SolidStandards

Enhancing the implementation of quality and sustainability standards and certification schemes for solid biofuels (EIE/11/218)

D2.1c:
Wood pellet module

Co-funded by the Intelligent Energy Europe Programme of the European Union

The SolidStandards project

The SolidStandards project addresses ongoing and recent developments related to solid biofuel quality and sustainability issues, in particular the development of related standards and certification systems. In the SolidStandards project, solid biofuel industry players will be informed and trained in the field of standards and certification and their feedback will be collected and provided to the related standardization committees and policy makers.

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About this document

This document is part of **Deliverable 2.1** of the SolidStandards project. It is the training guidebook for the wood pellet module and provides background information to the corresponding presentation slides. This document was prepared in **December 2011 and updated in February 2013** by:

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Table of contents

1. Introduction

1.1. Normative references

This document serves as a guideline to facilitate the implementation of quality standards in the production and the transportation of wood pellets according to the respective standards of the EN 14961 / EN 15234 series. Greyed text is quoted directly from the standards. Still, for the application of this system the acquisition of in this document mentioned standards is indispensable. For further information please contact the national standardization institutes.

Update: Most European standards mentioned in this document will be superseded within the next years by EN ISO standards. A list, which shows the relationship between the numbers of now valid EN standards with future EN ISO standards, can be found in the Annex.

1.2. Wood pellets supply chain

In Figure 1 typical wood pellet supply chains are shown. Most pellet productions use by-products and residues from wood processing industry (mostly sawmills) as raw material. Because of the increasing lack of these raw material assortments the use of stemwood became more and more common in the last years.

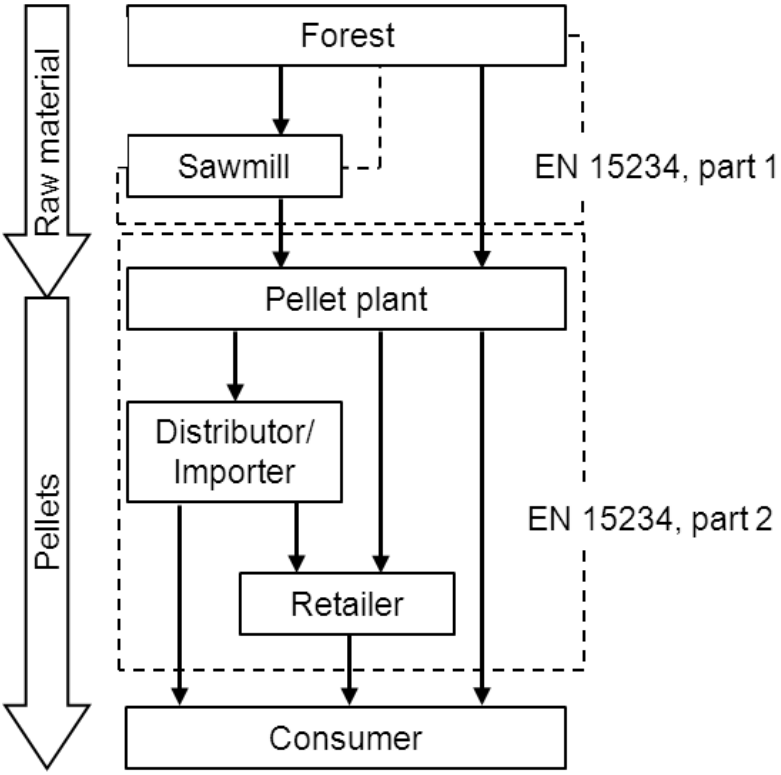

Figure 1: Typical wood pellet supply chains

Some pellet producers have a vehicle fleet by their own and deliver their pellets directly to the end-consumers. Others sell their products to regional retailers. Mostly large distributors import pellets from foreign producers and distribute them to regional retailers or to the end-consumers.

2. How to specify wood pellets

2.1. Relevant standards

EN 14961-1:2010: Solid biofuels – Fuel specification and classes.
Part 1: General requirements

Classification is flexible and hence the producer or the consumer may select from each property class. This classification does not bind different characteristics with each other. Some properties are normative (mandatory) some are informative (voluntary).

EN 14961-2:2011: Solid biofuels – Fuel specification and classes.
Part 2: wood pellets for non-industrial use

This product standard targets wood pellets for non-industrial use in small-scale appliances (households, small commercial and public sector buildings). Properties are bound together to form a class and all properties are normative.

2.2. Definition (EN 14588)

Wood pellets are densified biofuel made from pulverised woody biomass with or without additives usually with a cylindrical form, random length typically 5 to 40 mm, with broken ends.[1]

2.3. Specification

2.3.1. Origin and source (EN 14961-1, Table 1)

Structure of the classification system

Standard EN 14961-1 contains a system for the classification of origin and source of raw material for the production of solid biofuels. On the first level four biofuel types are defined: woody, herbaceous, and fruit biomass, furthermore mixtures and blends. On the second level the biofuel origin is specified, levels three and four give more detailed information. In total 115 level-four-descriptions enable a detailed description of origin and source.

While in EN 14961-1 the whole assortment of “woody biomass” can be utilized for the production of wood pellets, EN 14961-2 only allows the use of specific raw material classes for the production of a certain wood pellet quality class.

[1] EN 14961-2:2011, paragraph 3.1

2.3.2. Specification of properties (EN 14961-1 or EN 14961-2)

Property classes according to EN 14961-1

In Table 4 of EN 14961-1 pellets for **general use** are defined by the following properties:

N**ormative** properties (mandatory, always to be specified)	
Dimensions: Diameter (D) & Length (L)	
Classes: **see EN 14961-1, Table 4**	 **Figure 2: Diameter and length of a pellet; separate description of the test see slides**
Moisture, M (w-% as received) - Analysis according to EN 14774-1 or prEN14774-2	
Classes: **see EN 14961-1, Table 4**	 **Figure 3: Drying cabinet according to EN°14774-2; separate description of the test see slides**
Ash, A (w-% dry basis) - Analysis according to EN 14775	
Classes: **see EN 14961-1, Table 4** A high ash content could be caused by: [2] • Contamination e.g. with soil • A high content of bark • Inorganic additives • Chemical treatment	 **Figure 4: High temperature laboratory furnace according to EN°14775**

[2] EN 14961-1:2010, Annex C1

Mechanical durability, DU (w-% of pellets after testing) **-** Analysis according to EN 15210-1

Classes: **see EN 14961-1, Table 4**

Figure 5: Durability tester according to EN 15210-1; separate description of the test see slides

Amount of fines, F (w-%, < 3,15 mm b) - Analysis according to EN 15210-1

Classes: **see EN 14961-1, Table 4**

Figure 6: 3.,15mm sieve according to EN°15149-1 (respectively ISO°3310; separate description of the test see slides

Additives (w-% of pressing mass)

The maximum amount of additive is 20 w-% of pressing mass. If amount is greater, then raw material for pellet is blend. Type and content of pressing aids, slagging inhibitors or any other additives have to be stated [3]

Bulk density (BD) as received (kg/m^3) - Analysis according to EN 15103

Classes: **see EN 14961-1, Table 4**

Figure 7: Test container according to EN 15103; separate description of the test see slides

Net calorific value (Q) as received, (MJ/kg or kWh/kg) - Analysis according to EN 14918

Minimum value to be stated

A low net calorific value could be caused by: [4]

- High ash content
- Contamination of raw material

A high ash content could be caused by:

- Contamination of raw material

Figure 8: Calorimeter according to EN 14918

[3] EN 14961-1:2010, Table 4
[4] EN 14961-1:2010, Annex C1

Normative properties (mandatory only for chemically treated biomass - 1.2.2; 1.3.2; 2.2.2; 3.2.2) or **Informative** properties (for all other biomass)

Sulphur, S (w-% of dry basis) - Analysis according to EN 15289

Classes: **see EN 14961-1, Table 4**

A high content of nitrogen could be caused by: [5]

- High content of bark
- Use of additives containing sulphur
- Treatment with chemicals containing sulphur

Figure 9: Analyzer for S & Cl according to EN°15289

Nitrogen, N (w-% of dry basis) - Analysis according to EN 15104

Classes: **see EN 14961-1, Table 4**

A high content of nitrogen could be caused by: [6]

- High content of bark
- Contamination with glue or plastic

Figure 10: CHN-analyzer according to EN°15104

Chlorine, Cl (w-% of dry basis) - Analysis according to EN 15289

Classes: **see EN 14961-1, Table 4**

Picture of analyzer see Sulphur

A high content of chlorine could be caused by: [7]

- A high content of bark
- Origin of raw material from coast exposed to sea water
- Contamination by road salting

Informative properties (voluntary, but recommended to be stated)

Ash melting behaviour (°C) - Analysis according to CEN/TS 15370-1

Ash melting behavior is an important property for combustion. If ash melts at low temperatures it can cause deposit formation, slagging and fouling and even shut down of boiler.

[5] EN 14961-1:2010, Annex C1
[6] EN 14961-1:2010, Annex C1
[7] EN 14961-1:2010, Annex C1

Quality classes according to EN 14961-2

Wood pellets for **non-industrial use** can be specified as quality class A1, A2 or B if they comply with the respective property classes according to Table 2 of EN 14961-2. Class A1 represents the best quality for wood pellets with low ash and moisture content and a high mechanical durability with a low content of fine particles. Next to chemically untreated wood residues, stemwood is allowed as raw material basis for class A1 wood pellets. For quality class A2 also e. g. logging residues might be taken into account.

Fuel analysis and specification

When specifying a class within a property, the average numerical value from the whole lot (e.g. shipload, truckload, bag) shall determine which class is to be used. If the properties being specified are sufficiently known through information about the origin and handling, physical/chemical analyses may not be necessary.[8]

For the specification of the fuel one of the measures in the following order is recommended:

a) using typical values (e.g. laid down in annex B of EN 14961-1 or obtained by experience)

b) calculation of properties (e.g. by using typical values and considering documented specific values

c) carrying out of analysis (with simplified methods if available or with reference methods) [9]

The responsibility of the producer or supplier to provide correct and accurate information is exactly the same whether laboratory analysis is performed or not! [10]

[8] EN 14961-1:2010, paragraph 7.2
[9] EN 14961-1:2010, paragraph 7.2
[10] EN 14961-1:2010, paragraph 7.2

3. How to guarantee a specific quality of wood pellets

3.1. Relevant standards

EN 15234-1:2011	Solid biofuels – Fuel quality assurance. Part 1: General requirements
EN 15234-2:2012	Solid biofuels – Fuel quality assurance. Part 2: Wood pellets for non-industrial use

3.2. How to implement EN 15234-1 and/or EN 15234-2

3.2.1. General

According to EN 15234-1 quality assurance and control aims at providing confidence that a stable quality (not necessarily a high quality) is continually achieved in accordance with the customer requirements.[11]

Quality control = controlling the quality of a product or process [12]

- on the basis of company requirements, standards, agreements, ...
- with the aim to enable the delivery of the product within agreed parameters in the most efficient and cost effective way
- by means of analyses, calculations, checklists, etc.

Quality assurance = reviewing the products and processes[13]

- on the basis of data provided from the quality control records
- using this data to provide confidence that products are produced within the required specification and processes are operated as they should be, and to assure that over a longer term either consistency is being maintained or that quality improvements are making the intended impact
- by means of exception reporting

[11] EN 15234-1: 2011, paragraph 6.1
[12] EN 15234-1: 2011, paragraph 6.2
[13] EN 15234-1: 2011, paragraph 6.2

Procedure for the implementation of quality assurance measures

In addition to the transparent provision of information about origin and source as well as about biofuel properties, the implementation of appropriate measures to secure the customers confidence that the specifications are being realised is one of the core parts of the standard. Every step in the process chain has to be analysed on factors that may have an influence on the quality of products and processes.

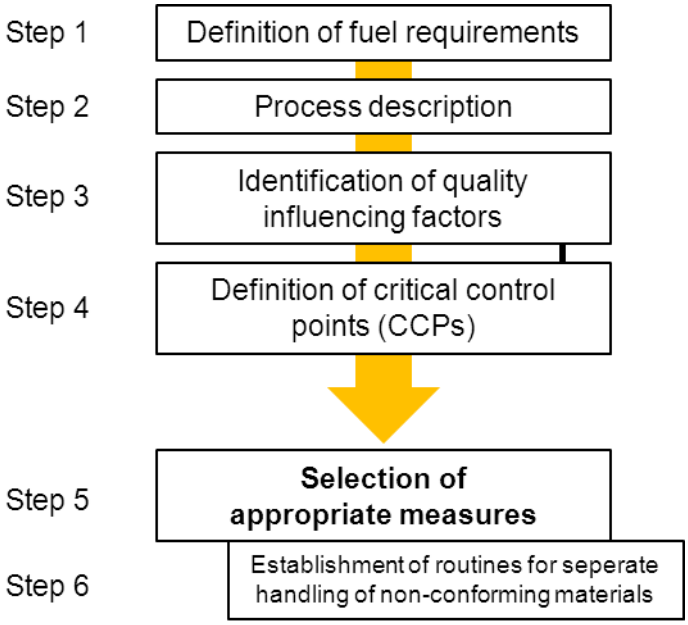

Figure 11: Procedure for the selection of appropriate quality assurance measures

As part of the quality assurance system all measures taken have to be documented, the documentation has to be kept up-to-date:

- Allocation of responsibilities
- Training of staff (concerning the required quality demands)
- Formulation of work instructions
- Use of appropriate equipment and facilities
- Quality control in the production process
  - Raw material reception (e.g. documentation on the delivery note or the invoice)
  - Results of wood pellet analyses as well as analysis methods and evaluation criteria
  - Outgoing wood pellets (e.g. delivery agreement with the customer or documentation on the delivery note).
- Handling of nonconforming raw material or wood pellets
- Complaint management system

The **raw material supplier** is the first operator in the supply chain for solid biofuels and is responsible for preparing the documents of 'origin and source' of the raw material the first time. The documents shall be available and provided on justified request throughout the entire supply chain [14] and thus guarantee the traceability of the wood pellets.

The **wood pellet producer** has to check whether the properties of the received raw material is in compliance with the declaration of 'origin and source' given by the raw material supplier. The wood pellet producer has to follow 6 consecutive steps to guarantee quality assurance and quality control throughout the whole production process (supply chain).

The **wood pellet trader** has to check whether the properties of the received pellets are in compliance with the product declaration given by the producer. The trader has to follow 6 consecutive steps to guarantee quality assurance and quality control throughout the whole production process (supply chain).

[14] EN 15234-1:2011, paragraph 6.3

3.2.2. Implementation process

In the following the fuel quality implementation processes for raw material supplier and wood pellets producer/trader are described on the basis of an example.

The example described in the following represents wood pellets for non-industrial use according to EN 14961-2 and EN 15234-2 (the same method is applicable for wood pellets for general use according to EN 14961-1 and EN 15234-1).

Raw material supplier

Start	Biomass first time traded as biofuel
Process	Classification of origin according Table 1 in EN 14961-1:2010
Result	Declaration according to EN 15234-1:2010

Raw material

Start

Figure 12: spruce sawdust

Process

Derivation of the source in Table 1 in EN 14961-1:2010

1 Woody biomass

1.2 By-products & residues from wood processing industry

1.2.1 Chemically untreated wood residues

1.2.1.2 Without bark, Coniferous

Result

mandatory documentation !

	Product declaration based on EN 14961-1	
	Supplier:	Spänehandel Pelz GmbH
	Origin:	**1.2.1.2** (spruce)
	Country:	Germany (or more detailed location if needed; e.g. 72108 Rottenburg)

e.g. on the invoice, delivery note, receiving slip, etc.

Wood pellets producer/trader

Start	Raw material specified by a 'declaration of origin and source'
Process	
Step 1	Define fuel requirements for the final product
Step 2	Document the steps in the process chain (process description)
Step 3	Identify factors influencing the fuel quality and company performance
Step 4	Identify and document Critical Control Points (CCP)
Step 5	Select appropriate measures to ensure the quality of the product (at CCP)
Step 6	Establish and document routines for separate handling of nonconforming materials and solid biofuels
Result	Product declaration according EN 15234-2:2012

Production

Start **mandatory documentation** !	*Origin and source of the used raw material have to be classified according to EN 14961-1, table 1.* Example: Raw material: Chemically untreated wood residues (from wood processing industry); Code according to EN 14962-1, Table 1: 1.2.1 In this case: spruce, saw dust
Process **Step 1**	**Fuel requirements** *Fuel quality is described in accordance with the appropriate part of EN 14961 and should be the result of an agreement between the producer and his customer (or according to anticipated market demands).*[15] *Usually the fuel quality requirements are described in sales contracts.* Example: Fuel requirements for the final product: quality according EN 14961-2, class A1

[15] EN 15234-1:2011, paragraph 6.4 a)

Step 2

mandatory documentation !

Process description

All relevant steps in the process chain have to be described. This could happen in form of a flow chart.

Example:

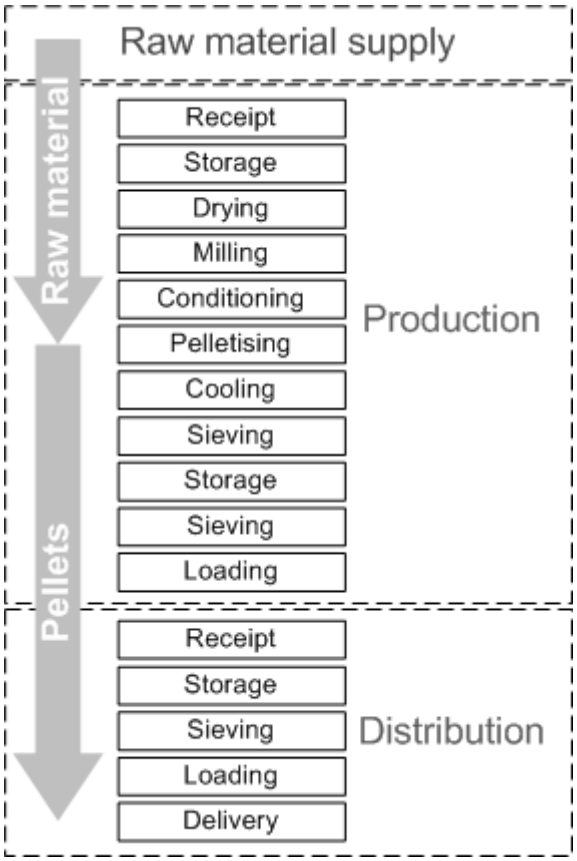

Figure 13: Process description in form of a flow chart

Step 3 **Identification of quality influencing factors**

All activities referring to both technical processes and management issues should be examined. The following factors determine the quality of the wood pellets and its performance.

- *The effectiveness of preliminary inspection of fuel sources and checking of incoming raw material.*
- *The care with which the material is stored and processed.*
- *The knowledge, competence and qualification of the staff.* [16]

Some factors may not influence directly the fuel property but the company performance since defects could be corrected later on in the process chain.

Example

	Influencing factors	Influenced fuel properties
Production	Receipt of raw material	• legitimacy of origin & source • impurities
	Storage conditions (Storage time, structural conditions)	• impurities • moisture
	Dryer (drying temperature & output)	• moisture (influence on the performance of the pellet press, on the mechanical durability and the bulk density of the produced pellets)
	Mill (condition & settings)	• particle size(influence on the performance of the pellet press, on the mechanical durability and the bulk density of the produced pellets)
	Conditioner unit (amount & type of additives, residence time)	• mechanical durability • bulk density • performance of the pellet press
	Pellet press (geometry of bores & roller, die temperature)	• mechanical durability • bulk density
	Cooler (condition & settings)	• mechanical durability • amount of fines (influence on the process performance)
	Sieving machine (condition & settings)	• amount of fines • bulk density
	Storage conditions (Storage time, structural conditions)	• impurities • moisture (influence on bulk density, amount of fines)
	Suitability of the transport unit	• impurities • bulk density • amount of fines • length
	Sieving machine (condition & settings)	• amount of fines • bulk density
Distribution	Receipt of pellets	• legitimacy of origin & source • impurities
	Storage conditions (Storage time, structural conditions	• impurities • moisture
	Suitability of the transport unit	• impurities • bulk density • amount of fines • length
	Sieving machine (condition & settings)	• amount of fines • bulk density
	Delivery	• amount of fines • bulk density

[16] EN 15234-1:2011, paragraph 6.4 c)

Step 4

mandatory documentation !

Definition of critical control points

Critical Control Points (CCPs) are points within or between processes at which properties can be most readily assessed and that offer the greatest potential for quality improvement.[17]

Example (see example step 3):

	Influencing factors	Critical control points (CCPs)
Production	Receipt of raw material	CCP1: delivery of raw material
	Storage conditions	CCP2: storage (before processing)
	Dryer	CCP3: after drying
	Mill	CCP4: after milling
	Conditioner unit	CCP5: before pressing
	Cooler	CCP6: after cooling
	Sieving machine	CCP7: after sieving
	Loading	CCP8: when loading
Distribution	Storage conditions	CCP9: storage (before processing)
	Sieving machine	CCP10: after sieving
	Delivery	CCP11: when delivering

Step 5

mandatory documentation !

Selection of appropriate quality assurance measures

Appropriate measures to give confidence to the customer, that the specifications are being realised[18]*, include besides product control the following management issues, which should be part of the 'company-manual.*

- ***Staff**: allocation of responsibilities, work instructions, trainings*
- ***Facilities and equipment**: general suitability, condition and settings, periodic maintenance*
- ***Product quality**: quality control, handling of non-conforming materials*
- ***Intersection points** to upstream and downstream stakeholders in the supply chain: agreements and control, product declaration, handling of complaints*
- ***Documentation** of all measures mentioned above*

Example (see example step 4):

Production

Receipt of raw materials

- Check of delivery note (origin & source)
- Visual inspection of raw material: condition, contaminations (e.g. soil, sand…)

Raw material storage

- Structural measures (e.g. roof & walls, concreted ground)
- Periodical visual inspections

Dryer

- Automatic instrumental control or periodical analyses (moisture content)
- Periodic maintenance

[17] EN 15234-1:2011, paragraph 6.4 d)
[18] EN 15234-1:2011, paragraph 6.4 e)

Mill

- Periodic visual inspections (particle size)
- Periodic maintenance

Conditioner unit

- Periodic sensory inspections (condition)
- Periodic maintenance

Pellet press

- Periodic visual inspection of pellets (length, durability, amount of fines)
- Period inspection of the geometry of bores and roller
- Periodic measurement of die temperature

Cooler

- Periodical measurement of temperature
- Periodic maintenance
- An evaluation of the length of the produced pellets is recommended at least once per shift
- An evaluation of the bulk density is recommended at least once per shift
- An evaluation of the mechanical durability and the moisture content is recommended. The frequency of the checks is calculated by the following formula:

$$N = \frac{10}{days} * \sqrt{\frac{tonne}{10}}$$

N	Number of samples in 24 hours
days	Annual working days
tonne	Annual quantity of pellets in tonnes

Example: N = 10/220* √50.000/10 = 3 samples in 24 hours[19]

- Archiving of representative retain samples.

Sieving machine

- Periodical visual inspection regarding the amount of fines
- Periodic maintenance

Pellet storage

- Structural measures (e.g. roof & walls, concreted ground)
- Periodical visual inspections

Suitability of the transport unit

- Visual inspection (vehicle type, equipment components)
- Contamination (e.g. with soil, sand…)

Sieving machine

- Periodical visual inspection regarding the amount of fines
- Periodic maintenance

Loading

- An evaluation of the amount of fines is recommended at least once per shift
- Periodic measurement of pellet's temperature (should not exceed 40°C)

<u>Distribution</u>

Receipt of pellets

[19] EN 15234-2:2012, paragraph 5.6.2

	• Check of delivery note (origin & source, product declaration) • Visual inspection of pellets: length, amount of fines, contaminations (e.g. soil, sand…) **Pellet storage** • Structural measures (e.g. roof & walls, concreted ground) • Periodical visual inspections **Suitability of the transport unit** • Visual inspection (vehicle type, equipment components) • Contamination (e.g. with soil, sand…) **Sieving machine** • Periodical visual inspection regarding the amount of fines • Periodic maintenance **Loading** • An evaluation of the amount of fines is recommended at least once per shift • Periodic measurement of the pellet's temperature (should not exceed 40 °C) • Analysis of moisture content and sensory inspection (amount of fines, length, mechanical durability) after long periods of intermediate storage **Delivery** • Control of injection air and pressure during unloading • Sieving of fines during unloading • Archiving of one representative retain sample per day
Step 6 **mandatory documentation** !	**Establishment and documentation of routines for separate handling of nonconforming materials and solid biofuels** • *If raw materials or the produced wood pellets are not fulfilling the requirements (due to e.g. excessive contents of over-sized particles, impurities and/or fines), these batches have to be stored separately from conforming ones.* • *Re-screening processes could be applied to achieve compliance with the required fuel properties (e.g. sieving, drying, ,..).* • *All necessary information has to be documented.* • *If nonconformity of the product is discovered at the premises of the consumer in connection with delivery, a nonconformity report is generated and handling of the nonconforming lot is agreed with the consumer.* [20] Example: The responsible employee realises at CCP6 that the mechanical durability does not match the requirements. He has to evaluate the amount of nonconforming pellets at the pellet storage. The nonconforming pellets can either been seen as raw material and be processed once again or they're sold as industrial pellets.

[20] EN 15234-2:2012, paragraph 5.7

Result

mandatory documentation !

The quality of the produced fuel corresponds to that defined in the beginning of the process.

If the producer/trader delivers wood pellets to end-consumers the product declaration/labelling shall as a minimum include:

- *Supplier (body or enterprise) including contact information*
- *A reference to EN 15234-2*
- *Origin and source (according to EN 14961-1)*
- *Country/countries (locations) of origin*
- *Traded form (e.g. wood pellets)*
- *Specification of properties (according to EN 14961-1 or EN 14961-2 for non-industrial wood pellets)*
- *Normative properties*
- *(Informative properties)*
- *Chemically treated material (yes/no)*
- *Signature, date, place (The product declaration can be approved electronically. Signature and date can be approved by signing of the waybill in accordance with the appropriate part of EN 14961)*

With the product declaration the supplier (producer) confirms, that the properties of the end product are in accordance with the requirements of the respective part of EN 14961 according to EN 15234-1. The supplier shall date the declaration and keep the record for a minimum of one year after the delivery. [21]

Example for a simplified product declaration

Product declaration based on EN 14961-2 – wood pellets	
Supplier:	PREMIUMPELLETs AG
Amount of delivery	5 tons
Origin:	1.2.1.2 (spruce)
Country:	Germany (or more detailed location if needed; e.g. 72108 Rottenburg)
Traded Form:	Wood pellets
Class	EN 14961-2, **A1**
Diameter class	**D06 x** D08 ☐
Chemically treated material	**No x** Yes ☐

[21] EN 15234-1:2012, paragraph 7

4. Certification schemes for high quality wood pellets

Certification schemes aim to ensure a consistent high quality of the fuel by providing periodic controls carried out by independent control bodies. The certified companies achieve the right to promote their products with the label of the scheme that show the customers (distributors as well as end-customers) that the pellets have been produced and handled in accordance with the scheme's requirements.

Quality signs require periodic production control and quality attestation systems that implement external controls (dependent testing centres offer less security to the customer). A comprehensive certification scheme consists of three parts mainly:

- product requirements (e. g. EN 14961-2, class A1)
- internal quality assurance (e. g. EN 15234-2)
- external control (by independent inspection body or laboratory)

The new European standards for wood pellets find their way into existing as well as new established certification schemes:

Scheme	Subject	Related quality classes [1)]	Comment
ENplus	Pellets for non-industrial use	A1, A2, B	Covering the whole supply chain
DINplus	Pellets for non-industrial use	A1	Certification of production and product
DINgeprüft	Pellets for commercial use	B	Certification of production and product
DINgeprüft	Pellet Logistic	--	Certification of pellet logistics

[1)] according to EN 14961, part 2

DINplus and ENplus are the two certification schemes with the strongest connection to the new European quality standards. Other certification schemes like "ÖNORM M 7135 geprüft", "Pellet Gold" or "Marque NF 434" where replaced mainly by ENplus.

Therefore ENplus and DINplus are currently the most widespread certification schemes for high quality wood pellets in central Europe, whereas ENplus seems to establish itself outside Europe as well. Below those two certification schemes are described more in detail.

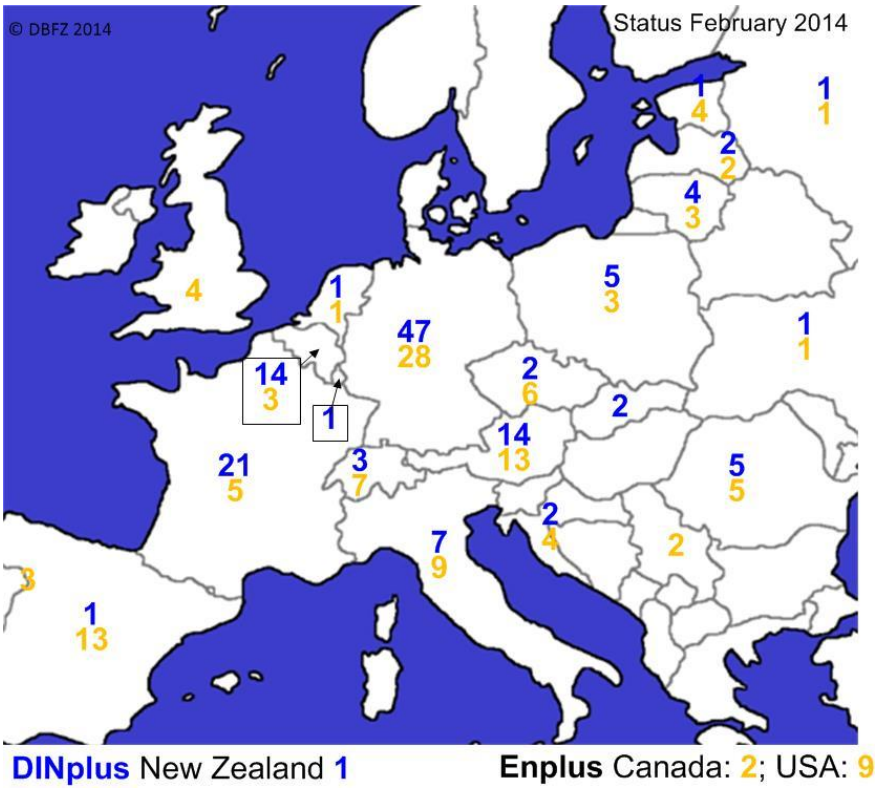

Figure 14: Number of DINplus- & ENplus certified producers

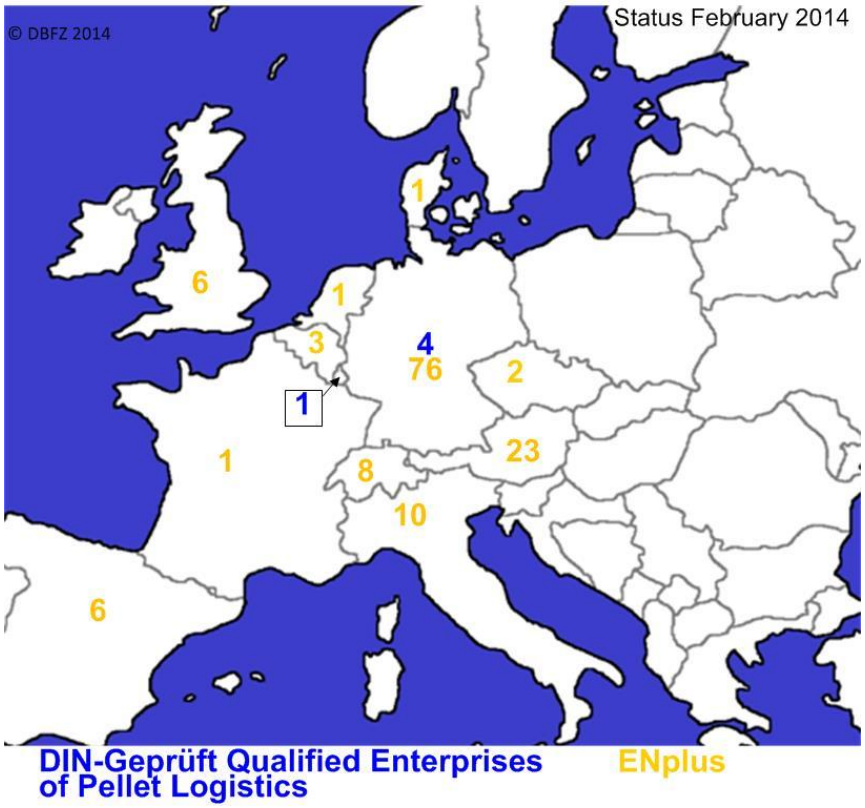

Figure 15: Number of DINgeprüft- & ENplus certified traders

4.1. DINplus: Wood pellets for central heating boilers

- Established in 2002
- Organisation DINCertco GmbH
- Nearly 131 certificate holders
- Requirements: EN 14961-2, class A1
- Certification of production and product
- No certification of traders included
- Additional schemes of DINCertco:
    - DIN-Geprüft Wood Pellets for Commercial Use (acc. to EN 14961-2, class B, currently no users)
    - DIN-Geprüft Qualified Enterprises of Pellet Logistics (currently 5 traders certified)

4.2. ENplus: Wood pellets for heating purposes

- Start in spring 2010
- Organisation: European Pellet Associations (under the roof of European Pellet Council, EPC)
- 129 producers & 140 traders
- Requirements: EN 14961-2, classes A1, A2 & B
- Certification of production and supply chain
- Identification numbers on delivery papers and/or pellet sacs allow tracing the origin of pellets from the end-consumer to the production site.
- ENplus going beyond EN 14961-2:
    - Threshold values for the ash deformation temperature are defined

      ENplus-A1: ≥1200°C,

      ENplus-A2 & EN-B: ≥1100°C
    - The use of chemical treated wood is not allowed for the production of pellets according to class EN-B
- ENplus going beyond EN 15234-2
    - A quality management representative has to be appointed; his experience has to be verified.
    - The other staff has to be trained in quality issues.
    - The assignments and responsibilities of every employee have to be defined.
    - Documentation requirements are clearly described.

Annex

Storing and handling of wood pellets

Risks for the deterioration of fuel quality, the plant equipment and the health of the employees are not explicitly mentioned in the new European standards. But most of the safety and health risks can be avoided when storing the pellets at a place clean and dry and handling the fuel carefully which are requirements mentioned in EN 15234-2.

Risk of deterioration of the fuel quality

Risk	Reasons	Improvements & prevention
Contamination of the fuel	• impurities on the (unsurfaced) storage ground • impurities from former loads of the transport unit	• use of appropriate equipment when possible (storage silos, silo trucks for the exclusive transport of wood pellets) • storage pavement • control and cleaning of storage ground • control and cleaning of transport units
Increase of fine particles	• abrasion caused by fuel handling • moisture in the storage	• appropriate handling equipment • storage and transportation under dry conditions (e.g. storage silos, silo trucks)

Risks for the production facilities (and employees)

Risk	Reasons	Improvements & prevention
Spontaneous ignition	microbiological activity & chemical oxidation caused by • high temperatures • high moisture content (> 20%) • high amount of fine particles • high bulks • high content of volatiles	• avoidance of water absorption • reduction of pellet abrasion by careful handling • height of pellet bulks < 4m • airing
Dust explosions	• high amount of fine particles in the air & ignition source (spark formation)	• evacuation system • explosion prevention • cleanliness of facilities

Risks for the health of the employees

Risk	Reasons	Improvements & prevention
CO formation	• use of fresh wood • high share of wood with an high amount of fatty acids (e.g. pine) • high temperatures in the storage • high amount of fine particles in the storage	• cooling of pellets after production • ventilation of storage • use of a CO-sensing device • prevention of fine particle formation (abrasion, moisture)
Bacteria & fungi	• water absorption	• storage on a dry place • (ventilation) • protective masks
Organic dust	• dust resuspension during pellet handling	• storage on a dry place (to avoid decomposition of pellets) • careful handling • protective masks

Overview of European standards and international standards on solid biofuels

As of January 2014

Below table provides an overview of European and international standards on solid biofuels. The European Standards are developed in CEN/TC 335 "Solid biofuels". Most of the standards on the work programme of CEN/TC 335 have been formally published as European (EN) standards. The international standards are developed in ISO/TC 238 "Solid biofuels". The standards on the work programme of ISO/TC 238 are either still under development or the process should formally be initiated. The list of (future) international standards is based on the information available at the so-called ISO Project Portal (31 January 2013); the work programme may extend in future. The work programme of ISO/TC 238 shows much overlap with the work programme of CEN/TC 335, noting that differences exist. For example, where the European standards on fuel specifications and classes (EN 14961 series) focus on non-industrial use, the international standards on this topic (future ISO 17225 series) enlarge the scope to industrial use as well.

European standards (EN)

If dated, the (draft) standard is published and publicly available

Terminology

EN 14588:2010	Solid biofuels – Terminology, definitions and descriptions

Fuel specifications and classes

EN 14961-1:2010	Solid biofuels – Fuel specifications and classes – Part 1: General requirements
EN 14961-2:2011	Solid biofuels – Fuel specifications and classes – Part 2: Wood pellets for non-industrial use
EN 14961-3:2011	Solid biofuels – Fuel specifications and classes – Part 3: Wood briquettes for non-industrial use
EN 14961-4:2011	Solid biofuels – Fuel specifications and classes – Part 4: Wood chips for non-industrial use
EN 14961-5:2011	Solid biofuels – Fuel specifications and classes – Part 5: Firewood for non-industrial use
EN 14961-6:2012	Solid biofuels – Fuel specifications and classes – Part 6: Non-woody pellets for non-industrial use

International standards (ISO)

If dated, the (draft) standard is published and publicly available

Terminology

ISO/DIS 16559: 2013 01 31	Solid biofuels -- Terminology, definitions and descriptions

Fuel specifications and classes

ISO/FDIS 17225-1: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 1: General requirements
ISO/FDIS 17225-2: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 2: Graded wood pellets
ISO/FDIS 17225-3: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 3: Graded wood briquettes
ISO/FDIS 17225-4: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 4: Graded wood chips
ISO/FDIS 17225-5: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 5: Graded firewood
ISO/FDIS 17225-6: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 6: Graded non-woody pellets

European standards (EN)

If dated, the (draft) standard is published and publicly available

Fuel quality assurance

EN 15234-1:2011	Solid biofuels – Fuel quality assurance – Part 1: General requirements
EN 15234-2:2012	Solid biofuels – Fuel quality assurance – Part 2: Wood pellets for non-industrial use
EN 15234-3:2012	Solid biofuels – Fuel quality assurance – Part 3: Wood briquettes for non-industrial use
EN 15234-4:2012	Solid biofuels – Fuel quality assurance – Part 4: Wood chips for non-industrial use
EN 15234-5:2012	Solid biofuels – Fuel quality assurance – Part 5: Firewood for non-industrial use
EN 15234-6:2012	Solid biofuels – Fuel quality assurance – Part 6: Non-woody pellets for non-industrial use

Sample and sample preparation

EN 14778:2011	Solid biofuels – Sampling
EN 14780:2011	Solid biofuels – Sample preparation

Physical and mechanical properties

EN 14774-1:2009	Solid biofuels – Determination of moisture content – Oven dry method – Part 1: Total moisture – Reference method
EN 14774-2:2009	Solid biofuels – Determination of moisture content – Oven dry method – Part 2: Total moisture – Simplified method
EN 14774-3:2009	Solid biofuels – Determination of moisture content – Oven dry method – Part 3: Moisture in general analysis sample

International standards (ISO)

If dated, the (draft) standard is published and publicly available

ISO/FDIS 17225-7: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 7: Graded non-woody briquettes

Fuel quality assurance

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Sample and sample preparation

ISO/NP 18135	Solid biofuels -- Sampling
ISO/NP 14780	Solid biofuels -- Sample preparation

Physical and mechanical properties

ISO/DIS 18134-1: 2013 09 19	Solid biofuels -- Determination of moisture content -- Oven dry method -- Part 1: Total moisture -- Reference method
ISO/DIS 18134-2: 2013 09 19	Solid biofuels -- Determination of moisture content -- Oven dry method -- Part 2: Total moisture - Simplified method
ISO/DIS 18134-3: 2013 09 19	Solid biofuels -- Determination of moisture content -- Oven dry method -- Part 3: Moisture in general analysis sample

European standards (EN)

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EN 14775:2009	Solid biofuels – Determination of ash content
EN 14918:2009	Solid biofuels – Determination of calorific value
EN 15103:2009	Solid biofuels – Determination of bulk density
EN 15148:2009	Solid biofuels – Determination of the content of volatile matter
EN 15149-1:2010	Solid biofuels – Determination of particle size distribution – Part 1: Oscillating screen method using sieve apertures of 1 mm and above
EN 15149-2:2010	Solid biofuels – Determination of particle size distribution – Part 2: Vibrating screen method using sieve apertures of 3,15 mm and below
CEN/TS 15149-3: 2006	Solid Biofuels – Methods for the determination of particle size distribution – Part 3: Rotary screen method
EN 15150:2011	Solid biofuels – Determination of particle density
EN 15210-1:2009	Solid biofuels – Determination of mechanical durability of pellets and briquettes – Part 1: Pellets
EN 15210-2:2010	Solid biofuels – Determination of mechanical durability of pellets and briquettes – Part 2: Briquettes
EN 16126:2012	Solid biofuels – Determination of particle size distribution of disintegrated pellets
EN 16127:2012	Solid biofuels – Determination of length and diameter for pellets and cylindrical briquettes

International standards (ISO)

If dated, the (draft) standard is published and publicly available

ISO/DIS 18122: 2013 09 19	Solid biofuels -- Determination of ash content
ISO/NP 18125	Solid biofuels -- Determination of calorific value
ISO/DIS 17828: 2013 11 01	Solid biofuels -- Determination of bulk density
ISO/DIS 18123: 2013 11 01	Solid biofuels -- Determination of the content of volatile matter
ISO/CD 17827-1	Solid biofuels -- Determination of particle size distribution for uncompressed fuels -- Part 1: Horizontally oscillating screen using sieve for classification of samples with a top aperture of 3.15 mm and above
ISO/CD 17827-2	Solid biofuels -- Determination of particle size distribution for uncompressed fuels -- Part 2: Vertically vibrating screen using sieve for classification of samples
ISO/DIS 18847: 2013-06-19	Solid biofuels -- Determination of particle density
ISO/DIS 17831-1: 2013 11 01	Solid biofuels -- Methods for the determination of mechanical durability of pellets and briquettes -- Part 1: Pellets
ISO/DIS 17831-2: 2013 11 01	Solid biofuels -- Methods for the determination of mechanical durability of pellets and briquettes -- Part 2: Briquettes
ISO/CD 17830	Solid biofuels -- Determination of particle size distribution of disintegrated pellets
ISO/DIS 17829: 2012-11-22	Solid biofuels -- Determination of length and diameter of pellets
ISO/CD 18846	Solid biofuels -- Determination of fines content in quantities of pellets -- Manual sieve method using 3,15 mm sieve aperture

European standards (EN)

If dated, the (draft) standard is published and publicly available

Chemical analysis

EN 15104:2011	Solid biofuels – Determination of total content of carbon, hydrogen and nitrogen – Instrumental methods
EN 15105:2011	Solid biofuels – Determination of the water soluble chloride, sodium and potassium content
EN 15289:2011	Solid biofuels – Determination of total content of sulfur and chlorine
EN 15290:2011	Solid biofuels – Determination of major elements – Al, Ca, Fe, Mg, P, K, Si, Na and Ti
EN 15296:2011	Solid biofuels – Conversion of analytical results from one basis to another
EN 15297:2011	Solid biofuels – Determination of minor elements – As, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Sb, V and Zn

International standards (ISO)

If dated, the (draft) standard is published and publicly available

Chemical analysis

ISO/DIS 16948: 2013 04 15	Solid biofuels -- Determination of total content of carbon, hydrogen and nitrogen
ISO/DIS 16995: 2013 04 15	Solid biofuels -- Determination of the water soluble content of chloride, sodium and potassium
ISO/DIS 16994: 2013 04 15	Solid biofuels -- Determination of total content of sulphur and chlorine
ISO/DIS 16967: 2013 04 01	Solid biofuels -- Determination of major elements
ISO/DIS 16993: 2013 04 15	Solid biofuels -- Conversion of analytical results from one basis to another
ISO/DIS 16968: 2013 04 01	Solid biofuels -- Determination of minor elements
ISO/CD 16996	Solid biofuels -- Determination of elemental composition by X-ray fluorescence

ISO/CD	Committee Draft developed by ISO (draft available for members only)
ISO/DIS	Draft International Standard (draft available for public enquiry)
ISO/FDIS	Final Draft International Standard (draft available for public enquiry)
ISO/NP	New Project by ISO, but standard development to be initiated