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

**Part 7:
Graded non-woody briquettes**

*Biocombustibles solides — Classes et spécifications des
combustibles —*

Partie 7: Classes de briquettes d'origine agricole



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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).

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 17225-7:2014), which has been technically revised. The main changes compared to the previous edition are as follows:

- [Figure 1](#) changed;
- Class A is split into two classes, A1 and A2;
- Chlorine value changed in Class A2;
- Arsenic value changed in Class B;
- Ash melting behaviour added as an informative property.

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 will also facilitate authority permission procedures and reporting.

This document supports the use of graded non-woody briquettes in specially designed appliances for residential, small commercial and public building applications and industrial use.

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.

Non-woody briquettes have high ash, chlorine (Cl), nitrogen (N), sulfur (S) and major element contents, so non-woody briquettes are recommended to be used in appliances, which are specially designed or adjusted for this kind of briquettes.

In general, non-woody biomass materials have higher content of ash forming elements and produces ashes with lower melting temperature compared to most woody biomass. Be aware that different growing and soil conditions of the herbaceous or fruit biomass may influence the fuel ash composition differently depending on growth and soil conditions. This may result in fouling, slagging and corrosion inside boilers. These problems are especially related to materials that have high content of potassium (K) and silicate (Si) and low content of calcium (Ca). The content of chlorine (Cl), phosphorous (P) and potassium (K) in the material may form chlorides and phosphates and other chemical compounds resulting in high hydrochloric emissions and chemically active ash causing corrosion. Special attention should be paid to the risk of corrosion in small and medium scale boilers and flue gas systems. Blending with woody biomass can improve the combustion characteristics.

NOTE 1 Briquettes produced according to this document can 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 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.

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Solid biofuels — Fuel specifications and classes —

Part 7: Graded non-woody briquettes

1 Scope

This document determines the fuel quality classes and specifications of graded non-woody briquettes. This document covers only non-woody briquettes produced from the following raw materials (see ISO 17225-1:2021, Table 1):

- 2 Herbaceous biomass
- 3 Fruit biomass
- 4 Aquatic biomass
- 5 Biomass blends and mixtures

NOTE 1 Herbaceous biomass originates from plants that have a non-woody stem and which die back at the end of the growing season. It includes grains or seeds crops from food production or processing industry and their by-products such as cereals.

NOTE 2 Blends and mixtures include blends and mixtures from the main origin-based solid biofuel groups woody biomass, herbaceous biomass, fruit biomass and aquatic biomass.

Blends are intentionally mixed biofuels, whereas mixtures are unintentionally mixed biofuels. The origin of the blend and mixture is to be described using ISO 17225-1:2021, Table 1.

If solid biofuel blend or mixture contains chemically treated material it shall be stated.

NOTE 3 Thermally treated biomass briquettes (e.g. torrefied briquettes) are not included in the scope of this document.

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 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 — Part 1 — General requirements*

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 18847, *Solid biofuels — Determination of particle density of pellets and briquettes*

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 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 briquette

densified biofuel made with or without additives in pre-determined geometric form with at least two dimensions of more than 25 mm, produced by compressing 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 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.

3.5 non-woody biomass

biomass originating from herbaceous, fruit or aquatic biomass as well as blends or mixtures of woody and non-woody biomass

3.6 non-woody briquette

biofuel briquette ([3.2](#)) made from non-woody biomass ([3.5](#))

4 Symbols and abbreviated terms

<i>A</i>	Designation for ash content, A_d on dry basis [% in mass]
<i>ar</i>	as received
<i>D</i>	Designation for diameter as received, D [mm]
<i>d</i>	dry (dry basis)
<i>DE</i>	Designation for particle density as received [g/cm^3]
<i>L</i>	Designation for length as received, L [mm]
<i>M</i>	Designation for moisture content as received on wet basis, M_{ar} [% in mass]
<i>Q</i>	Designation for net calorific value as received, $q_{p,net,ar}$ [MJ/kg or GJ/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 or GJ/t). 1 g/cm³ equals 1 kg/dm³. 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. 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 non-woody briquettes

The specification of the non-woody briquettes is stated in accordance with Table 1 and Figure 1.

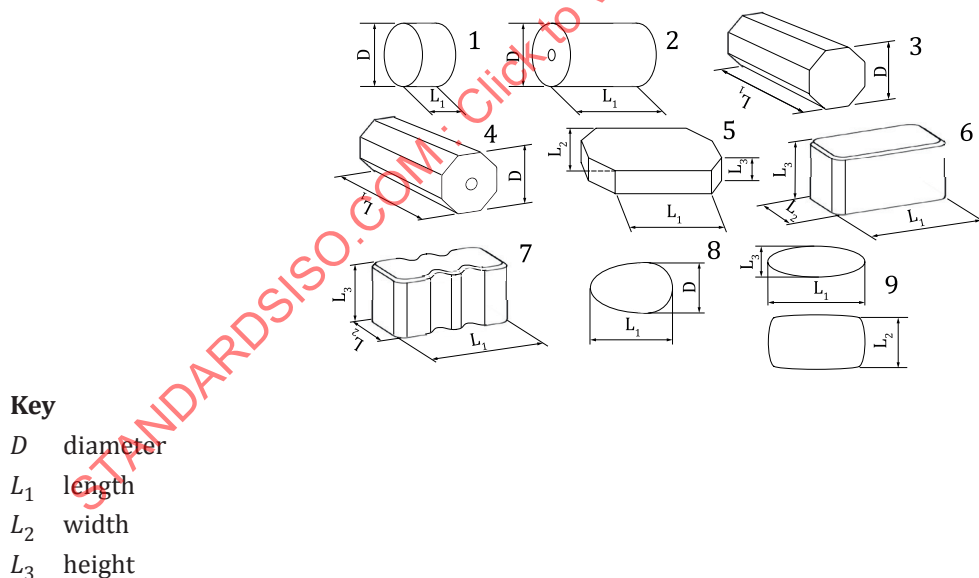


Figure 1 — Dimensions of briquettes

The documents listed in Clause 2 shall be used for the sampling (ISO 18135 or ISO 21945), sample preparation (ISO 14780) and analysis of the properties of solid biofuels.

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 the soil (e.g. coal slag heaps) or if planting has been used specifically for the sequestration of chemicals or biomass is fertilised by sewage sludge (originating 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. In case of raw materials belonging to 2.2.2 and 3.2.2 chemically treated herbaceous and fruit biomass according to ISO 17225-1:2021, Table 1 the actual origin of the raw material shall be clearly described.

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:

- 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.

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

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

Table 1 — Specification of graded non-woody briquettes

	Property class, Analysis method	Units	A1 ^b	A2	B
Normative	Origin and source ^a , ISO 17225-1:2021, Table 1		2 Herbaceous biomass 3 Fruit biomass 4 Aquatic biomass 5 Blends and mixtures		
	Diameter (D) or length (L₁), width (L₂) and height (L₃), According Figure 1	mm	Dimensions according to Figure 1 to be stated		
		Shape	Specify shape according to Figure 1 e.g. 1 or 2, etc.		
	Moisture, M , ISO 18134-1, ISO 18134-2	% in mass as received, wet basis	M12 ≤ 12	M12 ≤ 12	M15 ≤ 15
	Ash, A , ISO 18122	% in mass, dry	A3,0 ≤ 3	A6,0 ≤ 6	A10,0 ≤ 10
	Particle density, DE , ISO 18847	g/cm ³ as received	DE0,9 ≥ 0,9	DE0,9 ≥ 0,9	DE0,6 ≥ 0,6
	Additives ^c	% in mass as received	≤ 5 Type and amount to be stated	≤ 5 Type and amount to be stated	≤ 5 Type and amount to be stated
	Net calorific value, Q , ISO 18125	MJ/kg or kWh/kg as received	Q14,5 ≥ 14,5 or Q4,0 ≥ 4,0	Q14,5 ≥ 14,5 or Q4,0 ≥ 4,0	Q14,5 ≥ 14,5 or Q4,0 ≥ 4,0
	Nitrogen, N , ISO 16948	% in mass, dry	N1,5 ≤ 1,5	N1,5 ≤ 1,5	N2,0 ≤ 2,0
	Sulfur, S , ISO 16994	% in mass, dry	S0,20 ≤ 0,20	S0,20 ≤ 0,20	S0,30 ≤ 0,30
	Chlorine, Cl , ISO 16994	% in mass, dry	Cl0,10 ≤ 0,10	Cl0,20 ≤ 0,20	Cl0,30 ≤ 0,30
	Arsenic, As , ISO 16968	mg/kg dry	≤ 1,0	≤ 1,0	≤ 1,5
	Cadmium, Cd , ISO 16968	mg/kg dry	≤ 0,5	≤ 0,5	≤ 0,5
	Chromium, Cr , ISO 16968	mg/kg dry	≤ 50	≤ 50	≤ 50
	Copper, Cu , ISO 16968	mg/kg dry	≤ 20	≤ 20	≤ 20
	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

^a To be stated the 4-digit classification (ISO 17225-1:2021, Table 1). Blends and mixtures can include also woody biomass. If composition of blend is known, the % in mass can be used to specifying blends. Example 1: 80 % in mass 2.1.1.2 Straw, 20 % in mass 2.1.2.2 Grasses, straw parts. In the case of mixture, the main component should be stated first. Example 2: 2.1.1.2 Straw, 2.1.2.2 Grasses, straw parts.

^b It is recommended to blend woody biomass to achieve the limits of Class A1. Class A1 is recommended for residential use.

^c Type and amount of additive(s) 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.

^d It is recommended that all characteristic temperatures (shrinkage starting temperature (SST), deformation temperature (DT), hemisphere temperature (HT) and flow temperature (FT)) in oxidizing conditions should be stated Pre-ashing temperature is 550 °C.^[8]