



Designation: ~~D3180-07~~ Designation: D3180 - 12

Standard Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases¹

This standard is issued under the fixed designation D3180; 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 practice ~~gives lists formulas to enable that~~ allow analytical data to be expressed ~~on~~ in various ~~different~~ bases in common use. Such bases are: as received, dry, equilibrium moisture, dry ash free, and others.

1.2 *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 this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.3 The values stated in SI units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*²

D388 [Classification of Coals by Rank](#)

D1412 [Test Method for Equilibrium Moisture of Coal at 96 to 97 Percent Relative Humidity and 30C](#)

D2013 [Practice for Preparing Coal Samples for Analysis](#)

D3173 [Test Method for Moisture in the Analysis Sample of Coal and Coke](#)

D3174 [Test Method for Ash in the Analysis Sample of Coal and Coke from Coal](#)

D3302 ~~Test Method for Total Moisture in Coal~~ [Test Method for Total Moisture in Coal](#)

D7582 [Test Methods for Proximate Analysis of Coal and Coke by Macro Thermogravimetric Analysis](#)

3. Terminology

3.1 *Definitions:*

3.1.1 *as-determined basis*—analytical data obtained from the analysis sample of coal or coke after conditioning and preparation to No. 60 (250- μ m) sieve in accordance with Practice D2013 and Test Method D3302. As-determined data represents the numerical values obtained at the particular moisture level in the sample at the time of analysis. These values are normally converted, according to formulae contained herein, to conventional reporting bases.

3.1.2 *as-received basis*—analytical data calculated to the moisture condition of the sample as it arrived at the laboratory and before any processing or conditioning. If the sample has been maintained in a sealed state so that there has been no gain or loss, the as-received basis is equivalent to the moisture basis as sampled.

3.1.3 *dry basis*—data calculated to a theoretical base of no moisture associated with the sample. The numerical value as established by Test Methods [D3173](#) or [D7582](#) is used for converting the as-determined data to a dry basis.

3.1.4 *dry, ash-free basis*—data calculated to a theoretical base of no moisture or ash associated with the sample. Numerical values as established by Test Methods [D3173](#) and ~~Test Method~~, [D3174](#), or, [D7582](#) are used for converting the as-determined data to a moisture- and ash-free basis.

3.1.5 *equilibrium moisture base*—data calculated to the moisture level established as the equilibrium moisture. Numerical values as established by Test Method D1412 are used for the calculation.

4. Significance and Use

4.1 The calculations of analytical data for the coal and coke test parameters listed in Section 6, assume the analysis sample has been prepared according to Practice D2013 and Test Method D3302.

¹ This practice is under the jurisdiction of ASTM Committee D05 on Coal and Coke and is the direct responsibility of D05.21 on Methods of Analysis. Current edition approved July 15, 2007. Published July 2007. Originally approved in 1974. Last previous edition approved in 2002 as D3180-89(2002). DOI: 10.1520/D3180-07.

Current edition approved April 1, 2012. Published June 2012. Originally approved in 1974. Last previous edition approved in 2007 as D3180-07. DOI: 10.1520/D3180-12.

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.

4.2 This practice provides formulas, to enable calculations of data from the as-determined analysis sample to various moisture basis, bases, in common use by the coal and coke industry.

5. Applicable Parameters and Symbols Used

5.1 The calculation procedures defined in 6.1.3 and 6.2.2 are applicable to the following analysis parameters when expressed as weight percent, µg/g (trace elements) or Btu/lb (gross calorific value):

- Ash
- Carbon
- Carbon dioxide
- Chlorine
- Calorific value (gross)
- Fixed carbon
- Major, minor and trace elements
- Nitrogen
- Sulfur
- Sulfur forms (namely, pyritic, sulfate, organic)
- Volatile matter

5.2 The symbols used in this practice:

- A = ash; weight %
- M = moisture, weight %
- P = any analysis parameter listed in 5.1, weight % (except gross calorific value is Btu/lb)
- ADL = air-dry loss, weight % of as-received sample. See Test Method D3302
- H = hydrogen, weight %
- Ox = oxygen, weight %

5.3 Subscripts used in this practice:

- ad = as-determined
- ar = as-received
- d = dry
- daf = dry, ash-free (equivalent to moisture and ash free, maf)

6. Methods for Calculating Data

6.1 Converting from the analysis sample basis to the as-received basis (Note 1):

6.1.1 *Moisture:*

TABLE 1 Conversion Formula Chart

Given	Wanted			
	As-Determined (ad)	As-Received (ar)	Dry (d)	Dry Ash-free (daf)
As-Determined (ad)		$\frac{100 - M_{ar}}{100 - M_{ad}} D3180-07_{-10}$	$\frac{100}{100 - M_{ad}} D3180-07_{-11}$	$\frac{100}{100 - M_{ad} - A_{ad}} D3180-07_{-12}$
As-Determined (ad)		$\frac{100 - M_{ar}}{100 - M_{ad}} D3180-12_{-11}$	$\frac{100}{100 - M_{ad}} D3180-12_{-12}$	$\frac{100}{100 - M_{ad} - A_{ad}} D3180-12_{-13}$
As-Received (ar)	$\frac{100 - M_{ad}}{100 - M_{ar}} D3180-07_{-13}$		$\frac{100}{100 - M_{ar}} D3180-07_{-14}$	$\frac{100}{100 - M_{ar} - A_{ar}} D3180-07_{-15}$
As-Received (ar)	$\frac{100 - M_{ad}}{100 - M_{ar}} D3180-12_{-14}$		$\frac{100}{100 - M_{ar}} D3180-12_{-15}$	$\frac{100}{100 - M_{ar} - A_{ar}} D3180-12_{-16}$
Dry (d)	$\frac{100 - M_{ad}}{100} D3180-07_{-16}$	$\frac{100 - M_{ar}}{100} D3180-07_{-17}$		$\frac{100}{100 - A_d} D3180-07_{-18}$
Dry (d)	$\frac{100 - M_{ad}}{100} D3180-12_{-17}$	$\frac{100 - M_{ar}}{100} D3180-12_{-18}$		$\frac{100}{100 - A_d} D3180-12_{-19}$
Dry Ash-free (daf)	$\frac{100 - M_{ad} - A_{ad}}{100} D3180-07_{-19}$	$\frac{100 - M_{ar} - A_{ar}}{100} D3180-07_{-20}$	$\frac{100 - A_d}{100} D3180-07_{-21}$	
Dry Ash-free (daf)	$\frac{100 - M_{ad} - A_{ad}}{100} D3180-12_{-20}$	$\frac{100 - M_{ar} - A_{ar}}{100} D3180-12_{-21}$	$\frac{100 - A_d}{100} D3180-12_{-22}$	