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- *New international committee TC238 formed to create international standards to facilitate buying and selling biomass fuels*
- *New EN ISO standards to replace existing EN 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.*

Review of worldwide standards for solid biofuels

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Introduction

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

The European standardisation organisation, CEN has a mandate from the European Commission to develop standards for solid biofuels, under Technical Committee (TC) 335 Solid Biofuels. At the same time a large European project - BIONORM - has been funded under the EU Framework RTDI Programme, to carry out research to provide a scientific basis for the standards. 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 some 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.

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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

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.

TC238 Solid Biofuels has produced a long list of standards either published or under development (see Annex 1). The list contains standards on many different aspects of solid biofuels, such as taking samples, determination of chemical properties (macro and micro nutrients, heavy metals etc.), and physical properties (moisture content, size distribution, bulk density, etc.), as well as definitions and quality requirements. Standards on safety and health are also under development (such as 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.

All standards can be bought from the National Standards Authority of Ireland (www.nsai.ie). When ordering standards, remember to ask for the latest version or update.

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 standards should be used. Standards can be bought from the NSAI.

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 1-8

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

Both EN ISO 17225 and EN 15234 comprise 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 500 kW. 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

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 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: biofuel made from woody biomass with or without additives in the form of cubiform, polyhedral, polyhydric or cylindrical units, random length and typically 3.15 mm to 40 mm, a diameter up to 25 mm and with broken ends.
- Wood briquette: biofuel made with or without additives in the form of cubiform or cylindrical units and a diameter of over 25 mm produced by compressing pulverised woody biomass.
- Firewood: cut, and split fuelwood usually with a length of 20 to 100 cm used in household appliances like stoves, fireplaces and central heating devices.

EN ISO 17225 Solid Biofuels

The following parts have been published or are being developed:

- 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 (under development)

EN ISO 17225 has evolved from EN 14961. The EN ISO differs considerably from the EN, in that the standard has been split into a general part and nine product specific parts, and certain property classes have been changed radically.

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 olive stones) 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.

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

Tables 1 and 2 are followed by sixteen product-specific tables, listing the properties of the particular solid biomass. If a fuel is not listed as one of the 16 specific fuels, a final table of properties can be used for general application. An overview of the 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.

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.

Parts 2-8 of EN ISO 17225 have been formulated for the so-called non-industrial market, meaning for those boilers with

a capacity of less than 500 kW. 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.

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 500 kW, 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 be in excess of 97.5%, meaning that the pellets can withstand normal handling.

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

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

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 Broadleaf
			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 Broadleaf
			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 Broadleaf 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, Broadleaf (including leaves)
			1.1.4.2 Fresh/Green, coniferous (including needles)
			1.1.4.3 Stored, Broadleaf
1.1.4.4 Stored, Coniferous			
1.1.4.5 Blends and mixtures			
1.1.5 Stumps/roots	1.1.5.1 Broadleaf		
	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 drift wood 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 Broadleaf with bark	
		1.2.1.2 Coniferous with bark	
		1.2.1.3 Broadleaf without bark	
		1.2.1.4 Coniferous without bark	
		1.2.1.5 Bark (from industry operations) ^a	
	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) ^a	
		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 ^a	
	1.3.2 Chemically treated wood	1.3.2.1 Without bark	
		1.3.2.2 With bark	
		1.3.2.3 Bark ^a	
1.3.3 Blends and mixtures			
1.4 Blends and mixtures			

^a Cork waste is included in bark sub-groups.

NOTE 1: If appropriate, also the actual species (e.g. spruce, wheat) of biomass can be stated. Wood species can be stated e.g. according to EN13556 "Round and sawn timber nomenclature".

NOTE 2: Driftwood from salt water is not recommended as a fuel.

Table 2: Major traded forms of solid biomass.

Fuel name	Typical particle size	Common preparation method
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	Ø > 25 mm	Mechanical compression
Pellets	Ø < 25 mm	Mechanical compression
Bales		
Small square bales	0.1 m ³	Compressed and bound to squares
Big square bales	3.7 m ³	Compressed and bound to squares
Round bales	2.1 m ³	Compressed and bound to 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)

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

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 Broadleaf 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 $\leq 6\% > 31,5$ mm and all < 45 mm The cross sectional area of the oversized particles < 2 cm ²
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 ³ loose volume and less than 250 kg/m ³ 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

Table 5: Quality requirements for wood pellets for small scale use.

	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 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	w-% as received, wet basis	M10 ≤ 10	M10 ≤ 10	M10 ≤ 10
	Ash, A ^d , ISO 18122	w-% dry	A0.7 ≤ 0,7	A1.2 ≤ 1,2	A2.0 ≤ 2,0
	Mechanical durability, DU, ISO 17831-1	w-% as received	DU97.5 ≥ 97,5	DU97.5 ≥ 97,5	DU96.5 ≥ 96,5
	Fines, F ^e , ISO 18846	w-% as received	F1.0 ≤ 1,0	F1.0 ≤ 1,0	F1.0 ≤ 1,0
	Additives ^f	w-% 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	Q16.5 ≥ 16,5 or Q4.6 ≥ 4,6	Q16.5 ≥ 16,5 or Q4.6 ≥ 4,6	Q16.5 ≥ 16,5 or Q4.6 ≥ 4,6
	Bulk density, BD ^g , ISO 17828	kg/m ³ as received	BD600 ≥ 600	BD600 ≥ 600	BD600 ≥ 600
	Nitrogen, N, ISO 16948	w-% dry	N0.3 ≤ 0,3	N0.5 ≤ 0,5	N1.0 ≤ 1,0
	Sulphur, S, ISO 16994	w-% dry	S0.04 ≤ 0,04	S0.05 ≤ 0,05	S0.05 ≤ 0,05
	Chlorine, Cl, ISO 16994	w-% 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	
Informative: Ash melting behaviour ^h , CEN/TS 15370-1 ^[4]	°C	Should be stated	Should be stated	Should be stated	

Table 6: Quality requirements for wood pellets for industrial

	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 ^d and Length L ^c , ISO 17829 According 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 D10, 10 ± 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 ^d , ISO 18846	w-% as received	F4.0 ≤ 4,0	F5.0 ≤ 5,0	F6.0 ≤ 6,0
	Additives ^e	w-% 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 ^f , ISO 17828	kg/m ³	BD600 ≥ 600	BD600 ≥ 600	BD600 ≥ 600
	Nitrogen, N, ISO 16948	w-% dry	N0.3 ≤ 0,3	N0.3 ≤ 0,3	N0.6 ≤ 0,6
	Particle size distribution of disintegrated pellets, ISO 17830	w-% dry	≥ 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)
	Sulphur, S, ISO 16994	w-% dry	S0.05 ≤ 0,05	S0.05 ≤ 0,05	S0.05 ≤ 0,05
	Chlorine, Cl, ISO 16994	w-% dry	Cl0.03 ≤ 0,03	Cl0.05 ≤ 0,05	Cl0.1 ≤ 0,1
	Arsenic, As, ISO 16968	mg/kg dry	≤ 2	≤ 2	≤ 2
	Cadmium, Cd, ISO 16968	mg/kg dry	≤ 1,0	≤ 1,0	≤ 1,0
	Chromium, Cr, ISO 16968	mg/kg dry	≤ 15	≤ 15	≤ 15
	Copper, Cu, ISO 16968	mg/kg dry	≤ 20	≤ 20	≤ 20
	Lead, Pb, ISO 16968	mg/kg dry	≤ 20	≤ 20	≤ 20
Mercury, Hg, ISO 16968	mg/kg dry	≤ 0,1	≤ 0,1	≤ 0,1	
Zinc, Zn, ISO 16968	mg/kg dry	≤ 200	≤ 200	≤ 200	
Informative Ash melting behaviour ^g , CENTS 15370-1 ^[4]	°C	Should be stated	Should be stated	Should be stated	

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.

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.

Table 7: Quality requirements for wood briquettes.

	Property class, Analysis method	Units	A		B ^a
			1	2	
Normative	Origin and source, ISO 17225-1		1.1.3 Stemwood 1.2.1 Chemically untreated wood residues ^b	1.1.1 Whole trees without roots 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues ^b	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 (<i>D</i>) or length (<i>L_l</i>), width (<i>L_w</i>) and height (<i>L_h</i>) According Figure 1	mm	Diameter, width, height and length to be stated	Diameter, width, height and length to be stated	Diameter, width, height and length to be stated
		Shape	Specify according to Figure 1 e.g. 1 or 2, etc.	Specify according to Figure 1 e.g. 1 or 2, etc.	Specify according to Figure 1 e.g. 1 or 2, etc.
	Moisture, M, ISO 18134-1, ISO 18134-2	w-% as received	M12 ≤ 12	M15 ≤ 15	M15 ≤ 15
	Ash, A, ISO 18122	w-% dry	A1.0 ≤ 1,0	A1.5 ≤ 1,5	A3.0 ≤ 3,0
	Particle density, DE, ISO 18847	g/cm ³ as received	DE1.0 ≥ 1,0	DE0.9 ≥ 0,9	DE0.9 ≥ 0,9
	Additives ^c	w-% dry	≤ 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, ^d ISO 18125	MJ/kg or kWh/kg as received	Q15.5 ≥ 15,5 or Q4.3 ≥ 4,3	Q15.3 ≥ 15,3 or Q4.25 ≥ 4,25	Q14.9 ≥ 14,9 or Q4.15 ≥ 4,15
	Nitrogen, N, ISO 16948	w-% dry	N0.3 ≤ 0,3	N0.5 ≤ 0,5	N1.0 ≤ 1,0
	Sulphur, S, ISO 16994	w-% dry	S0.04 ≤ 0,04	S0.04 ≤ 0,04	S0.05 ≤ 0,05
	Chlorine, Cl, ISO 16994	w-% 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	
Informative	Surface area of briquettes, including the hole surface if any	cm ² /kg	Should be stated	Should be stated	Should be stated

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 500 kW 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.

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 should 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.

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.

EN15234 Solid biofuels - Quality assurance

This standard 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 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 WQFA 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.

Table 8: Size distribution requirements of wood chips for small scale boilers.

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

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

^b Length and cross sectional area only have to be determined for those particles, which are to be found in the coarse fraction. Maximum 2 pieces of about 10 litre sample may exceed the maximum length, if the cross sectional area is < 0,5 cm².

^c For measuring the cross sectional area it is recommended to use a transparent set square, place the particle orthogonally behind the set square and estimate the maximum cross sectional area of this particle with the help of the cm²-pattern.

Table 9: Quality requirements for graded wood chips.

	Property class, Analysis method	Unit	A		B	
			1	2	1	2
Normative	Origin and source, ISO 17225-1		1.1.1 Whole trees without roots ^a 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues	1.1.1 Whole trees without roots ^a 1.1.3 Stemwood 1.1.4 Logging residues 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood ^b 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood ^b 1.2. By-products and residues from wood processing industry 1.3.1. Chemically untreated used wood
	Particle size, P ISO 17827-1	mm	to be selected from Table 1		to be selected from Table 1	
	Moisture, M ^c , ISO 18134-1, ISO 18134-2	w-%	M10 ≤ 10 M25 ≤ 25	M35 ≤ 35	Maximum value to be stated	
	Ash, A, ISO 18122	w-% dry	A1.0 ≤ 1,0	A1.5 ≤ 1,5	A3.0 ≤ 3,0	
	Bulk density, BD ^d , ISO 17828	kg/loose m ³ as received	BD150 ≥ 150 BD200 ≥ 200 BD250 ≥ 250	BD150 ≥ 150 BD200 ≥ 200 BD250 ≥ 250 BD300 ≥ 300	Minimum value to be stated	
	Nitrogen, N, ISO 16948	w-% dry	Not applicable	Not applicable	N1.0 ≤ 1,0	
	Sulphur, S, ISO 16994	w-% dry	Not applicable	Not applicable	S0.1 ≤ 0,1	
	Chlorine, Cl, ISO 16994	w-% dry	Not applicable	Not applicable	Cl0.05 ≤ 0,05	
	Arsenic, As, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 1	
	Cadmium, Cd, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 2,0	
	Chromium, Cr, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Copper, Cu, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Lead, Pb, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
	Mercury, Hg, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 0,1	
	Nickel, Ni, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 10	
Zinc, Zn, ISO 16968	mg/kg dry	Not applicable	Not applicable	≤ 100		
Informative	Net calorific value, Q ^e , ISO 18125	MJ/kg or kWh/kg as received	Minimum value to be stated		Minimum value to be stated	

Table 10: Quality 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 ^a		To be stated		To be stated
	Diameter, D ^b	cm	D2 ≤ 2 D5 2 < D ≤ 5 D15 5 < D ≤ 15 D15+ > 15 (actual value to be stated)		D15 5 < D ≤ 15 D15+ > 15 (actual value to be stated)
	Length, L ^c	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 ^d ISO 18134-1, ISO 18134-2	w-% as received wet basis	M20 ≤ 20 M25 ≤ 25		M20 ≤ 20 M25 ≤ 25 M35 ≤ 35
	Volume or weight	Volume m ³ stacked or loose or weight, kg as received	To be stated which unit is used when retailed (m ³ stacked or loose, kg) and/or packaged log woods weight.		
Informative	Energy density, E ^e or Net calorific value, Q, ISO 18125	MJ/m ³ or kWh/m ³ 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 artificially by hot air.		
	Moisture, U ^d	w-% dry basis	U25 ≤ 25 U33 ≤ 33		U33 ≤ 33 U54 ≤ 54
	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 ^f	No requirements	No requirements

More information

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

A list of published standards can be found at:

http://standards.cen.eu/dyn/www/f?p=204:32:0:::FSP_ORG_ID,FSP_LANG_ID:19930,25&cs=19F087DBDE-0BACDFD4078ABA84D4941DC

Information on the Irish Wood Fuel Quality Assurance scheme <http://www.irbea.ie/index.php/wfqa>

For questions on the woodfuel supply chain or wood fuel quality please contact www.woodenergy.ie. This is a service for Irish residents only.

Postscript

This COFORD Connects note will be updated as new updated 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. Please check on one of these homepages for the latest version of this document.