Coal Analysis Basis Conversion (AR, AD, Dry, DAF)

Converts a coal or biomass analysis value or gross calorific value between as-received, air-dried, dry and dry ash-free bases from the moisture and ash.

Method: Basis relations of ASTM D3180 and ISO 17246 (mass balance of moisture and ash)

Input parameters

Unit system: SI

Parameter	Value	Unit
Value to convert (GCV, carbon %, ash %, volatile matter ...)	4,200.0	
Basis of the value	Air-dried	
Basis wanted	As received (as fired)	
Total moisture, as received	12.000	%
Moisture of the air-dried sample	6.0000	%
Ash, dry basis	38.000	%

Calculated results

Parameter	Value	Unit
Value on the basis wanted	3,931.9	
As received	3,931.9	
Air-dried	4,200.0	
Dry	4,468.1	
Dry, ash-free	7,206.6	

Notes for this case

• Valid for values that are zero in water and in ash: GCV, C, H (without moisture hydrogen), N, S, volatile matter. Ash itself converts only between as received, air-dried and dry; on a dry ash-free basis it is zero by definition. Not for net calorific value or moisture itself.

Formula and method

$$f_{ar} = 1 - M_{ar} \qquad f_{ad} = 1 - M_{ad} \qquad f_{d} = 1 \qquad f_{daf} = \frac{1}{1 - A_{d}}$$

$$v_{d} = \frac{v}{f_{from}} \qquad v_{to} = v_{d}\, f_{to}$$

Variables

v	value to convert	any
from	basis of the value	–
to	basis wanted	–
M_{ar}	total moisture, as received	–
M_{ad}	moisture of the air-dried sample	–
A_{d}	ash, dry basis	–
v_{to}	value on the basis wanted	any
v_{ar}	as received	any
v_{ad}	air-dried	any
v_{d}	dry	any
v_{daf}	dry, ash-free	any

f	factor for each basis: kg of dry fuel per kg of fuel on that basis (f_{daf}: kg of dry fuel per kg of dry ash-free fuel, inverted)	–

Method and standards

Mass balance of moisture and ash, the relations tabulated in ASTM D3180 and ISO 17246: a quantity that is zero in water scales with the dry mass, and one that is also zero in ash scales with the dry ash-free mass. Ash itself converts between as received, air-dried and dry only: on a dry ash-free basis it is zero by definition.

Assumptions and limits

- Values that are zero in water (and, for the daf basis, zero in ash): GCV, C, H excluding moisture hydrogen, N, S, O by difference on a dry basis, volatile matter. Ash converts between as received, air-dried and dry only; its daf value is meaningless (zero by definition).
- The calculator cannot tell whether hydrogen and oxygen include the moisture's H and O; enter values that exclude it.
- A result above 100 % for a percentage value is flagged as inconsistent.

References

- Basis relations of ASTM D3180 and ISO 17246 (mass balance of moisture and ash)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/combustion/fuel-basis-conversion

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.