INTERNATIONAL STANDARD

ISO 17225-5

Second edition
2021-07

Solid biofuels — Fuel specifications and classes —

Part 5: Graded firewood

Biocombustibles solides — Classes et spécifications des combustibles —

Partie 5: Classes de bois de chauffage

Reference number
ISO 17225-5:2021(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 238, *Solid biofuels*.

This second edition cancels and replaces the first edition (ISO 17225-5:2014), which has been technically revised. The main changes compared to the previous edition are as follows:

— Figure 1 and dimensions in Table 1 have been changed;

— Annex C has been changed.

A list of all parts in the ISO 17225 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The objective of the ISO 17225 series is to provide unambiguous and clear classification principles for solid biofuels; to serve as a tool to enable efficient trading of biofuels; to enable good understanding between seller and buyer as well as a tool for communication with equipment manufacturers. It also facilitates authority permission, procedures and reporting.

This document supports the use of graded firewood for residential, small commercial and public buildings which require classified firewood quality.

The residential, small commercial and public building appliances require higher quality fuel for the following reasons:

— Small-scale equipment does not usually have advanced controls and flue gas cleaning.

— Appliances are not generally managed by professional heating engineers.

— Appliances are often located in residential and populated districts.

NOTE 1 Firewood produced according to this document can be used in stoves, fireplaces, cookers, room heaters and multifired sauna stoves, which are tested according to European standards EN 13229,[1] EN 12815,[2] EN 12809,[3] EN 13240,[4] EN 15250[5] and EN 15821,[6] and boilers systems tested according to EN 303–5[7].

NOTE 2 For individual contracts ISO 17225-1 can be used.

Although this document may be obtained separately, it requires a general understanding of the standards based on and supporting ISO 17225-1. It is recommended to obtain and use ISO 17225-1 in conjunction with this document.

Solid biofuels — Fuel specifications and classes —

Part 5:
Graded firewood

1 Scope

This document determines the fuel quality classes and specifications of graded firewood. This document covers only firewood produced from the following raw materials (see ISO 17725-1:2021, Table 1):

— 1.1.1 Whole trees without roots;

— 1.1.3 Stem wood;

— 1.1.4 Logging residues (thick branches, tops etc.);

— 1.2.1 Chemically untreated by-products and residues from wood processing industry.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14780, *Solid biofuels — Sample preparation*

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*

ISO 17225-1:2021, *Solid biofuels — Fuel specifications and classes — Part 1: General requirements*

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified method*

ISO 21945, *Solid biofuels — Simplified sampling method for small scale applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16559 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
firewood
cut and split oven-ready fuelwood used in household wood burning appliances like stoves, fireplaces and central heating systems

Note 1 to entry: Firewood usually has a uniform length, typically in the range of 15 cm to 100 cm.

Note 2 to entry: Cut-offs from virgin wood can also be used as a firewood.

3.2
commercial application
facility that utilizes solid biofuel burning appliances or equipment that have similar fuel requirements as residential appliances

Note 1 to entry: Commercial applications should not be confused with industrial applications, which can utilize a much wider array of materials and have vastly different fuel requirements.

4 Symbols and abbreviated terms

The symbols and abbreviated terms used in this document conform with the SI system of units as far as possible.

ar as received

D Designation for diameter (*D*) as received [cm]

d dry (dry basis)

E Designation for energy density as received, E_{ar} [MJ/m^3 or kWh/m^3 loose or stacked volume or MJ/kg, kWh/kg]

L Designation for length (*L*) as received [cm]

M Designation for moisture content as received on wet basis, M_{ar} [% in mass]

Q Designation for net calorific value as received, $q_{p,net,ar}$ [MJ/kg or GJ/t or kWh/kg or MWh/t] at constant pressure

U Designation for moisture content on dry basis, U_d [% in mass]

NOTE 1 1 MJ/kg or GJ/t equals 0,2778 kWh/kg (1 kWh/kg equals 1 MWh/t and 1 MWh/t is 3,6 MJ/kg). 1 g/cm^3 equals 1 kg/dm^3. 1 mg/kg equals 0,000 1 %.

NOTE 2 Designation symbols are used in combination with a number to specify property levels in Table 1.

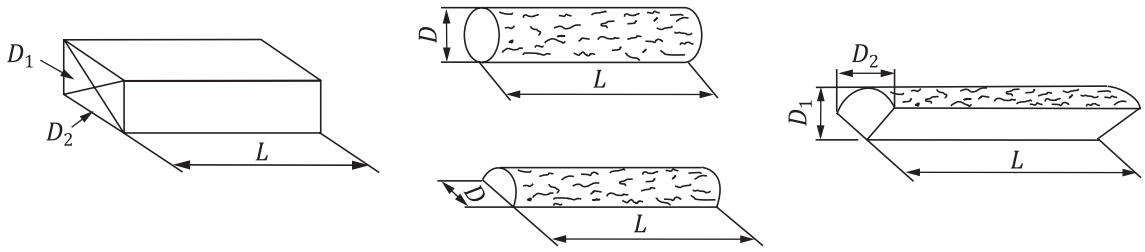
5 Specification of graded firewood8

Specification of the firewood is stated in accordance with Table 1 and Figure 1. Sampling (ISO 21945), sample preparation (as indicated in ISO 14780) and analysis of the properties of solid biofuels shall be carried out in accordance with the methods in the normative references in Clause 2.

Ash, N, S, Cl and minor elements are not required as firewood is produced from virgin material which has been grown in uncontaminated soil and therefore the likelihood of contamination is very low.

Firewood specified according to classes A1 and A2 are suitable to be used in stoves and fireplaces and class B in log wood boilers.

How to state the dimensions of firewood is expressed in Figure 1.



Key

D diameter, maximum diameter of D_1 or D_2

L length

Figure 1 — Dimensions of oven-ready firewood

NOTE Firewood amounts are given in cubic metres or in kilograms. A cubic metre of stacked wood means a stack of wood that occupies a space of one cubic metre. A cubic metre of loose wood is equal to a box one cubic metre in size into which the split logs are "thrown". This is also referred to as an "unstacked cubic metre". Naturally, the conversion rates between the volumes will be affected by the size of the logs and how they are arranged. Comparison of different cubic meters is shown in Annex B.

If the properties being specified are sufficiently known through information about the origin and handling (or preparation method combined with experience) then analysis may not be needed.

To ensure resources are used appropriately and the declaration is accurate, use the most appropriate measure below:

a) using previous measured values or obtained by experience of same raw material;

b) calculation of properties, e.g. by using typical values and considering generally accepted and documented specific values;

c) carrying out analysis:

   1) with simplified methods if available;

   2) with reference methods.

The responsibility of the producer or supplier to provide correct and accurate information is exactly the same whether laboratory analysis is performed or not. Typical values do not release the producer or supplier from providing accurate and reliable information.

In general, chemical treatment before harvesting of biomass does not need to be stated. Where any operator in the fuel supply chain has reason to suspect serious contamination of the biomass or of the soil (e.g. coal slag heaps) or if planting has been used specifically for the sequestration of chemicals or growing biomass is fertilized with sewage sludge (issued from waste water treatment or chemical process), then fuel analysis should be carried out to identify chemical impurities such as halogenated organic compounds or heavy metals.

Decay means a loss of mass and energy. Damage by insects, incipient rot and mould is not considered to be loss of mass and energy. Mould can appear on the surface of wood. The amount of mould generated depends on the drying and storage as well as the ambient conditions. Discolouration may appear as a result of chemical reactions between Fe ions and tannins (example is white oak) or by exposure to oxidation by air and kiln drying.

The quality shall be given either in the product declaration or by a corresponding label in the package.

Table 1 — Specification of graded firewood

	Property class, Analysis method	Units	A1		A2		B	
Normative	**Origin and source,** ISO 17225-1		1.1.3 Stemwood 1.2.1 Chemically untreated by-products and residues from wood processing industry		1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated by-products and residues from wood processing industry		1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated by-products and residues from wood processing industry	
	Wood species [a]		To be stated					
	Diameter, *D* [b]	cm		Main fraction, (minimum 70 % of mass), cm	Oversized particles, % of mass	Maximum diameter, cm	Small firewood, % of mass (D2 and D5)	
			D2	≤ 2	≤ 30	3	-	
			D5	2 ≤ D < 5	≤ 15	8	-	
			D10	5 ≤ D < 10	≤ 15	15	≤ 15	
			D15	10 ≤ D < 15	≤ 15	20	≤ 10	
			D20	15 ≤ D < 20	≤ 15	25	≤ 10	
			D25	20 ≤ D < 25	≤ 15	30	≤ 10	
	Length, *L* [c]	cm	L20 ≤ 20 (± 2 cm) L25 ≤ 25 (± 2 cm) L30 ≤ 30 (± 2 cm) L33 ≤ 33 (± 2 cm) L40 ≤ 40 (± 2 cm) L50 ≤ 50 (± 4 cm) L100 ≤ 100 (± 5 cm)					
	Moisture, M [d] ISO 18134-2	% in mass as received wet basis	≥ 10 and ≤ 20		≥ 10 and ≤ 25		≥ 10 and ≤ 35 value range to be stated	
	Volume or weight	Volume m^3 stacked or loose or weight, kg as received	To be stated which unit is used when retailed (m^3 stacked or loose, kg) and/or packaged log woods weight.					

[a] Wood species (e.g. spruce, birch, beech) can be stated by using EN 13556 Round and sawn timber Nomenclature[8]. If firewood includes different wood species, the main wood species should be mentioned first.

[b] The numerical value of dimension refers to the maximum diameter of the main fraction. For stoves it is recommended to use firewood with a diameter less than 15 cm. D2 and D5 are recommended for cookers and as kindling. In Annex B a simple method for measuring of the diameter is specified. Firewood declarations where two consecutive diameter classes are combined are acceptable e.g. D10/D15.

[c] It is allowed to have 15 % firewood shorter than requested length including the limit value.

[d] Moisture content should not be less 10 % in mass on wet basis (M) or 11,1 % in mass on dry basis (U). Calculation from M to U is shown in Table A.1.

[e] The energy density (E) may be calculated according to Annex C by the bulk density (BD) and the net calorific value [9].

[f] Cuts of chainsaw or circular saw are considered to be smooth and even.

Table 1 *(continued)*

	Property class, Analysis method	Units	A1	A2	B
Informative	**Energy density, E** [e] or **Net calorific value, Q,** ISO 18125	MJ/m^3 or kWh/m^3 stacked or loose MJ/kg or kWh/kg, as received	Recommended to be stated.		
	Drying		Recommended to be stated, if firewood is dried by natural seasoning by ambient air or artificially by hot air.		
	Decay and mould	% of pieces	No visible decay	≤ 5	If significant amount (more than 10 % of pieces) of decay or mould exists it should be stated.
	Proportion of split volume	% of pieces	≥ 90	≥ 50	No requirements
	The cut-off surface		Even and smooth [f]	No requirements	No requirements

[a] Wood species (e.g. spruce, birch, beech) can be stated by using EN 13556 Round and sawn timber Nomenclature[8]. If firewood includes different wood species, the main wood species should be mentioned first.

[b] The numerical value of dimension refers to the maximum diameter of the main fraction. For stoves it is recommended to use firewood with a diameter less than 15 cm. D2 and D5 are recommended for cookers and as kindling. In Annex B a simple method for measuring of the diameter is specified. Firewood declarations where two consecutive diameter classes are combined are acceptable e.g. D10/D15.

[c] It is allowed to have 15 % firewood shorter than requested length including the limit value.

[d] Moisture content should not be less 10 % in mass on wet basis (M) or 11,1 % in mass on dry basis (U). Calculation from M to U is shown in Table A.1.

[e] The energy density (E) may be calculated according to Annex C by the bulk density (BD) and the net calorific value [9].

[f] Cuts of chainsaw or circular saw are considered to be smooth and even.

Annex A
(informative)

Comparison of moisture content as received and dry basis

Table A.1 — Comparison of moisture content as received (M) and dry basis (U)

Moisture content, wet basis (M), % in mass	Moisture content, dry basis (U), % in mass
10	11,1
11	12,3
12	13,6
13	14,9
14	16,3
15	17,6
16	19,0
17	20,5
18	22,0
19	23,5
20	25,0
21	26,6
22	28,2
23	29,9
24	31,6
25	33,3
26	35,1
27	37,0
28	38,9
29	40,9
30	42,9
31	44,9
32	47,1
33	49,5
34	51,5
35	53,9
36	56,3
37	58,7
38	61,3
39	63,9
40	66,7
41	69,5
42	72,4
43	75,4
44	78,6

Moisture content, dry basis (U), % in mass	Moisture content, wet basis (M), % in mass
10	9,1
11	9,9
12	10,7
13	11,5
14	12,3
15	13,0
16	13,8
17	14,5
18	15,2
19	16,0
20	16,7
21	17,4
22	18,0
23	18,7
24	19,4
25	20,0
26	20,6
27	21,3
28	21,9
29	22,5
30	23,1
31	23,7
32	24,2
33	24,8
34	25,4
35	25,9
36	26,5
37	27,0
38	27,5
39	28,1
40	28,6
41	29,1
42	29,6
43	30,1
44	30,6

Table A.1 *(continued)*

Moisture content, wet basis (M), % in mass	Moisture content, dry basis (U), % in mass
45	81,8
46	85,2
47	88,7
48	92,3
49	96,1
50	100,0
51	104,1
52	108,3
53	112,8
54	117,4

Moisture content, dry basis (U), % in mass	Moisture content, wet basis (M), % in mass
45	31,1
46	31,5
47	32,0
48	32,4
49	32,9
50	33,3
51	33,8
52	34,2
53	34,6
54	35,1

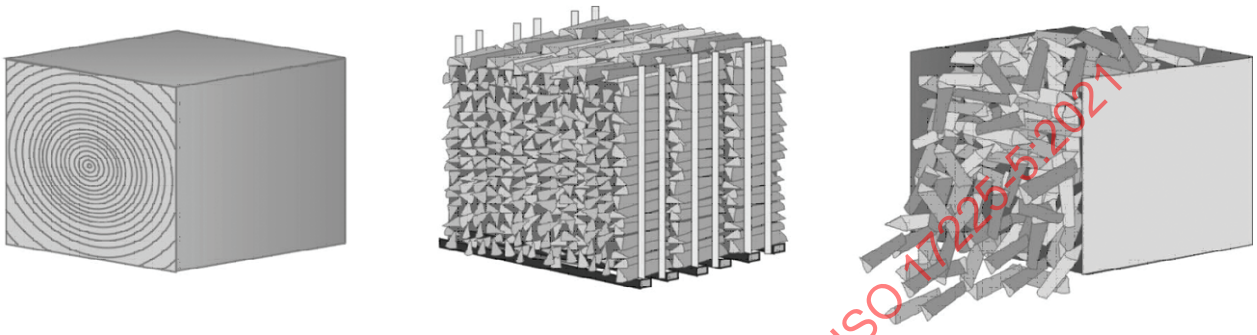
The relation between moisture on dry basis, U_d, or wet basis, M_{ar}, expressed as % in mass shall be calculated using the Formula (A.1) and Formula (A.2) according to ISO 18134-1.

$$U_d = \frac{M_{ar}}{100 - M_{ar}} \times 100 \quad \text{(A.1)}$$

$$M_{ar} = \frac{U_d}{100 + U_d} \times 100 \quad \text{(A.2)}$$

Annex B
(informative)

Measurement of firewood



a) Solid cubic metre b) Stacked cubic metre c) Loose cubic metre

Figure B.1 — Comparison of different cubic meters (1 m each side)

NOTE The cord is a unit of measure in North America to measure firewood. A cord is the amount of wood (arranged so pieces are aligned, parallel, touching and compact), that occupies a volume of 3,62 m^3 (128 cubic feet).

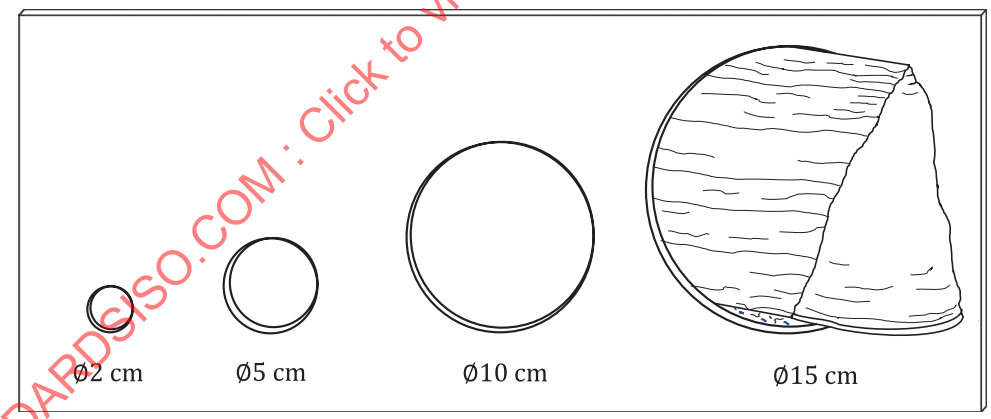


Figure B.2 — Measurement of firewood diameter

Annex C
(informative)

Calculation of energy density

C.1 Calculation of net calorific value as received (Q)

The net calorific value (at constant pressure) on as received (the moist biofuel) can be calculated on the net calorific value on dry basis according to Formula (C.1).

$$q_{p,net,ar} = q_{p,net,d} \times \left(\frac{100 - M_{ar}}{100}\right) - 0,024\,43 \times M_{ar} \quad \text{(C.1)}$$

where

$q_{p,net,ar}$ is the net calorific value (at constant pressure) as received in megajoules per kilogram (MJ/kg);

$q_{p,net,d}$ is the net calorific value (at constant pressure) in dry matter in megajoules per kilogram (MJ/kg);

M_{ar} is the moisture content as received [% in mass, wet basis];

0,024 43 is the correction factor of the enthalpy of vaporization (constant pressure) for water (moisture) at 25 °C (in megajoules per kilogram (MJ/kg) per 1 % in mass of moisture).

C.2 Calculation of energy density (E)

The wood fuels for households are traded usually on a volume basis, whereas the energy content (net calorific value) is specified often as kilowatt hours (kWh) per bulk volume. Bulk density and moisture content are measured or estimated.

The energy density as received can be calculated according to Formula (C.2).

$$E_{ar} = \frac{1}{3,6} \times q_{p,net,ar} \times BD_{ar} \quad \text{(C.2)}$$

where

E_{ar} is the energy density of the biofuel as received, in kilowatt hours per cubic metre (kWh/m^3) of bulk volume;

$q_{p,net,ar}$ is the net calorific value (at constant pressure) as received, in megajoules per kilogram (MJ/kg);

BD_{ar} is the bulk density, i.e. volume weight of the biofuel as received, in kilograms per cubic metre (kg/m^3) of bulk volume;

$\frac{1}{3,6}$ is the conversion factor for the energy units, from megajoules (MJ) to kilowatt hour (kWh).

The result shall be reported in kWh/m^3 of bulk volume.