

EUBIONET²


CEN-standards for solid biofuels
and feedback from market actors –

EUBIONET study

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Most important technical specifications for pellets

- **30 Technical Specifications (prestandards)**
- **Terminology, definitions and description (CEN/TS 14588)**
 - terms for pellets, mechanical durability etc.
- **Fuel specifications and classes (CEN/TS 14961)**
 - pellet classification and specification based on properties
- **Fuel quality assurance (CEN/TS 15234)**
 - quality assurance (example of pellet production chain)
 - quality control (how to meet quality requirements)
- **Mechanical durability of pellets (CEN/TS 15210-1)**
- **Methods for determination of the density of pellets and briquettes (CEN/TS 15103)**
- **Particle size distribution of disintegrated particles (under preparation)**

Specification and classes (CEN/TS 14961)

- The classification is based on **origin and source**, major traded forms and property grades
- **Hierarchical classification system in table format:**
 1. **Woody biomass** (from forest and wood processing industry, used wood)
 2. **Herbaceous biomass**
 3. **Fruit biomass**
 4. **Biomass blends and mixtures**
 - blends = intentional
 - mixtures = unintentional
- **For all user groups**
- **Special requirements for chemically treated biomass**
- **Chemical treatment defined as any treatment with chemicals other than air or water (e.g. glue and paint).**

Traded forms

- Briquettes
- **Pellets**
- Exhausted olive cake
- Wood chips
- Hog fuel
- Wood logs
- Sawdust
- Bark
- Straw bales
- General master table for others



Interviews of market actors in 2006 and the Feedback report

- EUBIONET II partners from **13 countries** carried out **47 interviews** in 2006
- Two Master's thesis, including 4 surveys, were carried out
 - a total of 1100 replies from producers and suppliers of solid biofuels and equipment, and end-users
- The total amount of traded solid biofuels reported by the interviewees was **78 PJ** (1.9 Mtoe) annually
 - equals to 3.4 % of the total amount of solid biomass in EU25 countries
 - approximately one-third (24 PJ annually) of the solid biofuels reported by the interviewees were wood pellets

1.2 Wood processing industry by-products and residues

Main raw materials for wood pellets

1.2. Wood processing industry, by-products and residues	1.2.1 Chemically untreated wood residues	1.2.1.1 Wood without bark
		1.2.1.2 Wood with bark *
		1.2.1.3 Bark (from industry operations)*
		1.2.1.4 Blends and mixtures
	1.2.2 Chemically treated wood residues	1.2.2.1 Wood without bark
		1.2.2.2 Wood with bark *
		1.2.2.3 Bark (from industry operations)*
		1.2.2.4 Blends and mixtures
	1.2.3 Fibrous waste from the pulp and paper industry	1.2.3.1 Chemically untreated fibrous waste
		1.2.3.2 Chemically treated fibrous waste

* cork is under bark

Properties are not bound together

- The classification is "flexible", and hence the producer or the consumer may select freely from each property class
- This classification does not bind different characteristics to each other
- A table for the traded forms including property classes
 - Example **M10**, means that the moisture content has to be less than $\leq 10\%$ on average
- Some of the properties are **normative** (mandatory)
 - **Origin and source** always have to be stated
 - Normative properties vary depending both on origin and traded form
 - Moisture content (M) and ash content (A) are normative for all fuels
- Some properties are voluntary (**informative**), but they are recommended to be stated
- Informative Annex for special **high quality grades of solid biofuels recommended for household usage**

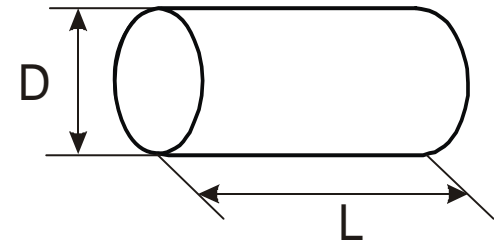
Pellets – Normative properties

Origin:

1 – Woody biomass, 2 – Herbaceous biomass, 3 – Fruit biomass

Dimensions

	Diameter (D)	Length (L)
D06	$\leq 6 \pm 0,5 \text{ mm}$	$\leq 5xD$
D08	$\leq 8 \pm 0,5 \text{ mm}$	$\leq 4xD$
D10	$\leq 10 \pm 0,5 \text{ mm}$	$\leq 4xD$
D12	$\leq 12 \pm 1,0 \text{ mm}$	$\leq 4xD$
D25	$\leq 25 \pm 1,0 \text{ mm}$	$\leq 4xD$



*) Max. 20 w-% of the pellets may have a length of 7,5xD

Feedback on Dimensions

- *Diameter* should be replaced by the term *Nominal diameter* (measuring the diameter in the die); no tolerance limits
- Pellets with $L = 7.5 \times \text{Diameter}$ (allowed for a max. of 20 w-%) are too long and can cause stoppages in household equipment
- Possibility of defining a minimum length for pellets should be discussed
- “Crushed” pellets are larger than 3,15 mm, but they are not cylindrical in form; proposal for a new definition of fines: particle size < 70% of pellet diameter

Pellets – Normative properties

Moisture (M)

- M10 \leq 10 w-% as received
- M15 \leq 15 w-% as received
- M20 \leq 20 w-% as received

Feedback on Moisture

- Given moisture classes are too high
- Good quality pellets contain less than 10% moisture (M20 is unnecessary)
- New moisture classes, e.g. M08 and M07, should be introduced

Pellets – Normative properties

Ash content (A)

- A0.7 ≤ 0.7 w-% of dry basis
- A1.5 ≤ 1.5 w-% of dry basis
- A3.0 ≤ 3.0 w-% of dry basis
- A6.0 ≤ 6.0 % of dry basis
- A6.0+ > 6.0 % of dry basis, actual value to be stated

Feedback on the Ash content

- More classes for the ash content should be introduced
- Pellets from wood without bark contain ≤ 0.5 w-% of ash
 \Rightarrow A0.5 should be introduced
- Some customers would not accept pellets with 0.7% ash
- The ash content describes the purity of the product; therefore the *actual* value for the ash content should be reported
- Beech wood (even without bark) has an ash content around 1.0% and requires A1.0

Pellets – Normative properties

Sulphur (S)

- Sulphur is normative only for chemically treated biomass and if sulphur containing additives have been used
- S0.05 ≤ 0.05 w-% dry basis
- S0.08 ≤ 0.08 w-% dry basis
- S0.10 ≤ 0.10 w-% dry basis
- S0.20+ > 0.20 w-% dry basis, and actual value to be stated

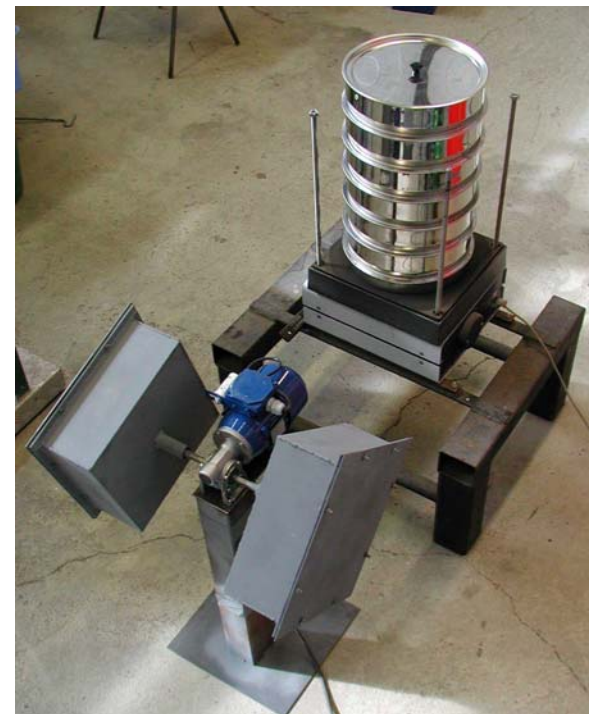
Feedback on Sulphur

- Sulphur should be informative instead of normative
- Straw pellets (sulphur content: 0.1–0.2%) require a threshold of S0.20

Pellets – Normative properties

Mechanical durability (DU)

- DU97.5
 $\geq 97.5 \%$ of pellets after testing
- DU95.0
 $\geq 95.0 \%$ of pellets after testing
- DU90.0
 $\geq 90.0 \%$ of pellets after testing



Testing of pellet durability

Feedback on Mechanical durability

- Pellets with DU90.0 are not suitable for household use
- The resolution of durability classes is insufficient:
 - DU97.5 corresponds to pellets of very good quality
 - DU95.0 corresponds to pellets of poor quality
- Mechanical durability fits well within the normative category

Pellets – Normative properties

Amount of fines (F)

- Fines (< 3,15 mm), at the “last possible stage” in the production, at the factory gate)
- F1.0 ≤ 1,0 w-%
- F2.0 ≤ 2,0 w-%
- F2.0+ > 2,0 w-% and actual value to be stated

Feedback on the Amount of fines

- The definition of fines (< 3.15 mm) excludes other material than just pellets
- The amount of fines is correctly classified as normative

Additives

- Type and content of pressing aids, slagging inhibitors or any other additives have to be stated

Normative or informative properties for pellets

Nitrogen (N)

- Nitrogen is normative only for chemically treated biomass
- N0.3 ≤ 0.3 w-% dry basis
- N0.5 ≤ 0.5 w-% dry basis
- N1.0 ≤ 1.00 w-% dry basis
- N3.0 ≤ 3.00 w-% dry basis
- N3.0+ > 3.0 % w-% dry basis and actual value to be stated)

Feedback on Nitrogen

- Should be informative instead of normative

Informative properties for pellets

Net calorific value as received ($q_{\text{net,ar}}$), MJ/kg

- or energy density (E_{ar}), kWh/kg
- Recommended to be informed by the retailer

Feedback on the Net calorific value

- The majority of the feedback (75%) suggested that the net calorific value should be normative instead of informative
- The net calorific value should be normative at least for household consumers

Bulk density (BD), kg/m³ loose

- Recommended to be stated if traded on volume basis

Feedback on Bulk density

- Controversy:
 - Important for small-scale use and when planning transportation and storage; should be normative
 - Irrelevant

Informative properties for pellets

Chlorine (Cl)

- Recommended to be stated as a category
- Cl 0.03
- Cl 0.07
- Cl 0.10
- Cl 0.10+ (if Cl > 0,10% the actual value to be stated)

Feedback on Chlorine

- The CEN practise for reporting chlorine as informative is fine
- Irrelevant property for woody biomass

Additional results and suggestions for pellets – 1/2

- Particle density (DE) should be informative for pellets
- Species of biomass should be included, especially in the case of pellets from sawdust or straw
- Ash deformation temperature should be reported (ash fusibility should be informative), since ash smelting may cause problems in boilers
- The content of caesium-137 should be optional (if ash is recycled)
- The content of heavy metals should be optional (if ash is recycled)

Additional results and suggestions for pellets – 2/2

- Certification of raw material for pellets will be required in the future (FSC or PEFC for forest wood)



- It might be necessary to bind standard properties together for household consumers

Example of specification for high quality classes (wood pellets) recommended for household usage

Origin	1.2.1.1 Chemically untreated wood, wood without bark
Moisture content	M10
Mech. durability	DU97.5
Amount of fines	F1.0 or F2.0
Dimensions	D06 or D08
Ash content	A0.7
Sulphur content	S0.05
Additives	< 2 w-% of dry basis Only products from the primarily agricultural and forest property biomass that are not chemically modified are approved to be added as a pressing aids. Type and amount of additive has to be stated.
Energy density	E4.7 [kWh/kg] ($E_{ar} \geq 4,7 \text{ kWh/kg} = 16.9 \text{ MJ/kg}$)

How to use the classification

- Boiler/burner manufacturers can select the property classes for their product
- The product can be marked with the classification



Manufacturer	Pelletburners Ltd
Output	15 kW
Fuel	Wood pellets (1.2.1.1/1.2.1.4)
Classification (CEN/TS14961)	D08/D06, M10, A0.7, DU97.5, F2.0

- For packages information should be marked on the packages (=Fuel quality declaration), see CEN/TS 15234
- For bulk material the Fuel Quality Declaration should be used

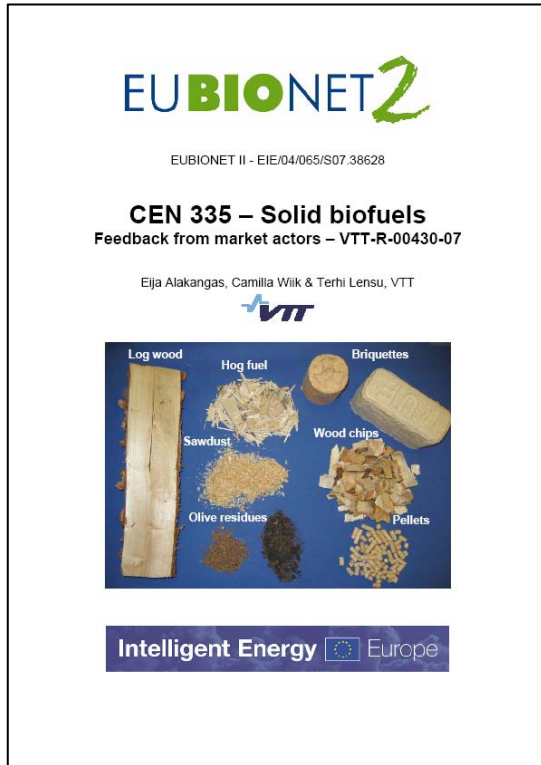
Example of Fuel quality declaration of wood pellets



Wood pellets

Producers	EAA Biofuels P.O. Box 1603 FI-40101 Jyväskylä tel. +358 20722 2550 E-mail: info@eaabiofuels.com	
Origin:	1.2.1.1 Wood without bark (cutter shavings)	
Traded Form:	Pellets	
Country of origin	Jyväskylä, Finland	
Normative (CEN/TS 14961:2005)		
Dimensions (mm) Diameter (D) and Length (L)	D08	≤ 8 mm ± 0,5 mm, and L ≤ 4 x Diameter
Moisture (w-% as received)	M10	≤ 10 %
Ash (w-% of dry basis)	A0.7	≤ 0,7%
Mechanical durability (w-% of pellets after testing)	DU97.5	≤ 97,5 % (Quality class 1)
Amount of fines (w-%, < 3.15 mm) after production at factory gatea	F1.0	≤ 1,0 % for small bags ^a In last possible place in the production site
Additives (w-% of pressing mass)	Starch	< 1
Informative (CEN/TS 14961:2005)		
Bulk density as received (kg/m ³ loose)	DB600	> 600 kg/m ³
Energy density, E	E4.7	[kWh/kg]

EUBIONET feedback reports



EUBIONET report

- *Alakangas, E., Wiik, C. & Lensu, T.* CEN 335 – Solid biofuels, Feedback from market actors, VTT-R-00430-07, Feb 2007 (www.eubionet.net)

Additional information

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