



Designation: D 3286 – 96

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Test Method for Gross Calorific Value of Coal and Coke by the Isoperibol Bomb Calorimeter¹

This standard is issued under the fixed designation D 3286; 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 This test method covers the determination of the gross calorific value of coal and coke by the isoperibol bomb calorimeter.

1.2 The values stated in SI units are to be regarded as the standard unless otherwise designated. The values given in parentheses are for information only.

1.3 *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 Section 8.

2. Referenced Documents

2.1 ASTM Standards:

D 121 Terminology of Coal and Coke²

D 346 Practice for Collection and Preparation of Coke Samples for Laboratory Analysis²

D 1193 Specification for Reagent Water³

D 2013 Method of Preparing Coal Samples for Analysis²

D 3173 Test Method for Moisture in the Analysis Sample of Coal and Coke²

D 3177 Test Methods for Total Sulfur in the Analysis Sample of Coal and Coke²

D 3180 Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases²

D 4239 Test Method for Sulfur in the Analysis Sample of Coal and Coke Using High Temperature Tube Furnace Combustion Methods²

E 1 Specification for ASTM Thermometers⁴

E 144 Practice for Safe Use of Oxygen Combustion Bombs⁵

3. Terminology

3.1 Definitions:

3.1.1 *calorific value, n*—the heat produced by combustion of a unit quantity of a test specimen under specific conditions.

3.1.1.1 *Discussion*—It is expressed in this test method in

calories per gram (cal/g) and can also be expressed in British thermal units per pound (Btu/lb) or in the International System of Units (SI), in joules per gram (J/g), when required. The unit equivalents are given in Table 1.

3.1.2 *gross calorific value (gross heat of combustion at constant volume), Q_v (gross), n*—see Terminology D 121.

3.1.3 *net calorific value (net heat of combustion at constant pressure), Q_p (net), n*—see Terminology D 121.

3.1.4 *calorimeter, n*—as used in this test method, consists of the bomb and its contents, the calorimeter vessel (bucket) with stirrer, the water in which the bomb is immersed, and the portions of the thermometer and the ignition leads within the calorimeter vessel.

3.2 Descriptions of Terms Specific to this Standard:

3.2.1 *corrected temperature rise, n*—the temperature change of the calorimeter caused by the process that occurs inside the bomb; that is, the observed temperature change corrected for various effects as noted in 10.4.1.

3.2.1.1 *Discussion*—Temperature is measured in degrees Celsius. Thermometer corrections shall be applied. Temperatures may be recorded in ohms or other arbitrary units as the equivalent of degrees. Consistent units shall be used in standardization and the actual calorific value determination. If arbitrary units other than degrees Celsius are used, the temperature interval over which all tests are made shall not vary so much that an error greater than 0.001°C would result.

3.2.2 *energy equivalent, heat capacity, or water equivalent, n*—the energy required to raise the temperature of the calorimeter an arbitrary unit. This is the number that, when multiplied by the corrected temperature rise, then adjusted for extraneous heat effects, and divided by the weight of the sample, equates the gross calorific value.

NOTE 1—Conversion to other units is discussed in Appendix X2. Time is expressed in minutes. Mass is expressed grams.

4. Summary of Test Method

4.1 Calorific value is determined in this test method by burning a weighed sample, in oxygen, in a calibrated isoperibol bomb calorimeter under controlled conditions. The calorimeter is standardized by burning benzoic acid. The calorific value of the sample is computed from temperature observations made before, during, and after combustion, and making proper allowances for heat contributed by other processes, and for thermometer and thermochemical corrections.

4.2 Oxidation after sampling of susceptible low-rank coal or lignite may result in a reduction of calorific value.

¹ This test method is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.21 on Methods of Analysis.

Current edition approved July 10, 1996. Published September 1996. Originally published as D 3286 – 73. Last previous edition D 3286 – 91a.

² Annual Book of ASTM Standards, Vol 05.05.

³ Annual Book of ASTM Standards, Vol 11.01.

⁴ Annual Book of ASTM Standards, Vol 14.03.

⁵ Annual Book of ASTM Standards, Vol 14.02.