INTERNATIONAL STANDARD

ISO 17225-2

Second edition
2021-05

Solid biofuels — Fuel specifications and classes —

Part 2: Graded wood pellets

Biocombustibles solides — Classes et spécifications des combustibles —

Partie 2: Classes de granulés 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).

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 17225-2:2014), which has been technically revised. The main changes compared to the previous edition are as follows:

— ash melting behaviour as normative and threshold values for DT temperature added for Table 1

— maximum value for bulk density added for Table 1

— particle density and coarse pellet fines added as informative

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 solid 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 wood pellets for residential, small commercial and public buildings as well as industrial energy generation applications, which require classified pellet quality.

The residential, small and 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 Pellets produced according to this document can be used in pellet stoves, which are tested according to European Standard EN 14785 [1], pellet burners tested according to EN 15270 [2] and pellet boilers or integrated-pellet burner systems tested according to EN 303–5 [3].

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

Although this document 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 2: Graded wood pellets

1 Scope

This document determines the fuel quality classes and specifications of graded wood pellets for non-industrial and industrial use. This document covers only wood pellets produced from the following raw materials (see ISO 17225-1:2021, 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.

Thermally treated biomass pellets (e.g. torrefied pellets) are not included in the scope of this document.

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 16948, *Solid biofuels — Determination of total content of carbon, hydrogen and nitrogen*

ISO 16968, *Solid biofuels — Determination of minor elements*

ISO 16994, *Solid biofuels — Determination of total content of sulfur and chlorine*

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

ISO 17828, *Solid biofuels — Determination of bulk density*

ISO 17829, *Solid Biofuels — Determination of length and diameter of pellets*

ISO 17830, *Solid biofuels — Particle size distribution of disintegrated pellets*

ISO 17831-1, *Solid biofuels — Determination of mechanical durability of pellets and briquettes — Part 1: Pellets*

ISO 18122, *Solid biofuels — Determination of ash content*

ISO 18125, *Solid biofuels — Determination of calorific value*

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 18135, *Solid Biofuels — Sampling*

ISO 21404, *Solid biofuels — Determination of ash melting behaviour*

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
additive
material which has been intentionally introduced into the fuel feed stock to improve quality of fuel (e.g. combustion or durability properties), to reduce emissions or to make production more efficient

Note 1 to entry: Trace amounts of e.g. grease or other lubricants that are introduced into the fuel processing stream as part of normal mill operations are not considered as additives.

3.2
biofuel pellet
densified biofuel made with or without *additives* (3.1) usually with a cylindrical form, random length typically 5 mm to 40 mm and diameter up to 25 mm and broken ends, produced by compressing biomass

Note 1 to entry: Usually the biomass has been milled before densification.

Note 2 to entry: See also non-woody pellet, wood pellet and pellet from thermally treated biomass.

3.3
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.

3.4
coarse pellet fines
CPF
particles with a size ranging from ≥ 3,15 mm to < 5,6 mm resulting from breakage of pellets during production or handling

3.5
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.

3.6
fines
F
fraction of small sized particles as defined by a specification or end-user

Note 1 to entry: In the solid biofuels standards fines are always defined as particles passing through a 3,15 mm round hole sieve.

3.7
woody biomass
biomass originating from trees, bushes and shrubs together with their fruit, leaves and needles inherent to the biomass

Note 1 to entry: This definition includes forest, plantation and other virgin wood, wood processing industry by-products and residues, and used wood.

3.8
wood pellet
biofuel pellet (3.2) made from *woody biomass* (3.7)

4 Symbols and abbreviated terms

The symbols and abbreviated terms used in this part of ISO 17225 conform with the SI system of units as far as possible.

A Designation for ash content on dry basis, A_d [% in mass]

ar as received

BD Designation for bulk density as received [kg/m^3, (loose volume)]

CPF Designation for coarse pellet fines as received [% in mass, particles ≥ 3,15 mm and < 5,6 mm]

D Designation for diameter as received, *D* [mm]

d dry (dry basis)

DE Designation for particle density as received [g/cm^3]

DT Designation fordeformation temperature of the fuel ash [°C]

DU Designation for mechanical durability as received [% in mass]

F Designation for amount of fines (< 3,15 mm) as received [% in mass]

FT Designation for flow temperature of the fuel ash [°C]

HT Designation for hemisphere temperature of the fuel ash [°C]

L Designation for length as received, *L* [mm]

M Designation for moisture 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

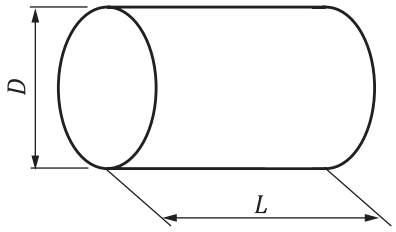
SST Designation for shrinkage starting temperature of the fuel ash [°C]

NOTE 1 1 MJ/kg or GJ/t equals 0,2 778 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 Tables 1 and 2. For designation of chemical properties, chemical symbols such as S (sulfur), Cl (chlorine), and N (nitrogen) are used and the property class is added at the end of the symbol.

5 Specification of graded wood pellets

The specification of the wood pellets is stated in accordance with Table 1, Table 2 and Figure 1. Sampling (ISO 18135 or ISO 21945), sample preparation (ISO 14780) and analysis of the properties shall be carried out in accordance with the methods mentioned in the normative references in Clause 2.



Key

D diameter

L length

Figure 1 — Dimension of pellets

Property classes A1, A2, I1 and I2 represents virgin wood and chemically untreated wood residues. A1 and A2 pellets are high quality pellets, suitable for small scale use like stoves and fireplaces. In Table 1 A1 represents fuels which are low in ash and nitrogen content, while class A2 has slightly higher ash and nitrogen content. Property classes I1 and I2 have similar ash and nitrogen content as A2. Property classes B and I3 allow chemically treated industrial wood by-products and residues and chemically untreated used wood.

1.2.2 Chemically treated wood by-products and residues from wood processing industry and 1.3.1 Chemically untreated used wood according to ISO 17225-1:2021, Table 1 are included in class B and I3 as long as they do not contain heavy metals or halogenated organic compounds more than typical virgin material values or typical values of country of origin. In case of raw materials belonging to 1.2.2 Chemically treated wood according to ISO 17225-1:2021, Table 1 the actual origin of the raw material shall be clearly described, e.g. 1.2.2 Residues from laminated wood production.

EXAMPLE For pellets of class B/I3 produced from 99 % in mass sawdust from spruce 1.2.1.2, and 1 % in mass can contain glued wood from wood beam production (amount of glue < 0,1 % in mass).

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 analysis:

   3a) with simplified methods if available;

   3b) 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.

NOTE It is important to carry out laboratory analysis, if the raw material basis is changed.

To ensure the end-user receives pellets with a low level of fines, the amount of fines shall be ≤ 1 % in mass leaving the final point of loading for delivery to the end-user (see Table 1). Between factory gates and the end-user, distributors shall take appropriate measures to maintain this low level of fines.

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

Table 1 — Specification of graded wood pellets for commercial and residential applications

	Property class Analysis method	**Unit**	**A1**	**A2**	**B**
Normative	Origin and source ISO 17225-1		1.1.3 Stemwood 1.2.1 Chemically untreated wood residues [a]	1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues [a]	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
	Diameter, *D* [b] and **Length *L*,** [c] ISO 17829 According to Figure 1	mm	D06, 6 ± 1; 3,15 ≤ L ≤ 40 D08, 8 ± 1; 3,15 ≤ L ≤ 40	D06, 6 ± 1; 3,15 ≤ L ≤ 40 D08, 8 ± 1; 3,15 ≤ L ≤ 40	D06, 6 ± 1; 3,15 ≤ L ≤ 40 D08, 8 ± 1; 3,15 ≤ L ≤ 40
	Moisture, M ISO 18134-1, ISO 18134-2	% in mass as received, wet basis	M10 ≤ 10	M10 ≤ 10	M10 ≤ 10
	Ash, A [d] ISO 18122	% in mass dry	A0,7 ≤ 0,7	A1,2 ≤ 1,2	A2,0 ≤ 2,0
	Mechanical durability, DU [e] ISO 17831-1	% in mass as received	DU98,0 ≥ 98,0 for D06 DU97,5 ≥ 97,5 for D08	DU97,5 ≥ 97,5	DU96,5 ≥ 96,5

[a] Negligible levels of glue, grease and other timber production additives used in sawmills during production of timber and timber product from virgin wood are acceptable, if all chemical parameters of the pellets are clearly within the limits and/or concentrations are too small to be concerned with.

[b] Selected size D06 or D08 of pellets to be stated.

[c] Amount of pellets longer than 40 mm may be up to 1 % in mass. Maximum length shall be 45 mm for class A1 and 50 mm for class A2 and class B. Pellets are longer than 3,15 mm, if they stay on a round hole-sieve of 3,15 mm. Amount of pellets shorter than 10 mm, % in mass recommended to be stated.

[d] For household burners and stoves an ash content < 0.5 % in mass is recommended.

[e] At final point of loading in bulk transport (at the time of loading) and in small (up to 20 kg) and big bags (at time of packing).

[f] Type and amount of additives to aid production, delivery or combustion (e.g. pressing aids, slagging inhibitors or any other additives like starch, corn flour, potato flour, vegetable oil, lignin) shall be stated.

[g] It is recommended to state the actual value of bulk density. This is especially important for household burners and stoves with no automatic control of air supply and thus are sensitive to variations in bulk density.

[h] It is recommended to state all characteristic temperatures (shrinkage starting temperature (SST), deformation temperature (DT), hemisphere temperature (HT) and flow temperature (FT)) in oxidizing conditions. Pre-ashing temperature shall be 815 °C.

Table 1 *(continued)*

	Property class Analysis method	**Unit**	**A1**	**A2**	**B**
	Fines, F [e]	% in mass as received	F1,0 ≤ 1,0	F1,0 ≤ 1,0	F1,0 ≤ 1,0
	Additives [f]	% in mass as received	≤ 2 Type and amount to be stated	≤ 2 Type and amount to be stated	≤ 2 Type and amount to be stated
	Net calorific value, Q ISO 18125	MJ/kg or kWh/kg as received	Q ≥ 16,5 or ≥ 4,6	Q ≥ 16,5 or ≥ 4,6	Q ≥ 16,5 or ≥ 4,6
	Bulk density, BD [g], ISO 17828	kg/m^3 as received	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750
	Nitrogen, N ISO 16948	% in mass dry	N0,3 ≤ 0,3	N0,5 ≤ 0,5	N1,0 ≤ 1,0
	Sulfur, S ISO 16994	% in mass dry	S0,04 ≤ 0,04	S0,04 ≤ 0,04	S0,05 ≤ 0,05
	Chlorine, Cl ISO 16994	% in mass dry	Cl0,02 ≤ 0,02	Cl0,02 ≤ 0,02	Cl0,03 ≤ 0,03
	Arsenic, As ISO 16968	mg/kg dry	≤ 1	≤ 1	≤ 1
	Cadmium, Cd ISO 16968	mg/kg dry	≤ 0,5	≤ 0,5	≤ 0,5
	Chromium, Cr ISO 16968	mg/kg dry	≤ 10	≤ 10	≤ 10
	Copper, Cu ISO 16968	mg/kg dry	≤ 10	≤ 10	≤ 10
	Lead, Pb, ISO 16968	mg/kg dry	≤ 10	≤ 10	≤ 10
	Mercury, Hg ISO 16968	mg/kg dry	≤ 0,1	≤ 0,1	≤ 0,1
	Nickel, Ni ISO 16968	mg/kg dry	≤ 10	≤ 10	≤ 10
	Zinc, Zn ISO 16968	mg/kg dry	≤ 100	≤ 100	≤ 100
	Ash melting behaviour [h] ISO 21404	°C	DT ≥ 1 200	DT ≥ 1 100	DT ≥ 1 100
Informative	**Coarse pellet fines, CPF** (3,15 mm ≤ CPF < 5,6 mm) ISO 18846	% in mass	Should be stated	Should be stated	Should be stated
	Particle density, DE ISO 18847[4],	g/cm^3	Should be stated	Should be stated	Should be stated

[a] Negligible levels of glue, grease and other timber production additives used in sawmills during production of timber and timber product from virgin wood are acceptable, if all chemical parameters of the pellets are clearly within the limits and/or concentrations are too small to be concerned with.

[b] Selected size D06 or D08 of pellets to be stated.

[c] Amount of pellets longer than 40 mm may be up to 1 % in mass. Maximum length shall be 45 mm for class A1 and 50 mm for class A2 and class B. Pellets are longer than 3,15 mm, if they stay on a round hole-sieve of 3,15 mm. Amount of pellets shorter than 10 mm, % in mass recommended to be stated.

[d] For household burners and stoves an ash content < 0.5 % in mass is recommended.

[e] At final point of loading in bulk transport (at the time of loading) and in small (up to 20 kg) and big bags (at time of packing).

[f] Type and amount of additives to aid production, delivery or combustion (e.g. pressing aids, slagging inhibitors or any other additives like starch, corn flour, potato flour, vegetable oil, lignin) shall be stated.

[g] It is recommended to state the actual value of bulk density. This is especially important for household burners and stoves with no automatic control of air supply and thus are sensitive to variations in bulk density.

[h] It is recommended to state all characteristic temperatures (shrinkage starting temperature (SST), deformation temperature (DT), hemisphere temperature (HT) and flow temperature (FT)) in oxidizing conditions. Pre-ashing temperature shall be 815 °C.