamic, and transport properties of normal butane for process design and operations. Tables are provided for gaseous and liquid normal butane at temperatures between 135 and 600K at pressures to 70 MPa. These tables were developed by the National Institute of Standards and Technology (formerly the National Bureau of Standards) upon culmination of four years of effort in acquiring available physical properties data, performing experimental measurements, and in formulating these tables for use in thermal computations.

2. Sponsorship

2.1 The preparation of the tables and supporting work was done by the National Institute of Standards and Technology (NIST) under the sponsorship of the Gas Research Institute, the American Gas Association, and the Standard Reference Data Program of NIST.

3. Applicability

3.1 These tables apply directly only to pure gaseous and liquid normal butane. However, it is expected that they will find substantial use in mathematical models and tables for the thermophysical properties of mixtures containing normal butane, such as natural gas.

4. Tables

4.1 These thermophysical property tables² are:

4.1.1 *Thermophysical Properties of Coexisting Gaseous and Liquid Normal Butane*, in SI units (Table in Appendix I, pp. 758–760).³

4.1.2 *Thermophysical Properties of Normal Butane*, along isobars, in SI units (Table in Appendix I, pp. 762–793).³

4.2 These tables were produced by equations from a computer package, “NIST Thermophysical Properties of Fluids Database 12” (also designated MIPROPS) of the Standard Reference Data Program of NIST.⁴ A wide selection of units (SI units, engineering units, chemical units) are available with this program.

5. Additional Information

5.1 These tables were originally published by the American Chemical Society and the American Institute of Physics for the National Institute of Standards and Technology in a comprehensive report titled “Thermophysical Properties of Fluids. II. Methane, Ethane, Propane, Isobutane and Normal Butane.”⁵ This report also contains the following:

5.1.1 Properties and uncertainties data.

5.1.2 Correlation equations for normal butane.

5.1.3 Description of the research study culminating in the tables.

5.1.4 References to properties data.

5.1.5 Computational methods used.

¹ This practice is under the jurisdiction of ASTM Committee D-3 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.08 on Thermophysical Properties.

Current edition approved March 15, 1993. Published May 1993. Originally published as D 4650 – 87. Last previous edition D 4650 – 87.

² Supporting data are available from ASTM Headquarters. Request RR:D03-1005.

³ *Journal of Physical and Chemical Reference Data*, Vol 16, 1987.


⁴ Available from Standard Reference Data, National Institute of Standards and Technology (NIST), Bldg. 221, Room A320, Gaithersburg, MD 20899.

⁵ Younglove, B.A., and Ely, J.F., *Journal of Physical and Chemical Reference Data*, Vol 16, 1987, pp. 577–798. Available from the American Chemical Society, Distribution Office, 1155 Sixteenth St., N.W., Washington, DC 20036-9976.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

**NOTICE: This standard has either been superceded and replaced by a new version or discontinued.
Contact ASTM International (www.astm.org) for the latest information.**

 **D 4650 – 93 (1998)**

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).