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**Solid biofuels — Fuel specifications  
and classes —**

Part 5:  
**Graded firewood**

*Biocombustibles solides — Classes et spécifications des  
combustibles —*

*Partie 5: Classes de bois de chauffage*

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ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

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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](http://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](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 238, *Solid biofuels*.

ISO 17225 consists of the following parts, under the general title *Solid biofuels — Fuel specifications and classes*:

- *Part 1: General requirements*
- *Part 2: Graded wood pellets*
- *Part 3: Graded wood briquettes*
- *Part 4: Graded wood chips*
- *Part 5: Graded firewood*
- *Part 6: Graded non-woody pellets*
- *Part 7: Graded non-woody briquettes*

## 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 will also facilitate authority permission procedures and reporting.

This part of ISO 17225 supports the use of graded firewood for residential, small commercial and public building applications.

The residential, small commercial and public building applications 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 part of ISO 17225 may be used in stoves, fireplaces, cookers, roomheaters 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 these product standards may be obtained separately, they require 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 these standards.

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# Solid biofuels — Fuel specifications and classes —

## Part 5: Graded firewood

### 1 Scope

This part of ISO 17225 determines the fuel quality classes and specifications of graded firewood. This part of ISO 17225 covers only firewood produced from the following raw materials (see ISO 17225-1, 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 wood residues

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*<sup>1)</sup>

ISO 17225-1, *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*<sup>2)</sup>

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture - Simplified method*<sup>3)</sup>

### 3 Terms and definitions

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

#### 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.

1) To be published.

2) To be published.

3) To be published.

### 3.2

#### commercial application

facility that utilize 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 part of ISO 17225 comply with the SI system of units as far as possible.

<i>d</i>	dry (dry basis)
<i>ar</i>	as received
w-%	weight-percentage
D	Designation for diameter ( <i>D</i> ) as received [mm]
E	Designation for energy density as received, $E_{ar}$ [MJ/m <sup>3</sup> or kWh/m <sup>3</sup> loose or stacked volume or MJ/kg, kWh/kg]
L	Designation for length ( <i>L</i> ) as received [cm]
M	Designation for moisture content as received on wet basis, $M_{ar}$ [w-%]
U	Designation for moisture content on dry basis, $U_d$ [w-%]
Q	Designation for net calorific value as received, $q_{p,net,ar}$ [MJ/kg or kWh/kg or MWh/t] at constant pressure

NOTE 1 1 MJ/kg equals 0,2778 kWh/kg (1 kWh/kg equals 1 MWh/t and 1 MWh/t is 3,6 MJ/kg). 1 g/cm<sup>3</sup> equals 1 kg/dm<sup>3</sup>.

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

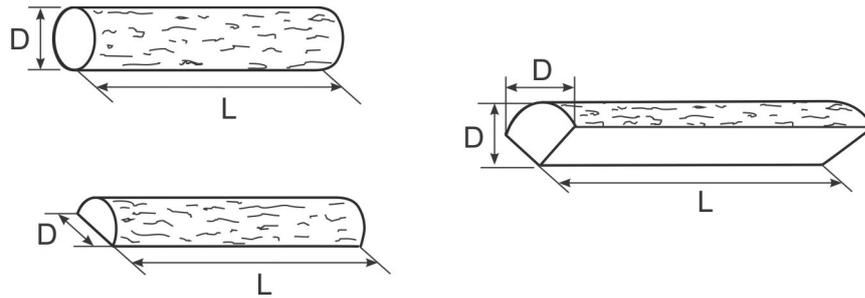
## 5 Specification of graded firewood

Specification of the firewood is stated in accordance with [Table 1](#) and [Figure 1](#). The determination of the properties shall be carried out in accordance with the methods mentioned in the normative references.

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**

- $D$  maximum diameter  
 $L$  maximum length

**Figure 1 — Dimensions of 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 informative [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:

- 1) using previous measured values or obtained by experience of same raw material;
- 2) calculation of properties, e.g. by using typical values and considering generally accepted and documented specific values;
- 3) carrying out of analysis:
  - a) with simplified methods if available;
  - b) 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.

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 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), 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	<b>Origin and source,</b> ISO 17225-1		1.1.3 Stemwood 1.2.1 Chemically untreated wood residues	1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues	1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues
	<b>Wood species</b> <sup>a</sup>		To be stated		To be stated
	<b>Diameter, D</b> <sup>b</sup>	cm	D2 ≤ 2 D5 2 < D ≤ 5 D15 5 < D ≤ 15 D15+ > 15 (actual value to be stated)		D15 5 < D ≤ 15 D15+ > 15 (actual value to be stated)
	<b>Length, L</b> <sup>c</sup>	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)		L30 ≤ 30 (±2 cm) L33 ≤ 33 (±2 cm) L40 ≤ 40 (±2 cm) L50 ≤ 50 (±4 cm) L100 ≤ 100 (±5 cm)
	<b>Moisture, M</b> <sup>d</sup> ISO 18134-1, ISO 18134-2	w-% as received wet basis	M20 ≤ 20 M25 ≤ 25		M20 ≤ 20 M25 ≤ 25 M35 ≤ 35
	<b>Volume or weight</b>	Volume m <sup>3</sup> stacked or loose or weight, kg as received	To be stated which unit is used when retailed (m <sup>3</sup> stacked or loose, kg) and/or packaged log woods weight.		
Informative	<b>Energy density, E</b> <sup>e</sup> or <b>Net calorific value, Q,</b> ISO 18125	MJ/m <sup>3</sup> or kWh/m <sup>3</sup> stacked or loose MJ/kg or kWh/kg, as received	Recommended to be stated.		
	<b>Drying</b>		Recommended to be stated, if firewood is dried by natural seasoning by ambient air or artificially by hot air.		
	<b>Moisture, U</b> <sup>d</sup>	w-% dry basis	U25 ≤ 25 U33 ≤ 33		U33 ≤ 33 U54 ≤ 54
	<b>Decay and mould</b>	% of pieces	No visible decay	≤ 5	If significant amount (more than 10 % of pieces) of decay or mould exists it should be stated.
	<b>Proportion of split volume</b>	% of pieces	≥ 90	≥ 50	No requirements
	<b>The cut-off surface</b>		Even and smooth <sup>f</sup>	No requirements	No requirements
<p><sup>a</sup> Wood species (e.g. spruce, birch, beech) can be stated by using EN 13556 Round and sawn timber Nomenclature.<sup>[8]</sup> If firewood includes different wood species, the main wood species should be mentioned first.</p> <p><sup>b</sup> 85 % of the firewood should be kept in specified diameter property class. 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 (ignition wood). In informative <a href="#">Annex B</a> a simple method for measuring of the diameter is specified.</p> <p><sup>c</sup> It is allowed to have 15 % firewood shorter than requested length including the limit value.</p> <p><sup>d</sup> Moisture content should not be less 12 w-% on wet basis (M) or 13,64 w-% on dry basis (U). Calculation from M to U-basis is shown in informative <a href="#">Annex A</a>.</p> <p><sup>e</sup> The energy density (E) may be calculated according to <a href="#">Annex C</a> on the basis of the bulk density (BD) and the net calorific value.</p> <p><sup>f</sup> Use of chainsaw and circular saw will give a smooth and even cut-off surface.</p>					

## 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), w-%	Moisture content, dry basis (U), w-%		Moisture content, dry basis (U), w-%	Moisture content, wet basis (M), w-%
12	13,6		12	10,7
13	14,9		13	11,5
14	16,3		14	12,3
15	17,6		15	13,0
16	19,0		16	13,8
17	20,5		17	14,5
18	22,0		18	15,2
19	23,5		19	16,0
20	25,0		20	16,7
21	26,6		21	17,4
22	28,2		22	18,0
23	29,9		23	18,7
24	31,6		24	19,4
25	33,3		25	20,0
26	35,1		26	20,6
27	37,0		27	21,3
28	38,9		28	21,9
29	40,9		29	22,5
30	42,9		30	23,1
31	44,9		31	23,7
32	47,1		32	24,2
33	49,5		33	24,8
34	51,5		34	25,4
35	53,9		35	25,9
36	56,3		36	26,5
37	58,7		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), w-%	Moisture content, dry basis (U), w-%		Moisture content, dry basis (U), w-%	Moisture content, wet basis (M), w-%
			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 a percentage by mass shall be calculated using the Formulae (1) and 2 according to ISO 18134-1.

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

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

## Annex B (informative)

### Measurement of firewood

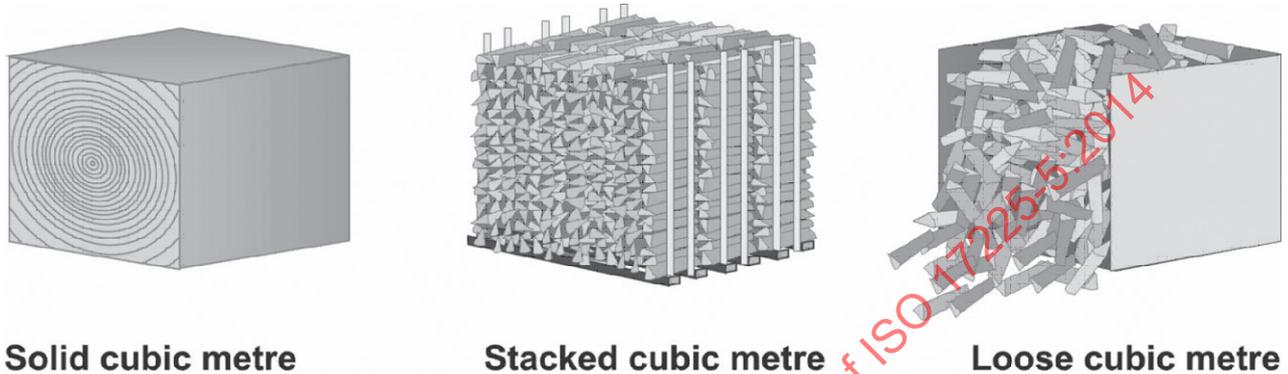


Figure B.1 — Comparison of different cubic meters (1 m each side)<sup>4)</sup>

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<sup>3</sup> (128 cubic feet).

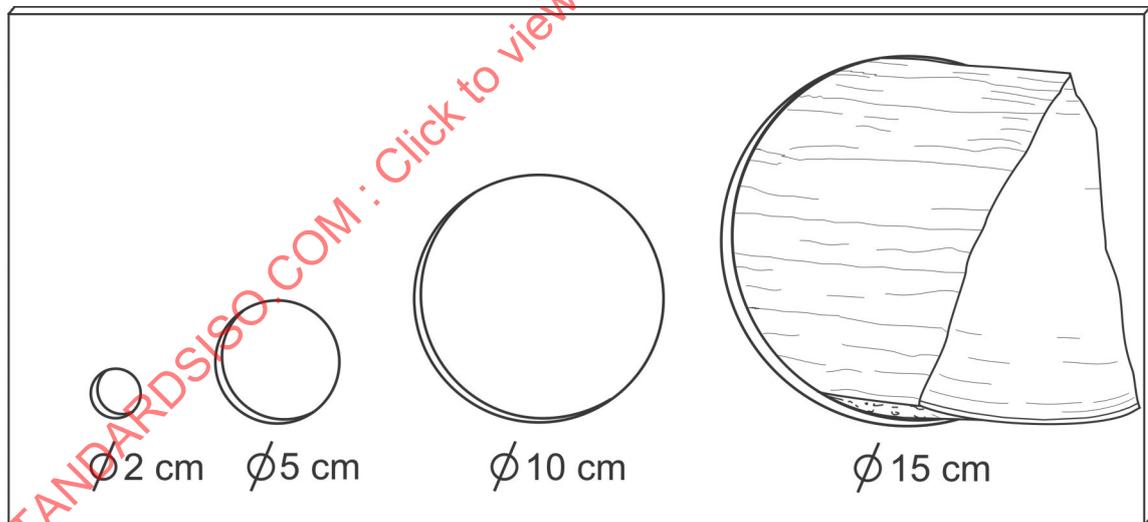


Figure B.2 — Measurement of firewood diameter<sup>5)</sup>

4) Source: Eija Alakangas, VTT.

5) Source: Eija Alakangas, VTT and Georg Krämer, IBT-Krämer.

## Annex C (informative)

### Calculation of energy density

#### C.1 Calculation of net calorific value from dry basis (Q)

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

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

where

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

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

$M_{\text{ar}}$  is the moisture content as received [w-% 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 w-% of moisture).

#### C.2 Calculation of energy density (E)

The wood fuels for households are traded usually on a volume basis and energy content (net calorific value) is informed often as kilowatts hour (kWh) per bulk volume. Bulk density and moisture content is measured or estimated.

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

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

where

$E_{\text{ar}}$  is the energy density of the biofuel as received, in 1 000 kilowatt hours per cubic metre (kWh/m<sup>3</sup>) of bulk volume;

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

$\text{BD}_{\text{ar}}$  is the bulk density, i.e. volume weight of the biofuel as received, in kilograms per cubic metre (kg/m<sup>3</sup>) of bulk volume;

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

The result shall be reported to the nearest 1 kWh/m<sup>3</sup> of bulk volume.