



Standard Test Method for Heat of Combustion of Hydrocarbon Fuels by Bomb Calorimeter (High-Precision Method)¹

This standard is issued under the fixed designation D 2382; 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.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This test method covers the determination of the heat of combustion of hydrocarbon fuels. It is designed specifically for use with aviation turbine fuels when the permissible difference between duplicate determinations is of the order of 0.1 % (Note 1). It can be used for a wide range of volatile and nonvolatile materials where slightly greater differences in precision can be tolerated.

NOTE 1—In order to attain this accuracy, strict adherence to all details of the procedure is essential since the error contributed by each individual measurement that affects the accuracy shall be kept below 0.02 %, insofar as possible.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 7.6, 7.8, Note 6, 11.6 and Note A1.1.

1.3 The values in SI units are to be regarded as the standard. The values in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- D 129 Test Method for Sulfur in Petroleum Products (General Bomb Method)²
- D 240 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter²
- D 1018 Test Method for Hydrogen in Petroleum Fractions²
- D 1193 Specification for Reagent Water³
- D 1266 Test Method for Sulfur in Petroleum Products (Lamp Method)²
- D 1552 Test Method for Sulfur in Petroleum Products (High-Temperature Method)²

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke and Oil Shale.

Current edition approved Oct. 31, 1988. Published December 1988. Originally published as D 2382 – 65 T. Last previous edition D 2382 – 83.

² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 11.01.

- D 2622 Test Method for Sulfur in Petroleum Products by X-Ray Spectrometry⁴
- D 3701 Test Method for Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry⁴
- D 4294 Test Method for Sulfur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectroscopy⁴
- E 1 Specification for ASTM Thermometers⁵
- E 144 Practice for Safe Use of Oxygen Combustion Bombs⁶
- E 200 Practice for Preparation, Standardization, and Storage of Standard Solutions for Chemical Analysis⁷

3. Terminology

3.1 The energy unit of measurement employed in this test method is the joule with the heat of combustion reported in megajoules per kilogram (Note 2).

$$1 \text{ MJ/kg} = 1000 \text{ J/g} \quad (1)$$

NOTE 2—In SI the unit of heat of combustion has the dimension J/kg, but for practical use a multiple is more convenient. The MJ/kg is customarily used for the representation of heats of combustion of petroleum fuels.

3.1.1 The following relationships may be used for converting to other units:

- 1 cal (Thermochemical) = 4.1840 J⁴
- 1 Btu (Thermochemical) = 1054.35 J
- 1 cal (I.T.)/g = 0.0041868 MJ/kg⁴
- 1 Btu/lb = 0.002326 MJ/kg⁴

⁴ Conversion factor is exact.

3.2 *Gross Heat of Combustion*, expressed as megajoules per kilogram. The gross heat of combustion at constant volume of a liquid or solid fuel containing only the elements carbon, hydrogen, oxygen, nitrogen, and sulfur is the quantity of heat liberated when a unit mass of the fuel is burned in oxygen in an enclosure of constant volume, the products of combustion being gaseous carbon dioxide, nitrogen, sulfur dioxide, and liquid water, with the initial temperature of the fuel and the oxygen and the final temperature of the

⁴ Annual Book of ASTM Standards, Vol 05.02.

⁵ Annual Book of ASTM Standards, Vols 05.03 and 14.03.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ Annual Book of ASTM Standards, Vol 15.05.