



Designation: **D4868 – 00 (Reapproved 2010) D4868 – 17**

Standard Test Method for Estimation of Net and Gross Heat of Combustion of Hydrocarbon Burner and Diesel Fuels¹

This standard is issued under the fixed designation D4868; 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—Scope*

1.1 This test method covers the estimation of the gross and net heat of combustion in SI units, megajoules per kilogram, of petroleum hydrocarbon fuels and blendstocks from the fuel density, density and sulfur, water, and ash content.

NOTE 1—~~The equation for estimation of net and gross heat of combustion used in this method were originally published by the NIST Publication No. 97.~~

1.1.1 This test method is not applicable to fuels containing non-hydrocarbons such as alcohols (for example, ethanol, methanol), ethers (for example, MTBE), or esters (for example, biodiesel).

NOTE 1—The equation for estimation of net and gross heat of combustion used in this method was originally published as NBS Miscellaneous Publication No. 97.

1.2 This test method is especially useful for estimating, using a minimum number of tests, the heat of combustion of burner and diesel fuels (which do not contain non-hydrocarbon components) for which it is not usually critical to obtain very precise heat determinations.

NOTE 2—More accurate estimation methods are available for aviation fuels (Test Methods **D1405**, **D4529**, and **D3338**). However, those estimation methods require additional tests to those required in this test method.

1.3 This test method is purely empirical (**Note 1**). ~~It is applicable only to~~ was derived using liquid hydrocarbon fuels ~~derived~~ produced by normal refining processes from conventional crude oil that conform to the requirements of specifications for petroleum fuels as described in **Note 3**. This test method is valid for those fuels in the density range from 750 kg/m^3 to 1000 kg/m^3 and those that do not contain an unusually high aromatic content. High aromatic content fuels will not normally meet some fuel specification criteria.

NOTE 3—The estimation of the heat of combustion of a hydrocarbon fuel from its density and sulfur, water, and ash content is justifiable only when the fuel belongs to well-defined classes for which a relationship between these quantities have been derived from accurate experimental measurements on representative samples of these classes. Even in these classes, the possibility that the estimate ~~may~~ can be in error ~~by large amounts~~ for individual fuels should be recognized. This test method has been tested for a limited number of fuels from oil sand bitumen and shale oil origin and has been found to be valid. The classes of fuels used to establish the correlation presented in this test method are represented by the following applications:

¹ This test method is under the jurisdiction of ASTM Committee **D02** on Petroleum ~~Products~~—Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee **D02.05** on Properties of Fuels, Petroleum Coke and Carbon Material.

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

Fuel (not applicable to any fuels containing non-hydrocarbon components)	Specification
Fuel Oils Grades No. 1, 2, 4 (light), 4, 5 (light), 5 (heavy), and 6	D396
Diesel Grades 1-D, 2-D, and 4-d	D975
Grades No. 1-D, 2-D, and 4-D	D975
Aviation Turbine Jet A, Jet A-1, and Jet B	D1655
Jet A and Jet A-1	D1655
Jet B	D6615
Gas Turbine Grades 0-GT, 1-GT, 2-GT, 3-GT and 4-GT	D2880
Grades No. 0-GT, 1-GT, 2-GT, 3-GT, and 4-GT	D2880
Kerosine Kerosene Grades No. 1-K and 2-K	D3699

1.4 This test method is not applicable to pure ~~hydrocarbons~~ hydrocarbon compounds. It is not intended as a substitute for highly accurate experimental measurements of heat of combustion (Note 4).

NOTE 4—The procedures for the experimental determination of the gross and net heats of combustion are described in Test Methods D240 and D4809.

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

1.6 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

- D95 Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
- D129 Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)
- D240 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
- D396 Specification for Fuel Oils
- D482 Test Method for Ash from Petroleum Products
- D975 Specification for Diesel Fuel Oils
- D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)
- D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D1405 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D1480 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Bingham Pycnometer
- D1481 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Lipkin Bicapillary Pycnometer
- D1552 Test Method for Sulfur in Petroleum Products by High Temperature Combustion and Infrared (IR) Detection or Thermal Conductivity Detection (TCD)
- D1655 Specification for Aviation Turbine Fuels
- D1744 Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent (Withdrawn 2016)³
- D1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)
- D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
- D2880 Specification for Gas Turbine Fuel Oils
- D3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D3699 Specification for Kerosine
- D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
- D4529 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D4809 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
- D5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D6304 Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration

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.

³ The last approved version of this historical standard is referenced on www.astm.org.