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Solid biofuels — Fuel specifications and classes —

Part 4: Graded wood chips

Biocombustibles solides — Classes et spécifications des combustibles —

Partie 4: Classes de plaquettes de bois

Reference number
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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).

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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 also facilitates authority permission procedures and reporting.

This part of ISO 17225 supports the use of graded wood chips 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 usually does not 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 Wood chips produced according to this part of ISO 17225 may be used in boilers tested according to EN 303–5[1].

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.

Solid biofuels — Fuel specifications and classes —

Part 4: Graded wood chips

1 Scope

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

- 1.1 Forest, plantation and other virgin wood
- 1.2 By-products and residues from wood processing industry
- 1.3.1 Chemically untreated used wood

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.

NOTE ISO standards describing methods for analysis of fuel properties listed in the Bibliography, will become normative references when they are published.

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*[1)]

ISO 16948, *Solid biofuels — Determination of total content of carbon, hydrogen and nitrogen*[2)]

ISO 16968, *Solid biofuels — Determination of minor elements*[3)]

ISO 16994, *Solid biofuels — Determination of total content of sulfur and chlorine*[4)]

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

ISO 17828, *Solid biofuels — Determination of bulk density*[5)]

ISO 18122, *Solid biofuels — Determination of ash content*[6)]

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*[7)]

1) To be published.

2) To be published.

3) To be published.

4) To be published.

5) To be published.

6) To be published.

7) To be published.

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture - Simplified method*[8)]

3 Terms and definitions

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

3.1
wood chips
chipped *woody biomass* in the form of pieces with a defined *particle size* produced by mechanical treatment with sharp tools such as knives

Note 1 to entry: Wood chips have a subrectangular shape with a typical length of 5 mm to 50 mm and a low thickness compared to other dimensions.

3.2
chemical treatment
any treatment with chemicals other than air, water or heat

EXAMPLE Glue and paint.

Note 1 to entry: Examples of chemical treatment are listed in ISO 17225-1.

3.3
contamination
exposure to impurity such as poisonous or polluting substance to a fuel

3.4
commercial application
facility that utilises 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.

d	dry (dry basis)
ar	as received
w-%	weight-percentage
A	Designation for ash content on dry basis, A_d [w-%]
BD	Designation for bulk density as received [kg/m^3]
P	Designation for particle size distribution
M	Designation for moisture content as received on wet basis, M_{ar} [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 1 GJ/t or 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 % or 1 ppm.

8) To be published.

NOTE 2 Designation symbols are used in combination with a number to specify property levels in Table 1. For designation of chemical properties, chemical symbols like S (sulfur), Cl (chlorine), N (nitrogen) are used and the property class is added at the end of the symbol.

5 Specification of graded wood chips

Specification of the graded wood chips is stated in accordance with Table 1 and 2. The sampling and analysis of the properties shall be carried out in accordance with the methods mentioned in the normative references.

Property classes A1 and A2 represent virgin woods and chemically untreated wood residues. A1 represents fuels with lower ash content indicating no or little bark, and lower moisture content, while class A2 has slightly higher ash content and/or moisture content. B1 extends the origin and source of class A to include other material, such as, short rotation coppice, wood from gardens and plantation etc., and chemically untreated industrial by-products and residues. Property class B2 also includes chemically treated industrial by-products and residues and chemically untreated used wood.

Chemically treated wood by-products and residues from wood processing industry (1.2.2) and chemically untreated used wood (1.3.1) are included in property class B2 as long as they do not contain heavy metals or halogenated organic compounds as a result of treatment with wood preservatives or coating. In case of raw materials belonging to 1.2.2 (chemically treated wood) the actual origin of the raw material shall be clearly described, e.g. 1.2.2, Residues from laminated wood production.

EXAMPLE Chips of class B2 produced from 99 w-% stemwood from spruce 1.1.3, 1 w-% may contained glued wood from wood beam production (amount of glue < 0,1 %).

Chemical treatment before harvesting of biomass does not have to be stated. Where any operator in the fuel supply chain has reason to suspect serious contamination from soil (e.g. coal slag heaps) or if planting has been used specifically for the sequestration of chemicals or growing woody 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.

If data for chemical or physical properties are available, further analysis may not be required.

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.

The threshold values (N, S, Cl and minor elements) for grade A1 and A2 are not required as these classes of fuels are chemically untreated wood residues or from virgin material, which has been grown in uncontaminated land and therefore the likelihood of contamination is very low.

In Table 1 particle size classes are shown and in the informative Annex A bulk densities for different moisture content ranges are given.

The quality shall be given in the product declaration.

Table 1 — Particle size of graded wood chips

Dimensions (mm), ISO 17827-1					
Main fraction [a] (minimum 60 w-%), mm		Fines fraction, w-% (≤3,15 mm)	Coarse fraction, w-%, (length of particle, mm)	Max. length of particles [b], mm	Max. cross sectional area of the coarse fraction [c], cm^2
P16S	3,15 mm < *P* ≤ 16 mm	≤ 15 %	≤ 6 % (>31,5 mm)	≤ 45 mm	≤ 2 cm^2
P31S	3,15 mm < *P* ≤ 31,5 mm	≤ 10 %	≤ 6 % (>45 mm)	≤ 150 mm	≤ 4 cm^2
P45S	3,15 mm < *P* ≤ 45 mm	≤ 10 %	≤ 10 % (>63 mm)	≤ 200 mm	≤ 6 cm^2

[a] The numerical values (P-class) for dimension refer to the particle sizes passing through the mentioned round hole sieve size (ISO 17827-1). The lowest possible class should be stated. Only one class shall be specified for wood chips.

[b] Length and cross sectional area only have to be determined for those particles, which are to be found in the coarse fraction. Maximum 2 pieces of about 10 l sample may exceed the maximum length, if the cross sectional area is < 0,5 cm^2.

[c] For measuring the cross sectional area it is recommended to use a transparent set square, place the particle orthogonally behind the set square and estimate the maximum cross sectional area of this particle with the help of the cm^2-pattern.

Table 2 — Specification of graded wood chips

	Property class, Analysis method	**Unit**	**A**		**B**	
			1	**2**	**1**	**2**
Normative	**Origin and source,** ISO 17225-1		1.1.1 Whole trees without roots [a] 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues	1.1.1 Whole trees without roots [a] 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood [b] 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood [b] 1.2. By-products and residues from wood processing industry 1.3.1.Chemically untreated used wood
	Particle size, P ISO 17827-1	mm	to be selected from Table 1		to be selected from Table 1	
	Moisture, M [c], ISO 18134-1, ISO 18134-2	w-%	M10 ≤ 10 M25 ≤ 25	M35 ≤ 35	Maximum value to be stated	
	Ash, A, ISO 18122	w-% dry	A1.0 ≤ 1,0	A1.5 ≤ 1,5	A3.0 ≤ 3,0	
	Bulk density, BD [d], ISO 17828	kg/loose m^3 as received	BD150 ≥ 150 BD200 ≥ 200 BD250 ≥ 250	BD150 ≥ 150 BD200 ≥ 200 BD250 ≥ 250 BD300 ≥ 300	Minimum value to be stated	
	Nitrogen, N, ISO 16948	w-% dry	Not applicable	Not applicable	N1.0 ≤ 1,0	
	Sulfur, S, ISO 16994	w-% dry	Not applicable	Not applicable	S0.1 ≤ 0,1	
	Chlorine, Cl, ISO 16994	w-% dry	Not applicable	Not applicable	Cl0.05 ≤ 0,05	
	Arsenic, As, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 1	
	Cadmium, Cd, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 2,0	
	Chromium, Cr, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Copper, Cu, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Lead, Pb, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Mercury, Hg, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 0,1	
	Nickel, Ni, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Zinc, Zn, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 100	

Table 2 *(continued)*

	Property class, Analysis method	**Unit**	**A**		**B**	
			1	**2**	**1**	**2**
Informative	**Net calorific value, Q** [e], ISO 18125	MJ/kg or kWh/kg as received	Minimum value to be stated		Minimum value to be stated	

[a] Excluding class 1.1.1.3 Short rotation coppice, if reason to suspect contamination of land or if planting has been used for the sequestration of chemicals or growing trees have been fertilized by sewage sludge (issued from waste water treatment or chemical process).

[b] Excluding classes 1.1.5 Stumps/roots and 1.1.6 Bark

[c] Lowest possible property class to be stated. Certain boilers require minimum moisture content, which should to be stated. Moisture class M10 is for artificially dried wood chips.

[d] The bulk density is lower for coniferous than for broadleaf wood, see informative Annex A.

[e] See Annex D from ISO 17225-1 for calculation of net calorific value as received.

Annex A
(informative)

General guidelines for bulk density of graded wood chips

In this Annex a very general guideline for bulk density of graded wood chips is given. The bulk density range is given for two general classes of tree species: broadleaf and coniferous species.

Coniferous species contain most of the softwood species (e.g. pine, spruce, fir) as well as the light broadleaf species like poplar and willow. As a basis for the calculation a basic density of 400 kg dry matter/m^3 is assumed. Basic density is the ratio of the mass on dry basis and the solid volume on green basis (ISO 16559).

Broadleaf species comprise most of the hardwood species like oak, beech, maple, birch. For the broadleaf species a basic density of 550 kg dry matter/m^3 is assumed.

In the table, a range of bulk densities is given, which depend on the moisture content of the chip.

Table A.1 — Range of bulk densities

Moisture content on wet basis	w-%	8 to 18	18 to 25	25 to 35	35 to 45
Bulk density for coniferous species	kg/m^3 loose volume	160 to 180	180 to 200	200 to 225	225 to 270
	Property class	BD150	BD150	BD200	BD200
Bulk density for broadleaf species	kg/m^3 loose volume	225 to 250	250 to 280	280 to 320	320 to 380
	Property class	BD200	BD250	BD250	BD300

NOTE 1 solid m^3 is on average from 2,5 to 3,0 loose m^3 of wood chips.

Bibliography

[1] EN 303-5:2012, *Heating boilers. Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW. Terminology, requirements, testing and marking*

[2] ISO 17827-1, *Solid biofuels — Determination of particle size distribution for uncompressed fuels — Part 1: Horizontally oscillating screen using sieve for classification of samples with top aperture of 3,15 mm and above*[9)]

[3] ISO 18125, *Solid Biofuels — Determination of calorific value*[10)]

[4] ISO 14780, *Solid biofuels — Sample preparation*[11)]

[5] ISO 18135, *Solid Biofuels — Sampling*[12)]

9) Under development.

10) Under development.

11) Under development.

12) Under development.

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