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- **All EN standards (except EN15234) have been replaced by EN ISO standards**
- **EN ISO 16559 lists the terminology, definitions and descriptions for solid biofuels**
- **EN ISO 17225 defines the fuel specifications and classes for solid biofuels**
- **EN 15234 defines the standards on quality assurance for individual solid biofuels**
- **Many EN ISO standards have now been revised and updated.**

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## Review of worldwide standards for solid biofuels, revised April 2021

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### Introduction

There has been a substantial increase in the amount of biomass being used for energy in Europe and other parts of the world. As trade between countries and continents becomes more widespread, it is necessary to create international standards to facilitate buying and selling biomass fuels.

It all started in year 2000 when the European standardisation organisation, CEN got a mandate from the European Commission to develop standards for solid biofuels, under Technical Committee (TC) 335 Solid Biofuels. After CEN completed most of the work to create European standards, a decision was made to move these standards to a worldwide level using ISO, the International Organization for Standardization, which develops and publishes international standards. This work is being taken forward by a new Technical Committee: ISO TC 238. It comprises experts from Europe involved in the CEN process, with additional participation from US, Canada and Asian countries. TC 238 has taken the existing European standards as the basis for the ISO standards.

All the ISO standards within TC 238 are developed under the so-called Vienna Agreement, meaning that all standards developed, will also become European Standards (ENs). New EN ISO standards will replace existing EN standards.

Solid biofuel covers many fuels including woody biomass (chips, hogfuel, firewood, wood pellets, briquettes), herbaceous biomass (straw, grass, miscanthus etc.), fruit biomass (olive stones, cherry pips, grape waste, nut shells etc.), aquatic biomass (algae, seaweeds), as well as a group called “blends and mixtures”. Solid biofuel excludes all animal-based biomass (manure, meat and bone meal and such-like materials); these fuels will be dealt with by other standardisation committees. (Demolition timber is classified as hazardous waste and is not included in the solid biofuel category).

From a working document (WD) the standard is developed into a Committee Draft (CD). The CD is then put up for balloting to become a Draft International Standard (DIS). Comments received during the ballot are then incorporated in the Final Draft International Standard (FDIS). At this stage only editorial comments can be made, which are then considered before the standard is finally published.

During the process, drafts are not available to the general public. Input is confined to experts working on the drafts and the national mirror committees, which discuss the drafts at country level. The national mirror committees consists of representatives

For information and a free on-line advisory service on the wood energy supply chain, the quality of wood fuels and internal handling visit [www.woodenergy.ie](http://www.woodenergy.ie)

from the concerned sector, which in Ireland means sawmills, producers of firewood, wood pellets, wood chips and other woodworking industries.

EN ISO standards are published as national standards, meaning that they get an I.S. number for Ireland. Once issued any prior national or international standards dealing with the same topic are withdrawn.

There is no obligation to use ENs, but in contracts it can be very useful to refer to them to ensure everyone knows what is being referred to and how it is measured. Using the quality standards for the specific wood fuels assures that the fuels are of high and consistent quality.

TC238 Solid Biofuels has produced a long list of standards either published or under development (see [www.woodenergy.ie](http://www.woodenergy.ie) for the latest updated list). The list contains standards on many different aspects of solid biofuels, such as taking samples, sample preparation, determination of chemical properties (macro and micronutrients, heavy metals etc.), and physical properties (moisture content, size distribution, bulk density, durability etc.), as well as definitions and quality requirements. Standards on safety and health have been published (safe storage of pellets) and are under development (such as on self ignition, dust explosion, fungal spores etc).

For producers and consumers, the most relevant standards are likely to be those on terminology (EN ISO 16559), on specifications and requirements (EN ISO 17225), and on quality assurance (EN 15234). The terminology standard defines all the terms that are being used. The specifications and requirements standard defines the quality of solid biofuels, and the one on quality assurance enables a system to be put in place to assure the consumer about the quality of fuel being purchased. Most of the other standards will be of direct interest to testing laboratories, either to document fuel quality for producers or where a dispute arises between buyer and seller.

In the ISO Technical Committee, work on updating the European quality assurance standard has come to a halt, so the existing EN 15234 standard will continue until further notice.

Five years after publication all standards come up for automatic revision to see if they are still relevant and adequate. Many of the early EN ISO standards have been revised. The members of the TC are asked if they think the standard should be revised or not. Most EN ISO standards will be revised, but the revision on the EN standard on quality assurance was not accepted, so it will continue in the present shape until the next automatic revision. It is also possible that standards can be revised earlier if they are found to be inadequate or changes in the trade or use have occurred that necessitate a revision earlier than after 5 years.

When referring to standards in contracts, one should mention the year of publication, so that one knows which version of the standard is being referred to. In other cases, it is more

prudent to refer to the undated version of the standard, which means that it should be the latest available version.

In the following review, tables have been abridged in comparison to the original text of the standard, so if one wants to use these tables as a reference for any purpose, the original tables from the complete standards should be used.

All standards can be bought from the National Standards Authority of Ireland ([www.nsai.ie](http://www.nsai.ie)) or directly from ISO ([www.iso.org/store.html](http://www.iso.org/store.html)). When ordering standards, remember to look for or ask for the latest version or update.

## Useful standards for producers and consumers

For producers as well as consumers of wood fuels, three standards are of most interest:

EN ISO 16559 Solid Biofuels - Terminology, definitions and descriptions

EN ISO 17225 Solid Biofuels - Fuel specifications and classes, parts 1-9

EN 15234 Solid Biofuels - Fuel quality assurance, parts 1-6

Both EN ISO 17225 and EN 15234 are comprised of several parts: part 1 gives the general requirements; other parts are specific for fuels to be used by relatively small-scale users (non-industrial applications). In the standards, the limit is drawn at boilers with a capacity of 1 MW. All boilers above that size are considered “industrial”, those below are “non-industrial”. In the EN ISO standards the concept of “non industrial and industrial” has been abandoned in favour of the term “Graded biofuels”.

### EN ISO 16559 Solid biofuels – Terminology, definitions and descriptions

This standard defines many words and terms used in the standards, including:

- Wood chips: chipped woody biomass with a sub rectangular shape and a typical length 5 mm to 50 mm typically in the form of pieces with a defined particle size produced by mechanical treatment with sharp tools such as knives
- Hogfuel: fuelwood that has pieces of varying size and shape, produced by crushing with blunt tools such as rollers, hammers, or flails
- Wood pellets: densified biofuel made with or without additives 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
- Wood briquette: densified biofuel made with or without additives in pre-determined geometric form with at least two diameters of more than 25 mm, produced by compressing biomass

- Firewood: cut, and usually split fuelwood usually with a length of 20 to 100 cm used in household appliances like stoves, fireplaces and central heating devices.

This standard has been revised. Several terms have been deleted because they had become obsolete, and many new terms have been added. Many terms have been revised in their definition. The revised standard will be published early 2022.

### **EN ISO 17225 Solid Biofuels – Fuel specifications and classes**

The following parts have been published:

- 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
- part 8 Graded thermally treated and densified biomass fuels (Technical Specification)
- part 9 Graded hog fuel and wood chips for industrial use (Has been published as Technical Specification, but will be upgraded soon to a full standard)

EN ISO 17225 is the most interesting and important standard produced by TC238, because it describes the origin of the fuel, the traded form, and for each fuel gives a list of properties and the classes into which these properties are divided. In Part 1, general requirements, quality demands are not formulated as such, but for each property a list of classes is given and how each class is delimited. In Parts 2 to 9, quality classes are given for specific fuels (like wood pellets, briquettes, wood chips, firewood, non woody pellets, non woody briquettes, thermally treated wood and hog fuel) and the criteria which that fuel must comply with to belong to a given quality class.

In delivery contracts for wood fuels, it was often difficult to describe what kind of wood was and was not permitted. The new standard better addresses this issue.

All parts of ISO 17225 have been revised and the latest version has been published in 2020 or will be published in 2021.

## **Part 1 General requirements**

Table 1 of the standard allows for the origin of the solid biofuel to be clearly specified. In the first column the main groups of solid biofuels are given: woody biomass, herbaceous biomass (grass, straw, miscanthus, reed canary grass etc), fruit biomass (kernels, stones, husks etc), aquatic biomass (algae and seaweeds) and then “blends and mixtures” group. The other columns allow the origin of the fuel to be provided in increasing detail.

Since this publication concerns itself only with woody biomass, only the classification of woody biomass is given in detail. For the other materials, please see the full standard

**Table 1: Classification of origin and sources of woody solid biomass**

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 Broadleaf 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 garden, park, roadside maintenance, vineyards and 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 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) <sup>a</sup>
		1.2.2 Chemically treated wood 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) <sup>a</sup>
			1.2.2.4 Fibres and wood constituents
		1.2.3 Blends and mixtures	
	1.3 Used wood	1.3.1 Chemically untreated wood	1.3.1.1 Without bark
			1.3.1.2 With bark
			1.3.1.3 Bark <sup>a</sup>
		1.3.2 Chemically treated wood	1.3.2.1 Without bark
			1.3.2.2 With bark
			1.3.2.3 Bark <sup>a</sup>
		1.3.3 Blends and mixtures	
	1.4 Blends and mixtures		

Table 2 explains the shape in which biomass can be traded, the main dimensions and how the material is commonly processed.

**Table 2: Major traded forms of solid biomass**

<b>Fuel name</b>	<b>Typical particle size</b>	<b>Common preparation method</b>
Whole tree	> 500 mm	No preparation or delimbed
Wood chips	5 to 100 mm	Cutting with sharp tools
Hog fuel	Varying	Crushing with blunt tools
Stemwood/roundwood	>100 cm	Cutting with sharp tools
Logwood	50 to 100 cm	Cutting with sharp tools
Firewood	5 to 100 cm	Cutting with sharp tools
Slabs and offcuts	Varying	Cutting with sharp tools
Bark	Varying	Debarking residue from trees Can be shredded or unshredded
Bundle	Varying	Lengthways oriented & bound
Fuel powder	< 1 mm	Milling
Sawdust	1 to 5 mm	Cutting with sharp tools
Shavings	1 to 30mm	Planing with sharp tools
Briquettes	$\varnothing \geq 25$ mm	Mechanical compression
Pellets	$\varnothing < 25$ mm	Mechanical compression
Bales Small square bales	0.1 m <sup>3</sup>	Compressed and bound into squares
Big square bales Round bales	3.7 m <sup>3</sup> 2.1 m <sup>3</sup>	Compressed and bound into squares Compressed and bound into cylinders
Chopped straw or energy grass	10 to 200 mm	Chopped during harvesting or before combustion
Grain or seed	Varying	No preparation or drying except for process operations necessary for storage for cereal grain
Fruit stones or kernel	5 to 15 mm	No preparation or pressing and extraction by chemicals
Fibre cake	Varying	Prepared from fibrous waste by dewatering
Charcoal	Varying	Charcoal is prepared by destructive distillation and pyrolysis of biomass
Thermally treated biomass	Varying	Mild pre-treatment of biomass at a temperature between 200- 300 °C for a short time period (e.g. 60 minutes)

Tables 1 and 2 are followed by thirteen product-specific tables, listing the properties of the particular solid biomass. If a fuel is not listed as one of the 13 specific fuels, a final table of properties can be used for general application. An overview of the wood fuel tables is provided in Table 3 specifying properties for each of the main wood fuels and whether these properties are normative or informative.

If a property is normative, it means that the information has to be made available; if it is informative, the information may be given. In some cases where the base material may have been treated chemically, some properties change from informative to normative.

**Table 3: Overview of properties for four wood fuels**

Property	Property abbreviation	Wood briquettes	Wood pellets	Wood chips/hogfuel	Firewood
Origin		norm	norm	norm	norm
Traded form		norm	norm	norm	norm
Wood species		NA	NA	NA	norm
Dimensions	D or P	norm (D, L and W), shape	norm (D and L)	norm (P)	norm (D, L)
Moisture content	M	norm	norm	norm	norm
Ash content	A	norm	norm	norm	NA
Mechanical durability	DU	NA	norm	NA	NA
Amount of fines	F	NA	norm	norm	NA
Bulk density	BD	norm	norm	norm	NA
Additives		norm	norm	NA	NA
Net calorific value	Q	norm	norm	inform	inform
Nitrogen content	N	norm	norm	norm/inform	NA
Sulphur content	S	norm	norm	norm/inform	NA
Chlorine content	Cl	norm	norm	norm/inform	NA
Arsenic	As	norm	norm	norm/inform	NA
Cadmium	Cd	norm	norm	norm/inform	NA
Chromium	Cr	norm	norm	norm/inform	NA
Copper	Cu	norm	norm	norm/inform	NA
Lead	Pb	norm	norm	norm/inform	NA
Mercury	Hg	norm	norm	norm/inform	NA
Nickel	Ni	norm	norm	norm/inform	NA
Zinc	Zn	norm	norm	norm/inform	NA
Ash melting behaviour	DT	NA	inform	inform	NA
Surface area of briquettes		inform	NA	NA	NA

Norm: normative, has to be stated  
 Inform: informative, may be stated  
 Norm/inform: has to be stated if base material is chemically treated, otherwise informative  
 NA: not applicable

In all cases, a range of classes is given for each property. For example, for moisture content the range starts with M10, which means that the product should contain less than 10% moisture. The range then extends in 5% classes from M10 to M55+. M55+ means that the moisture content is higher than 55%, and in such cases the maximum value should be stated. In Table 4 an example is given showing how one could define the wood chip quality requirements for a certain boiler.

**Table 4: Example of quality requirements for wood chips class A1 for a small boiler**

Property	Class	Explanation
Origin	1.1.1.1	Woody biomass, from forest or plantation wood, from whole trees without roots, from broad-leaf trees
Traded form	Wood chips	Cut with sharp instruments
Dimensions	P16S	Chip particles of which 60% will fall through a screen of 16 mm round holes, with maximum 15% fines (less than 3.15 mm in size) and < 6% > 31.5 mm and all < 45 mm
Moisture content	M10-M25	Fuel with a moisture content of between 10 and 25% of total weight
Ash content	A1.0	Fuel with an ash content of less than 1% on dry basis
Bulk density	BD150-BD250	Bulk density of the loose chips to be larger than 150 kg/m <sup>3</sup> loose volume and less than 250 kg/m <sup>3</sup> at the moisture content as received
Net calorific value	Q	Can be calculated from the moisture content
Chemical content		Does not have to be specified since the fuel comes from a virgin source



Parts 2-9 of EN ISO 17225 have been formulated for the so-called non-industrial market, meaning for those boilers with a capacity of less than 1 MW. The quality classes have been formulated for typical boilers within that range. The quality classes should make it easier for boiler manufacturers and installers, consumers and suppliers to have the right quality fuel for such boilers. Complicated descriptions using different words and meanings can thus be avoided. In some of the parts also quality requirements for industrial use of the fuel have been included, such as for wood pellets and for industrial hog fuel and wood chips.

In all the parts dealing with non-industrial boilers several quality classes have been formulated, usually with two A class fuels (A1 and A2) and one or two B class fuels. The quality requirements for the A class are always higher than for the B class.

## Part 2: Graded wood pellets

For wood pellets stringent quality requirements have been formulated:

- for stoves and small boilers class A pellets,
- for larger boilers up to 1 MW, class B pellets with slightly lower quality requirements

The standard also includes a second table which defines the quality requirements for wood pellets for industrial use, which have the denomination I1 to I3.

Important properties of wood pellets are the origin of the base material, the dimensions, the ash content, the durability, the amount of fines and the chlorine content.

A1 class pellets have to be produced from either sawdust or from debarked roundwood. These materials have a low chemical content. Pellets in the A2 class may be produced from materials containing bark, while B class pellets may also contain by-products from board and paper mills as well as clean, used wood.

Since most stoves or small boilers do not have automatic de-ashing, it is important that the ash content of wood pellets is as low as possible. With low ash content, one should only have to remove the ash once a week. So for Class A1 and A2 there is a low ash content, while for class B, which is meant for larger boilers with automatic de-ashing, a higher ash content can be tolerated.

Pellets endure a lot of wear from the moment they are produced until they arrive in the boiler. Wear produces fines, which have a different burning characteristic to whole pellets. If the fines content gets too large, the boiler will burn hotter than usual, and the ash may form clinker. Therefore, pellet durability should in general be in excess of 97.5%, meaning that the pellets can withstand normal handling. For class A1 pellets of 6 mm diameter the requirements is a durability of 98%.

The chlorine content of the wood pellets is important, because the risk of corrosion increases with an increased amount of chlorine in the pellets.

Table 5 shows the requirements for wood pellets for small scale applications in an abbreviated form.

**Table 5: Quality requirements for wood pellets for small scale use (status 2021)**

	Property class, Analysis method	Unit	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 Forest, plantation and other virgin wood 1.2 By-products and residues from wood processing industry 1.3.1 Chemically untreated used wood
	<b>Diameter, D and Length L</b> ISO 17829	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
	<b>Moisture, M</b> , ISO 18134-1, ISO 18134-2	% in mass as received, wet basis	M10 ≤ 10	M10 ≤ 10	M10 ≤ 10
	<b>Ash, A</b> , ISO 18122	% in mass dry	A0.7 ≤ 0.7	A1.2 ≤ 1.2	A2.0 ≤ 2.0
	<b>Mechanical durability</b> , DU, 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
	<b>Fines, F</b> , ISO 5730	% in mass as received	F1.0 ≤ 1.0	F1.0 ≤ 1.0	F1.0 ≤ 1.0
	<b>Additives</b>	% 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
	<b>Net calorific value, Q</b> , 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
	<b>Bulk density, BD</b> , ISO 17828	kg/m <sup>3</sup> as received	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750
	<b>Ash melting behaviour</b> , ISO 21404	°C	DT ≥ 1 200	DT ≥ 1 100	DT ≥ 1 100

There is a corresponding table for wood pellets for industrial use (Table 6).

**Table 6: Quality requirements for wood pellets for industrial use (status 2021).**

	Property class, Analysis method	Unit	I1	I2	I3
Normative	Origin and source, ISO 17225-1		1.1 Forest, plantation and other virgin wood 1.2.1 Chemically untreated wood residues a	1.1 Forest, plantation and other virgin wood 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 and Length L, ISO 17829	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 D10, 10 ± 1; 3.15 ≤ L ≤ 40 D12, 12 ± 1; 3.15 ≤ L ≤ 40	D06, 6 ± 1; 3.15 ≤ L ≤ 40 D08, 8 ± 1; 3.15 ≤ L ≤ 40 D10, 10 ± 1; 3.15 ≤ L ≤ 40 D12, 12 ± 1; 3.15 ≤ L ≤ 40
	Moisture, M, ISO 18134-1, ISO 18134-2	w-% as received, wet basis	M10 ≤ 10	M10 ≤ 10	M10 ≤ 10
	Ash, A, ISO 18122	w-% dry	A1.0 ≤ 1.0	A1.5 ≤ 1.5	A3.0 ≤ 3.0
	Mechanical durability, DU, ISO 17831-1	w-% as received	97.5 ≤ DU ≤ 99.0	97.0 ≤ DU ≤ 99.0	96.5 ≤ DU ≤ 99.0
	Fines, F, ISO 5730	% in mass as received	F4.0 ≤ 4.0	F5.0 ≤ 5.0	F6.0 ≤ 6.0
	Additives	% in mass as received	< 3 Type and amount to be stated	< 3 Type and amount to be stated	< 3 Type and amount to be stated
	Net calorific value, Q, ISO 18125	MJ/kg as received	Q16.5 ≥ 16.5	Q16.5 ≥ 16.5	Q16.5 ≥ 16.5
	Bulk density, BD, ISO 17828	kg/m <sup>3</sup>	BD600 ≥ 600	BD600 ≥ 600	BD600 ≥ 600
	Nitrogen, N, ISO 16948	% in mass dry	N0.3 ≤ 0.3	N0.3 ≤ 0.3	N0.6 ≤ 0.6
	Particle size distribution of disintegrated pellets, ISO 17830	% in mass equilibrated basis	≥ 99 % (< 3.15 mm) ≥ 95 % (< 2.0 mm) ≥ 60 % (< 1.0 mm)	≥ 98 % (< 3.15 mm) ≥ 90 % (< 2.0 mm) ≥ 50 % (< 1.0 mm)	≥ 97 % (< 3.15 mm) ≥ 85 % (< 2.0 mm) ≥ 40 % (< 1.0 mm)



## Part 3: Graded wood briquettes

This standard is very much the same as the pellets standard with the quality classes A and B. In the briquette standard the durability test has been replaced by a measurement of the basic density. Briquettes do not sustain as much wear as wood pellets. The specifications are in Table 7.

**Table 7: Quality requirements for wood briquettes (status 2021).**

	Property class, Analysis method	Units	A		B
			1	2	
Normative	Origin and source, ISO 17225-1:2021, Table 1		1.1 Forest, plantation and other virgin wood 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood 1.2.1 Chemically untreated wood residues	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) and length (L <sub>1</sub> ) or length (L <sub>2</sub> ), width (L <sub>3</sub> ) and height (L <sub>4</sub> ) and shape	mm	Diameter, length, width and height to be stated	Diameter, length, width and height to be stated	Diameter, length, width and height to be stated
			Specify to the number in figure 1 of the entire standard	Specify to the number in figure 1 of the entire standard	Specify to the number in figure 1 of the entire standard
	Moisture, M, ISO 18134-1, ISO 18134-2	% in mass as received	M12 ≤ 12	M15 ≤ 15	M15 ≤ 15
	Ash, A, shall be ISO 18122	% in mass dry	A1.0 ≤ 1.0	A3.0 ≤ 3.0	A5.0 ≤ 5.0
	Particle density, DE, ISO 18847	g/cm <sup>3</sup> as received	DE1.0 ≥ 1.0 °	DE0.9 ≥ 0.9	DE0.9 ≥ 0.9
Informative	Additives	% 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 ≥ 15.5 or ≥ 4.3	Q ≥ 14.4 or ≥ 4.0	Q ≥ 14.4 or ≥ 4.0
Informative	Surface area of briquettes, including the hole surface if any	cm <sup>2</sup> /kg	Should be stated	Should be stated	Should be stated

## Part 4: Graded wood chips

Quality requirements have also been formulated for wood chips. Property classes A1 and A2 represent virgin wood and chemically untreated wood residues. A1 represents fuels with lower ash content indicating no or little bark, and a lower moisture content, while class A2 has slightly higher ash content and/or moisture content. Class B1 extends the origin and source of class A to include other material, such as short rotation coppice, wood from gardens and plantations etc., and chemically untreated industrial by-products and residues. Property class B2 also includes chemically treated industrial by-products and residues and used wood, but without harmful chemicals or heavy metals.

For wood chips the most important issues are the moisture content, the size distribution and the ash content.

The moisture content more or less dictates the kind of boiler in which the chips can be used. Small boilers need a dry fuel, while the larger boilers can often work with a higher moisture content.

Since boilers up to 1 MW are usually fed by auger, it is important that the chips are of an even size and do not contain too many oversize particles. Long thin particles can bridge over the intake opening of the fuel and prevent it from entering the boiler. Blocky oversize pieces can get stuck in the auger and prevent it from feeding fuel to the boiler.

Small boilers usually do not have automatic de-ashing and thus it is important to have a low ash content in the fuel, which is the case in the class A fuels. Larger boilers usually have automatic de-ashing and so can tolerate the B class fuel with a higher ash content.

The size distribution of wood chips is a bit complicated, that is why the size requirements for the different classes are given in Table 8, while the full requirements for wood chips are given in Table 9.

**Table 8: Size distribution requirements of wood chips for small scale boilers (status 2021)**

Dimensions (mm) ISO 17827-1				
Main fraction a (minimum 60 w-%), mm		Coarse fraction, w-% (sieve aperture size or length of particle, mm)	Fines fraction (< 3.15 mm), w-%	Max. length (L) of particles, mm
P16s	$3.15\text{ mm} \leq m < 16\text{ mm}$	$\leq 6\text{ \%} \geq 31.5\text{ mm}$	$\leq 15\text{ \%}$	45 mm
P31s	$3.15\text{ mm} \leq m < 31.5\text{ mm}$	$\leq 6\text{ \%} \geq 45\text{ mm}$	$\leq 10\text{ \%}$	120 mm
P45s	$3.15\text{ mm} \leq m < 45\text{ mm}$	$\leq 10\text{ \%} \geq 63\text{ mm}$	$\leq 10\text{ \%}$	200 mm
P16	$3.15\text{ mm} \leq m < 16\text{ mm}$	$\leq 6\text{ \%} \geq 31.5\text{ mm}$	to be stated from F-classes below	value to be stated
P31	$3.15\text{ mm} \leq m < 31.5\text{ mm}$	$\leq 6\text{ \%} \geq 45\text{ mm}$		
P45	$3.15\text{ mm} \leq m < 45\text{ mm}$	$\leq 10\text{ \%} \geq 63\text{ mm}$		
P63	$3.15\text{ mm} \leq m < 63\text{ mm}$	$\leq 10\text{ \%} \geq 100\text{ mm}$		
Fines fraction, F (<3.15 mm w-%), ISO 17827-1				
F02	$\leq 2\text{ \%}$			
F05	$\leq 5\text{ \%}$			
F10	$\leq 10\text{ \%}$			
F15	$\leq 15\text{ \%}$			
F20	$\leq 20\text{ \%}$			
F25	$\leq 25\text{ \%}$			
F30	$\leq 30\text{ \%}$			
F30+	$> 30\text{ \%}$ (maximum value to be stated)			

**Table 9: Quality requirements for graded wood chips (status 2021)**

	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 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	1.1 Forest, planta- tion and other virgin wood 1.2.1 Chemically untreated wood residues	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 (table 8 in this publication)		to be selected from Table 1 (table 8 in this publication)	
	Moisture, M, ISO 18134-2	w-%	$\leq 25$ Values below 10 w-% to be stated	$> 25$ and $\leq 55$ Value range to be stated	$\leq 35$ Values below 10 w-% to be stated	$> 15$ and $\leq 55$ Value range to be stated
	Ash, A, ISO 18122	w-% dry	$A1.5 \leq 1.5$	$A1.5 \leq 1.5$	$A3.0 \leq 3.0$	$A3.0 \leq 3.0$

## Part 5: Graded firewood

Specification of firewood is stated in accordance with Table 10. It should be noted that the standard assumes that combustion-ready firewood is being traded. In case the wood is not sufficiently seasoned, the standard can still be used but the actual moisture content shall be indicated.

Moisture content is the most important quality for firewood. Wood shall be seasoned properly before being used, to prevent pollution due to unburned gasses, the build-up of running soot in the chimney and the emission of fine dust.

Since most stoves and small boilers have a relatively small burning chamber, the length and diameter of the logs is also important. In addition, the amount of split wood is important, because splitting helps in the seasoning of the wood and improves the burning characteristics of the fuel.

Firewood specified according to classes A1 and A2 is suitable for use in stoves and fireplaces and class B in log wood boilers. The requirements are in Table 10.

**Table 10: Requirements for graded firewood**

	Property class, Analysis method	Units	A1		A2		B	
Normative	Origin and source, 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	
	Wood species		To be stated					To be stated
	Diameter, D	cm		Main frac- tion, (minimum 70 % of mass), cm	Coarse fraction, % of mass	Maximum diame- ter, cm	Small firewood, % of mass (D2 or D5)	
			D2	< 2	< 15	3	-	
			D5	2 ≤ D < 5	< 15	8	-	
			D10	5 ≤ D < 10	< 15	15	15	
			D15	10 ≤ D < 15	< 15	20	10	
			D20	15 ≤ D < 20	< 15	25	10	
		D25	20 ≤ D < 25	< 15	30	10		
	Length, L	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)		
Moisture, M ISO 18134-1, ISO 18134-2	% in mass as received wet basis	≥ 10 and ≤ 2		≥ 10 and ≤ 25		≥ 10 and ≤ 35 value range to be stated		
Volume or weight	Volume m³ stacked or loose or weight, kg as received	To be stated which unit is used when retailed (m³ stacked or loose, kg) and/or packaged log woods weight.						
Informative	Energy density, E or Net calorific value, Q, ISO 18125	MJ/m³ or kWh/m³ stacked or loose MJ/kg or kWh/kg, as received	Recommended to be stated.					
	Drying		Recommended to be stated, if firewood is dried by natural seasoning by ambient air or artifi- cially by hot air.					
	Decay and mould	% of pieces	No visible decay		≤ 5		If significant amount (more than 10 % of pieces) of decay or mould exists it should be stated.	
	Proportion of split volume	% of pieces	≥ 90		≥ 50		No requirements	
	The cut-off surface		Even and smooth		No requirements		No requirements	

## EN15234 Solid biofuels - Quality assurance

This standard, formulated in 2011 comprises 6 parts: part 1 gives the general requirements, while the remainder deal with quality assurance for individual fuels such as wood pellets, wood briquettes, wood chips, firewood and non woody pellets. The standard is only available as a European standard and is not included in the ISO suit of standards on solid biofuels. It has not been updated since the original publication in 2011.

The task of quality assurance (QA) is to assure the buyer that the quality of the delivered fuel is in agreement with what was specified in the contract. This is done by internal QA procedures followed by a quality declaration to the customer.

QA thus does not have to mean that the quality of the fuel is as required by a standard. Supplier and customer can agree to a set of specifications for a contract. QA checks that the delivered fuel complies with that agreement.

In Ireland a Wood Fuel Quality Assurance scheme is in place and is run by the Irish Bioenergy Association (IrBEA). Members of the WQFA submit their internal quality control measures for external auditing. The scheme includes random testing to see if the quality of the products is in agreement with the contracts. The WFQA has developed a quality mark, so that one can see on the packing materials or on the delivery notice that the products comply to the quality requirements (Figure 1). The scheme includes firewood, briquettes, wood pellets and wood chips. The basis for the approval are the ISO standards on solid biofuels in the series 17225 parts 1 to 9.



Figure 1 Label of approval by the WFQA

## More information

For questions on the woodfuel supply chain or wood fuel quality please contact [www.woodenergy@gmail.com](mailto:www.woodenergy@gmail.com). This is a service for Irish residents only.

Standards can be ordered from:

NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland  
T + 353 1 807 3800, F + 353 1 807 3838, [www.nsai.ie](http://www.nsai.ie)

A list of published standards can be found on [www.woodenergy.ie](http://www.woodenergy.ie). For the latest information one can check the homepages of either CEN or ISO at the url below:

<http://standards.cen.eu>. Find TC335 on the list of Technical bodies and click on the heading “published standards” or at:

<https://www.iso.org/committee/554401/x/catalogue/>

Information on the Irish Wood Fuel Quality Assurance scheme <http://www.wfqa.org>

## Postscript

This COFORD Connects note will be updated as new information becomes available from the standardisation working group ISO TC238. The updated version will be put on the COFORD and woodenergy homepages as soon as possible. A list of published standards and standards under development can be found on [www.woodenergy.ie](http://www.woodenergy.ie).

This version was updated in April 2021.