

BS EN ISO 17225-1:2014



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Solid biofuels — Fuel specifications and classes

Part 1: General requirements

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PTI/17, Solid biofuels.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Solid biofuels - Fuel specifications and classes - Part 1: General requirements (ISO 17225-1:2014)

Biocombustibles solides - Classes et spécifications des combustibles - Partie 1: Exigences générales (ISO 17225-1:2014)

Feste Biobrennstoffe - Brennstoffspezifikationen und -klassen - Teil 1: Allgemeine Anforderungen (ISO 17225-1:2014)

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN ISO 17225-1:2014) has been prepared by Technical Committee ISO/TC 238 “Solid biofuels” in collaboration with Technical Committee CEN/TC 335 “Solid biofuels” the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2014, and conflicting national standards shall be withdrawn at the latest by November 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14961-1:2010.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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Endorsement notice

The text of ISO 17225-1:2014 has been approved by CEN as EN ISO 17225-1:2014 without any modification.

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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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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 and to serve as a tool to enable efficient trading of biofuels and 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.

The ISO 17225 series is made for all stakeholders.

Solid biomass covers organic, non-fossil material of biological origin which may be used as fuel for heat and electrical generation.

[Figure 1](#) describes the bioenergy utilization chain from sources of biomass, to biofuel production to final use of bioenergy. Although biomass can be used for energy generation it has many other primary uses (non-fuels) as a raw material for construction, furniture, packaging, paper products, etc.

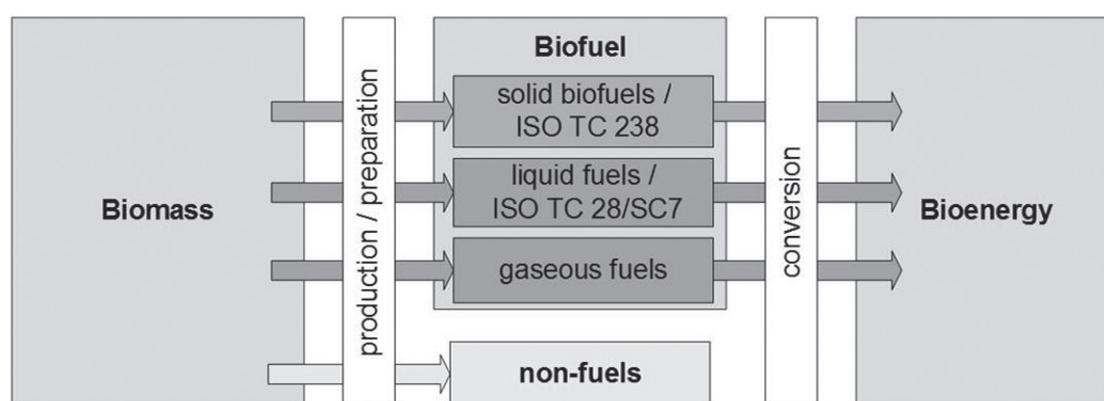


Figure 1 — ISO TC 238 within the biomass — Biofuel — Bioenergy field

The classifications given in this International Standard are provided with the objective of using biomass as a solid biofuel and therefore do not deal with all other uses.

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.

In these product standards, graded means that solid biofuel is used either in commercial applications, such as in households and small commercial and public sector buildings or industrial applications, which demand the use of fuels with specified quality (properties) expressed by quality classes like A1, A2 or B.

Solid biofuels — Fuel specifications and classes —

Part 1: General requirements

1 Scope

This part of ISO 17225 determines the fuel quality classes and specifications for solid biofuels of raw and processed materials originating from

- a) forestry and arboriculture;
- b) agriculture and horticulture;
- c) aquaculture.

Chemically treated material may not include halogenated organic compounds or heavy metals at levels higher than those in typical virgin material values (see [Annex B](#)) or higher than typical values of the country of origin.

NOTE Raw and processed material includes woody, herbaceous, fruit, aquatic biomass and biodegradable waste originating from above sectors.

2 Normative references

The following referenced 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 16967, *Solid biofuels — Determination of major elements*³⁾

ISO 16968, *Solid biofuels — Determination of minor elements*⁴⁾

ISO 16993, *Solid biofuels — Conversion of analytical results from one basis to another*⁵⁾

ISO 16994, *Solid biofuels — Determination of total content of sulfur and chlorine*⁶⁾

ISO 17828, *Solid biofuels — Determination of bulk density*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 17829, *Solid biofuels — Determination of length and diameter for pellets*⁸⁾

ISO 17831-1, *Solid biofuels — Determination of mechanical durability of pellets and briquettes — Part 1: Pellets*⁹⁾

ISO 17831-2, *Solid biofuels — Determination of mechanical durability of pellets and briquettes — Part 2: Briquettes*¹⁰⁾

ISO 18122, *Solid biofuels — Determination of ash content*¹¹⁾

ISO 18123, *Solid biofuels — Determination of the content of volatile matter*¹²⁾

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*¹³⁾

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified method*¹⁴⁾

3 Terms and definitions

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

3.1 chemical treatment

any treatment with chemicals other than air, water or heat

Note 1 to entry: Examples of chemical treatments are listed in informative [Annex C](#).

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.

8) To be published.

9) To be published.

10) To be published.

11) To be published.

12) To be published.

13) To be published.

14) To be published.

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>daf</i>	dry, ash-free
<i>ar</i>	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]
C	Designation for fixed carbon on dry basis C_f [w-%]
D	Designation for diameter as received, D [mm]
DE	Designation for particle density as received [g/cm ³]
DU	Designation for mechanical durability as received [w-%]
E	Designation for energy density as received, E_{ar} [MJ/m ³ or kWh/m ³ loose or stacked volume] (amount of energy/volume unit)
F	Designation for amount of fines as received [w-%]
L	Designation for length as received L [mm]
M	Designation for moisture content as received on wet basis, M_{ar} [w-%]
P	Designation for particle size distribution on analysis moisture basis
$q_{V,gr,d}$	Gross calorific value at constant volume on dry basis [MJ/kg or kWh/kg]
$q_{p,net,d}$	Net calorific value at constant pressure on dry basis [MJ/kg or kWh/kg]
Q	Designation for net calorific value as received, $q_{p,net,ar}$ [MJ/kg or kWh/kg or MWh/t] at constant pressure
U	Designation for moisture content as received on dry basis U_{ar} [w-%]
VM	Designation for volatile matter on dry basis [w-%]

NOTE 1 Fixed carbon (%) is calculated by the following: 100 - [moisture (w-%) + ash (w-%)+volatile matter (w-%)]. All percentages are on the same moisture base.

NOTE 2 1 MJ/kg equals 0,277 8 kWh/kg (1 kWh/kg equals 1 MWh/t and 1 MWh/t is 3,6 MJ/kg). 1 g/cm³ equals 1 kg/dm³. 1 mg/kg equals 0,000 1 % or 1 ppm.

NOTE 3 Designation symbols are used in combination with a number to specify property levels in Tables 3 to 16. 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 Principle

Solid biofuels are specified by:

- a) origin and source, [Clause 6](#);

b) major traded forms and properties, [Clause 7](#).

For specification of origin and source, see [Table 1](#). For major traded forms, see [Table 2](#).

For specification of properties see [Tables 3 to 15](#). The major traded forms of solid biofuels are covered by [Tables 3 to 15](#). [Table 16](#) is a general master table to be used for a specification of solid biofuels not covered by [Tables 3 to 15](#).

[Tables 3 to 16](#) list the normative properties, which shall be specified and informative properties, which are voluntary. Normative properties vary depending on both origin and traded form.

EXAMPLE OF SPECIFICATION

Origin: Logging residues (1.1.4)

Traded form: Wood chips

Properties: Dimensions P45, Moisture M40, Ash A1.5

In the case of wood chips ([Table 5](#)) the properties of dimensions, moisture and ash are normative in the specification. Other properties are informative.

Product standards for graded solid biofuels are given in other parts of this ISO series.

6 Classification of origin and sources of solid biofuels

6.1 General

The classification is based on the biofuel origin and source. In the hierarchical classification system ([Table 1](#)) the main origin-based solid biofuel groups are:

- a) woody biomass;
- b) herbaceous biomass;
- c) fruit biomass;
- d) aquatic biomass;
- e) blends and mixtures.

Woody biomass is biomass from trees, bushes and shrubs.

Herbaceous biomass is from plants that have a non-woody stem and which die back at the end of the growing season. It includes grains and their by-products such as cereals.

Fruit biomass is biomass from those parts of a plant which are from or hold seeds.

Aquatic biomass is from so called hydrophytic plants or hydrophytes, which are plants that have adapted to living in or on aquatic environments.

If appropriate, also the actual species (e.g. spruce, wheat) of biomass should be stated.

The term “Blends and mixtures” in [Table 1](#) refers to material of various origin within the given box in the classification table and appears on four levels. Blends are intentionally mixed biofuels, whereas mixtures are unintentionally mixed biofuels. The origin of the blend and mixture shall be described using [Table 1](#).

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

The second level of classification in [Table 1](#) describes fuels from different sources within the main groups, primarily stating whether the biomass is a virgin material, a by-product or a residue from the industry.

Groups in [Table 1](#) are further divided into third and fourth level sub-groups. The purpose of [Table 1](#) is to allow the possibility to differentiate and specify biofuel material based on origin with as much detail as needed. With the help of typical values from informative [Annex B](#) information on physical and chemical properties can be deduced.

Examples for classification according to [Table 1](#):

- a) Whole trees without roots from birch (1.1.1.1);
- b) Blend of broad-leaf and coniferous whole trees without roots (1.1.1.1, 1.1.1.2);
- c) Oil palm stem (1.1.3.3);
- d) Logging residues (1.1.4);
- e) Oil palm branches (1.1.4.1);
- f) Logging residues from spruce stands (1.1.4.2);
- g) Sawdust from broad-leaf (1.2.1.1);
- h) Plywood from coniferous (1.2.1.2);
- i) Plywood residues (1.2.2.1);
- j) Grinding dust from furniture industry (1.2.2.1);
- k) Lignin (1.2.2.4);
- l) Construction wood (1.3.1.1);
- m) Pallets (1.3.2.1);
- n) Straw from wheat, barley, oat, rye (2.1.1.2);
- o) Rice husk (2.1.1.4);
- p) Reed canary grass (2.1.2.1);
- q) Bamboo (2.1.2.5);
- r) Grains or seeds crops from food processing industry (2.2.1.1);
- s) Palm kernel or palm shell (3.1.2.3);
- t) Oil palm fruit bunch (3.2.1.2);
- u) Olive residues from olive pressing (3.2.2.4);
- v) Kelp (4.3.2.4);
- w) Blend; 80w-% sawdust from coniferous (1.2.1.2) and 20w-% reed canary grass (2.1.2.1);
- x) Mixture; whole trees without roots from birch (1.1.1.1), whole trees without roots from spruce (1.1.1.2);
- y) Blend; 99w-% sawdust (1.2.1), 1w-% glued wood (glue content of whole mass 0,1w-%) (1.2.2).

Table 1 — Classification of origin and sources of solid biofuels

1. Woody biomass	1.1 Forest, plantation and other virgin wood	1.1.1 Whole trees without roots	1.1.1.1 Broad-leaf 1.1.1.2 Coniferous 1.1.1.3 Short rotation coppice 1.1.1.4 Bushes 1.1.1.5 Blends and mixtures
		1.1.2 Whole trees with roots	1.1.2.1 Broad-leaf 1.1.2.2 Coniferous 1.1.2.3 Short rotation coppice 1.1.2.4 Bushes 1.1.2.5 Blends and mixtures
		1.1.3 Stemwood	1.1.3.1 Broad-leaf with bark 1.1.3.2 Coniferous with bark 1.1.3.3 Broad-leaf without bark 1.1.3.4 Coniferous without bark 1.1.3.5 Blends and mixtures
		1.1.4 Logging residues	1.1.4.1 Fresh/Green, Broad-leaf (including leaves) 1.1.4.2 Fresh/Green, Coniferous (including needles) 1.1.4.3 Stored, Broad-leaf 1.1.4.4 Stored, Coniferous 1.1.4.5 Blends and mixtures
		1.1.5 Stumps/roots	1.1.5.1 Broad-leaf 1.1.5.2 Coniferous 1.1.5.3 Short rotation coppice 1.1.5.4 Bushes 1.1.5.5 Blends and mixtures
		1.1.6 Bark (from forestry operations)	
		1.1.7 Segregated wood from gardens, parks, roadside maintenance, vineyards, fruit orchards and driftwood from freshwater	
		1.1.8 Blends and mixtures	
	1.2 By-products and residues from wood processing industry	1.2.1 Chemically untreated wood by-products and residues	1.2.1.1 Broad-leaf with bark 1.2.1.2 Coniferous with bark 1.2.1.3 Broad-leaf without bark 1.2.1.4 Coniferous without bark 1.2.1.5 Bark (from industry operations)
		1.2.2 Chemically treated wood by-products, residues, fibres and wood constituents	1.2.2.1 Without bark 1.2.2.2 With bark 1.2.2.3 Bark (from industry operations) 1.2.2.4 Fibres and wood constituents
		1.2.3 Blends and mixtures	
	1.3 Used wood	1.3.1 Chemically untreated used wood	1.3.1.1 Without bark 1.3.1.2 With bark 1.3.1.3 Bark
		1.3.2 Chemically treated used wood	1.3.2.1 Without bark 1.3.2.2 With bark 1.3.2.3 Bark
		1.3.3 Blends and mixtures	
	1.4 Blends and mixtures		

Table 1 (continued)

2. Herbaceous biomass	2.1 Herbaceous biomass from agriculture and horticulture	2.1.1 Cereal crops	2.1.1.1 Whole plant 2.1.1.2 Straw parts 2.1.1.3 Grains or seeds 2.1.1.4 Husks or shells 2.1.1.5 Blends and mixtures
		2.1.2 Grasses	2.1.2.1 Whole plant 2.1.2.2 Straw parts 2.1.2.3 Seeds 2.1.2.4 Shells 2.1.2.5 Bamboo 2.1.2.6 Blends and mixtures
		2.1.3 Oil seed crops	2.1.3.1 Whole plant 2.1.3.2 Stalks and leaves 2.1.3.3 Seeds 2.1.3.4 Husks or shells 2.1.3.5 Blends and mixtures
		2.1.4 Root crops	2.1.4.1 Whole plant 2.1.4.2 Stalks and leaves 2.1.4.3 Root 2.1.4.4 Blends and mixtures
		2.1.5 Legume crops	2.1.5.1 Whole plant 2.1.5.2 Stalks and leaves 2.1.5.3 Fruit 2.1.5.4 Pods 2.1.5.5 Blends and mixtures
		2.1.6 Flowers	2.1.6.1 Whole plant 2.1.6.2 Stalks and leaves 2.1.6.3 Seeds 2.1.6.4 Blends and mixtures
		2.1.7 Segregated herbaceous biomass from gardens, parks, roadside maintenance, vineyards and fruit orchards	
		2.1.8 Blends and mixtures	
	2.2 By-products and residues from food and herbaceous processing industry	2.2.1 Chemically untreated herbaceous residues	2.2.1.1 Cereal crops and grasses 2.2.1.2 Oil seed crops 2.2.1.3 Root crops 2.2.1.4 Legume crops 2.2.1.5 Flowers 2.2.1.6 Blends and mixtures
		2.2.2 Chemically treated herbaceous residues	2.2.2.1 Cereal crops and grasses 2.2.2.2 Oil seed crops 2.2.2.3 Root crops 2.2.2.4 Legume crops 2.2.2.5 Flowers 2.2.2.6 Blends and mixtures
		2.2.3 Blends and mixtures	
	2.3 Blends and mixtures		

Table 1 (continued)

3. Fruit biomass	3.1 Orchard and horticulture fruit	3.1.1 Berries	3.1.1.1 Whole berries 3.1.1.2 Flesh 3.1.1.3 Seeds 3.1.1.4 Blends and mixtures	
		3.1.2 Stone/kernel fruits	3.1.2.1 Whole fruit 3.1.2.2 Flesh 3.1.2.3 Stone/kernel/fruit fibre 3.1.2.4 Blends and mixtures	
		3.1.3 Nuts and acorns	3.1.3.1 Whole nuts 3.1.3.2 Shells/husks 3.1.3.3 Kernels 3.1.3.4 Blends and mixtures	
		3.1.4 Blends and mixtures		
	3.2 By-products and residues from food and fruit processing industry	3.2.1 Chemically untreated fruit residues	3.2.1.1 Berries 3.2.1.2 Stone/kernel fruits/fruit fibre 3.2.1.3 Nuts and acorns 3.2.1.4 Crude olive cake 3.2.1.5 Blends and mixtures	
		3.2.2 Chemically treated fruit residues	3.2.2.1 Berries 3.2.2.2 Stone/kernel fruits 3.2.2.3 Nuts and acorns 3.2.2.4 Exhausted olive cake 3.2.2.5 Blends and mixtures	
		3.2.3 Blends and mixtures		
	3.3 Blends and mixtures			
	4. Aquatic biomass	4.1 Algae	4.1.1 Micro algae (latin name to be stated)	
			4.1.2 Macro algae (latin name to be stated)	
4.1.3 Blends and mixtures				
4.2 Water hyacinth				
4.3 Lake and sea weed		4.3.1 Lake weed (latin name to be stated)		
		4.3.2 Sea weed	4.3.2.1 Blue sea weed (latin name to be stated)	
			4.3.2.2 Green sea weed (latin name to be stated)	
			4.3.2.3 Blue-green sea weed (latin name to be stated)	
4.3.2.4 Brown sea weed (latin name to be stated)				
4.3.2.5 Red sea weed (latin name to be stated)				
4.3.3 Blends and mixtures				
4.4 Reeds		4.4.1 Common reed		
		4.4.2 Other reed		
	4.4.3 Blends and mixtures			
4.5 Blends and mixtures				
5 Blends and mixtures	5.1 Blends			
	5.2 Mixtures			

NOTE 1 If appropriate, also the actual species (e.g. spruce, wheat) of biomass may be stated according to EN 13556, *Round and sawn timber — Nomenclature of timbers used in Europe*.^[1]

NOTE 2 Driftwood from saltwater is not recommended as a fuel.

NOTE 3 Group 5 “Blends and mixtures” include blends and mixtures from the main origin-based solid biofuel groups 1 to 4.

6.2 Woody biomass

6.2.1 Forest, plantation and other virgin wood

Forest, plantation and other virgin wood in this group may only have been subjected to size reduction, debarking, drying or wetting. Forest, plantation and other virgin wood includes wood from forests, parks, gardens, plantations and from short rotation forests and coppice.

6.2.2 By-products and residues from wood processing industry

Wood by-products and wood residues from industrial production are classified in this group. These biofuels can be chemically untreated (for example residues from debarking, sawing or size reduction, shaping, pressing) or chemically treated wood residues from wood processing and the production of panels and furniture (glued, painted, coated, lacquered or otherwise treated wood), as long as they do not contain heavy metals or halogenated organic compounds as a result of treatment with wood preservatives or coating.

6.2.3 Used wood

This group includes post consumer/post society wood waste; natural or merely mechanically processed wood, contaminated only to an insignificant extent during use by substances that are not normally found in wood in its natural state (for example pallets, transport cases, boxes, wood packages, cable reels, construction wood). With respect to treatment the same criteria apply as with respect to “wood processing industry by-products and residues”, i.e. the used wood shall not contain heavy metals more than in virgin wood, or halogenated organic compounds as a result of treatment with wood preservatives or coating.

6.2.4 Blends and mixtures

This refers to blends and mixtures of woody biomass in the groups 1.1 to 1.3 in [Table 1](#). The mixing can be either intentional (blends) or unintentional (mixtures).

6.3 Herbaceous biomass

6.3.1 Herbaceous biomass from agriculture and horticulture

Material, which comes directly from the field, perhaps after a storage period, and may only have been subject to size reduction and drying is included here. It covers herbaceous material from agricultural and horticultural fields and from gardens and parks.

6.3.2 By-products and residues from food and herbaceous processing industry

This refers to any herbaceous biomass material that is left over after industrial handling and treatment.

Examples are residues from the production of sugar from sugar beets, barley malt residues from beer production and raw vegetable residues from food processing industry.

6.3.3 Blends and mixtures

This refers to blends and mixtures of herbaceous biomass in the groups 2.1 to 2.2 in [Table 1](#). The mixing can be either intentional (blends) or unintentional (mixtures).

6.4 Fruit biomass

6.4.1 Orchard and horticulture fruit

Fruit from trees, bushes and fruit from herbs (e.g. tomatoes and grapes) are classified in this group.

6.4.2 By-products and residues from food and fruit processing industry

This refers to a fruit biomass material that is left over after industrial handling and treatment.

Examples are pressing residues from olive oil or apple juice production and processed (e.g. heated, steamed, cooked, etc.) vegetable residues from food processing industry.

6.4.3 Blends and mixtures

This refers to blends and mixtures of fruit biomass in the groups 3.1 to 3.2 in Table 1. The mixing can be either intentional (blends) or unintentional (mixtures).

6.5 Aquatic biomass

Aquatic biomasses are divided in to the following main species: algae, water hyacinth, lake and sea weed.

6.6 Biomass blends and mixtures

These include blends and mixtures of different biomasses mentioned above under 6.2 to 6.5. The mixing can be either intentional (blends) or unintentional (mixtures).

7 Specification of solid biofuels based on traded forms and properties

7.1 Traded forms of solid biofuels

Solid biofuels are traded in many different sizes and shapes. The size and shape influence the handling of the fuel as well as its combustion properties. Biofuels may be delivered e.g. in the forms shown in Table 2.

Table 2 — Major traded forms and raw materials of solid biofuels

Fuel name	Typical particle size	Common preparation method
Whole tree (Table 16)	> 500 mm	No preparation or delimbed
Wood chips (Table 5)	5 mm to 100 mm	Cutting with sharp tools
Hog fuel (Table 5)	Varying	Crushing with blunt tools
Stemwood/roundwood (Table 6)	> 100 cm	Cutting with sharp tools
Logwood (Table 6)	50 cm to 100 cm	Cutting with sharp tools
Firewood (Table 6)	5 cm to 100 cm	Cutting with sharp tools
Slabs and offcuts (Table 6 or 16)	Varying	Cutting with sharp tools
Bark (Table 9)	Varying	Debarking residue from trees (shredded or unshredded)
Bundle (Table 16)	Varying	Lengthwise oriented and bound
Fuel powder (Table 16)	< 1 mm	Milling
Sawdust (Table 7)	1 mm to 5 mm	Cutting with sharp tools
Shavings (Table 8)	1 mm to 30mm	Planing with sharp tools
Briquettes (Table 3)	Ø > 25 mm	Mechanical compression
Pellets (Table 4)	Ø ≤ 25 mm	Mechanical compression
Bales (Table 10) Small square bales Big square bales Round bales	0,1 m ³ 3,7 m ³ 2,1 m ³	Compressed and bound to squares Compressed and bound to squares Compressed and bound to cylinders
Chopped straw or energy grass (Table 16)	10 mm to 200 mm	Chopped during harvesting or before combustion

Table 2 (continued)

Fuel name	Typical particle size	Common preparation method
Grain (Table 11 , Table 13) or seed (Table 12 , Table 13)	Varying	No preparation or drying except for process operations necessary for storage for cereal grain
Fruit stones or kernel (Table 12)	5 mm to 15 mm	No preparation or pressing and extraction by chemicals.
Fibre cake (Table 16)	Varying	Prepared from fibrous waste by dewatering
Charcoal (Table 14)	Varying	Charcoal is prepared by the destructive distillation and pyrolysis of biomass.
Thermally treated biomass (Table 15)	Varying	Mild pre-treatment of biomass at a temperature between 200 and 300 °C for a short time period (e.g. 60 min).

NOTE 1 Also other forms may be used.

NOTE 2 The definitions from different traded forms are in accordance with ISO 16559.

Figures in the informative [Annex A](#) describe the particle size differences between different wood fuels and also the difference between wood chips and hog fuel.

7.2 Specification of properties of solid biofuels

The International Standards listed in [Clause 2](#) shall be used for the sampling and determination of properties of solid biofuels. The additional parts of ISO 17225 (e.g. ISO 17225-2, ISO 17225-3, etc.) have been developed to describe graded solid biofuel products. These International product Standards are recommended for smaller scale appliances, such as used in households and small commercial and public sector applications. Pellets, briquettes, wood chips and firewood (log wood) are traded forms commonly used for small-scale applications. ISO 17225-2 also include specifications for graded industrial pellets.

For a specification of a solid biofuel, the denominations given in [Tables 3](#) to [16](#) are normative and informative properties. In [Tables 3](#) to [15](#) solid biofuels are defined by property classes.

When specifying a class within a property, the average numerical value from the whole lot or defined portion from the lot (e.g. shipload, truckload or bag) shall determine which class shall be used. For an example in [Table 5](#), the ash class A3.0 (≤ 3 %) means that the ash content shall not be higher than 3,0 % to belong to this class. For all properties the lowest possible class shall be stated, except for bulk density, particle density and mechanical durability where the highest possible class shall be stated. Only one class shall be specified.

EXAMPLE A fuel with a moisture content of 17 w-% should be categorized as M20 and not M10 or M30.

A general master table ([Table 16](#)) shall be used for solid biofuels not covered by [Tables 3](#) to [15](#).

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 (see [Annex B](#));
- b) calculation of properties, e.g. by using typical values and considering documented specific values;
- c) carrying out of 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 negate the producer or supplier from providing accurate and reliable information.

Conversion of a value on a dry basis (d) to a dry, ash free basis (daf) or to as received basis (ar) is given in ISO 16993.

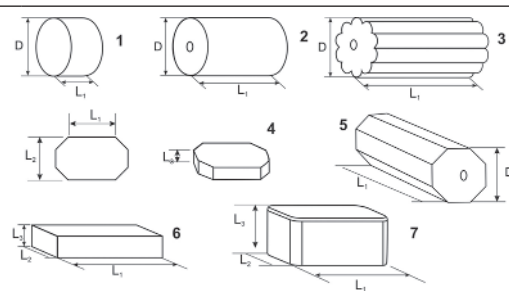
NOTE 1 Typical values for some physical and chemical properties of biofuels are listed in [Annex B](#). These can be used as an indication of the properties when needed, however, they may not be used for the limitation of the fuel parameters.

NOTE 2 It is important to carry out laboratory analysis, if raw material basis is changed.

NOTE 3 For [Tables 3 to 16](#): only chemically treated biomass that are included in the scope, should be considered, i.e. wood waste which can contain halogenated organic compounds or heavy metals more than virgin wood as a result of treatment with wood preservatives or coating, are not included. Examples of chemical treatment are mentioned in [Annex C](#).

NOTE 4 For [Tables 3 to 16](#) is stated that the net calorific value should be specified on as received basis. The net calorific value will vary depending on the actual moisture content in the fuel. The value given in a specification is thus valid only for the actual connected moisture content. The net calorific value as received ($q_{p,net,ar}$, designation Q) can be calculated using both the net calorific value on a dry basis ($q_{p,net,d}$) and the moisture content (see [Annex D](#)).

Table 3 — Specification of properties for briquettes

Master table		
Normative	Origin: According to 6.1 and Table 1	Woody biomass (1); Herbaceous biomass (2); Fruit biomass (3); Aquatic biomass (4); Blends and mixtures (5).
	Traded Form (see Table 2)	Briquette
	Dimensions (mm)	
	Diameter (<i>D</i>) and Length (<i>L</i>)	
	Diameter, height, width and length to be stated <i>L</i> ₁ length, <i>L</i> ₂ width, <i>L</i> ₃ height Specify shape according to Figure 2 e.g. 1 or 2, etc.	 <i>L</i> Length <i>D</i> Diameter Figure 2 — Examples of briquettes
	Moisture, M (w-% as received) ISO 18134-1, ISO 18134-2	
	M10	≤ 10 %
	M12	≤ 12 %
	M15	≤ 15 %
	Ash, A (w-% of dry basis) ISO 18122	
	A0.5	≤ 0,5 %
	A0.7	≤ 0,7 %
	A1.0	≤ 1,0 %
	A1.5	≤ 1,5 %
	A2.0	≤ 2,0 %
	A3.0	≤ 3,0 %
	A5.0	≤ 5,0 %
	A7.0	≤ 7,0 %
	A10.0	≤ 10,0 %
	A10.0+	> 10,0 % (maximum value to be stated)
	Particle density, DE (g/cm ³ as received) ISO 18847	
	DE0.8	≥ 0,8 g/cm ³
	DE0.9	≥ 0,9 g/cm ³
	DE1.0	≥ 1,0 g/cm ³
	DE1.1	≥ 1,1 g/cm ³
	DE1.2+	> 1,2 g/cm ³ (maximum value to be stated)
	Additives ^a (w-% of pressing mass)	Type and content of pressing aids, slagging inhibitors or any other additives have to be stated
	Net calorific value, Q (MJ/kg or kWh/kg as received) ISO 18125	Minimum value to be stated ^b