SolidStandards

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

D2.1h:

Non-woody 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 March 2013** by:

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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 non-woody 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Update: Most European standards mentioned in this document will be superseded within the next years by EN ISO standards.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. Non-woody pellets supply chain

Figure 1 presents typical non-woody pellet supply chains. Most pellet productions use by-products from agriculture (straws), raw material from energy plantations (e.g. miscanthus) or residues from processing industry (e.g. sunflower husks, tobacco stalks).

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

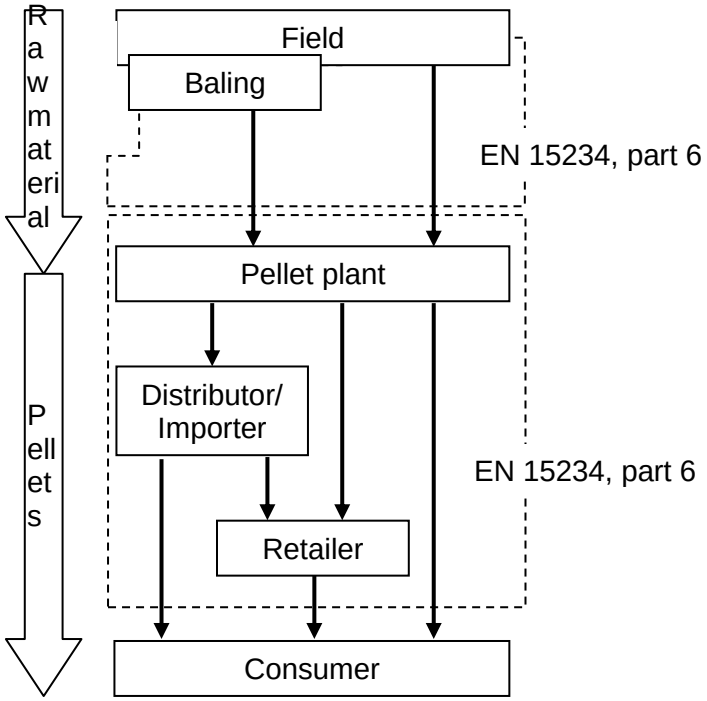

Figure 1: Typical non-woody pellet supply chains

Harvesting and baling (e.g. wheat straw) can be performed by the same person or company, but it can also be done by different actors as a chain of different operations. When baling is carried out by a farmer or a member of the cooperative (in some cases also the contractor), it is usually done with a tractor mounted baler. It is feasible mostly at small sites where the amount of non-woody biomass is relatively small. If baling is carried out by a farmer or cooperative it is mainly the responsibility of the raw material producer to provide protection against precipitation.

Larger sites with large amounts of non-woody raw material use heavier machinery. There are also enterprises that specialise in bioenergy procurement and baling. They usually have heavier equipment which allows for baling and transportation of larger amounts of biomass at a time. Baling can be carried out by a pellet producer and in this case the responsibility for protection against precipitation lies with the pellet producer.

2. How to specify non-woody 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 14961-6:2012: Solid biofuels – Fuel specification and classes.
Part 6: Non-woody pellets for non-industrial use

This product standard targets non-woody 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 14961-6)

Non-woody pellets are densified biofuel made from pulverised herbaceous or fruit biomass or blends and mixtures of herbaceous, fruit and woody biomass with or without additives usually with a cylindrical form, random length typically 3,15 mm to 40 mm with broken ends.[1]

2.3. Specification

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

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. All in all 115 level-four-descriptions enable a detailed description of origin and source.

While in EN 14961-1 the whole assortment of “Herbaceous Biomass”, “Fruit Biomass” and mixtures can be utilized for the production of non-woody pellets, EN 14961-6 defines in addition to the general quality classes A and B, separate quality classes for “Cereal straw pellets”, Miscanthus pellets” and “reed canary grass pellets”.

Example of classification for typical non-woody pellets material (for industrial use)

1st level	2 Herbaceous biomass
2nd level	2.1 Herbaceous biomass from agriculture and horticulture
3rd level	2.1.1 Cereal crops
4th level	**2.1.1.2** Straw parts

[1] EN 14961-6:2011, paragraph 3.1

2.3.2. Specification of properties (EN 14961-1 or EN 14961-6)

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 (source: DBFZ)**
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 (source: VTT)**
Ash, A (w-% dry basis) - Analysis according to EN 14775	
Classes: **see EN 14961-1, Table 4**	 **Figure 4: High temperature laboratory furnace according to EN 14775 (source: VTT)**
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 (source: DBFZ)**

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 (source: DBFZ)

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 [2]

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 (source: DBFZ)

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: [3]

- 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 (source: VTT)

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

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

Figure 9: Analyzer for S & Cl according to EN°15289 (source: DBFZ)

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: [5]

- High content of bark
- Contamination with glue or plastic

Figure 10: CHN-analyzer according to EN°15104 (source: DBFZ)

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: [6]

- 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.

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

Classes according to EN 14961-6

Non-woody pellets for **non-industrial use** can be specified either:

- as quality class A or B if they comply with the respective property classes according to Table 2 of EN 14961-6 or
- as cereal straw pellets, miscanthus pellets or reed canary grass pellets depending on the raw material type and as long as they comply with the respective property classes according to Table 1 of EN 14961-6

In comparison to wood pellets higher ash content, higher values for Copper and Chromium as well as higher contents of Nitrogen, Sulphur and Chlorine have to be expected.

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.[7]

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) [8]

The responsibility of the producer or supplier to provide correct and accurate information is exactly the same whether laboratory analysis is performed or not! [9]

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

3. How to guarantee a specific quality of non-woody pellets

3.1. Relevant Standards

EN 15234-1:2011:	Solid biofuels – Fuel quality assurance. Part 1: General requirements
EN 15234-6:2012:	Solid biofuels – Fuel quality assurance. Part 6: Non-woody pellets for non-industrial use

3.2. How to implement EN 15234-1 and/or EN 15234-6

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.[10]

Quality control = controlling the quality of a product or process [11]

- 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[12]

- 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

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

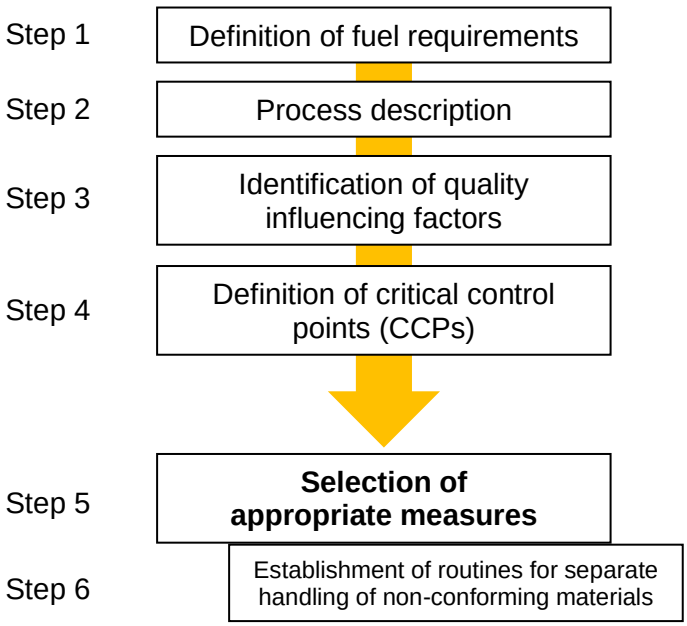

Figure 11: Procedure for the selection of appropriate quality assurance measures

As part of quality assurance system all measures taken to assure the fuel quality have to be documented and kept up-to-date. The documentation shall include:

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

Depending on the position of a market actor in the non-woody pellets supply chain, there are different responsibilities for implementing fuel quality assurance.

A **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[13] and thus guarantee the traceability of the non-woody pellets.

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

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

The **non-woody pellets consumer** has to check whether the properties of the received non-woody pellets are in compliance with the product declaration given by the non-woody pellets producer/trader.

[13] 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 non-woody pellets producer/trader are described on the basis of an example.

The example described in the following represents non-woody pellets for non-industrial use according to EN 14961-6 and EN 15234-6 (the same method is applicable for non-woody 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 15234-1:2011

Raw material

Start

Figure 13: Cereal crops (wheat), straw parts

Process

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

2 Herbaceous biomass

2.1 Herbaceous biomass from agriculture and horticulture

2.1.1 Cereal crops

2.1.1.2 Straw parts

Result

mandatory documentation !

Product declaration based on EN 14961-1	
Supplier:	---
Origin:	**2.1.1.2**
Country:	Poland (or more detailed location if needed; e.g. 80-180 Gdansk)

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

Non-woody 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 to EN 15234-6:2012

Production/Trade

Start **mandatory documentation** !	*Origin and source of the used raw material have to be classified according to EN 14961-1, Table 1.* *The non-woody pellets 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. If there does not exist a 'declaration of origin and source' the producer is responsible for preparing this declaration for the first time.* Example: Raw material: Straw parts from cereal crops (e.g. wheat); 4-digit code according to EN 14961-1, Table 1: 2.1.1.2
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).*[14] *Usually the fuel quality requirements are described in sales contracts. The non-woody pellets producer shall determine key properties of the pellets in accordance with the end-user needs.* Example: Fuel requirements for the final product: quality according EN 14961-6, Cereal straw pellets

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

Step 2

Process description

All relevant steps in the process chain have to be described. To document the steps in the process chain the non-woody pellets producer can elaborate a flow diagram.

Example:

mandatory documentation !

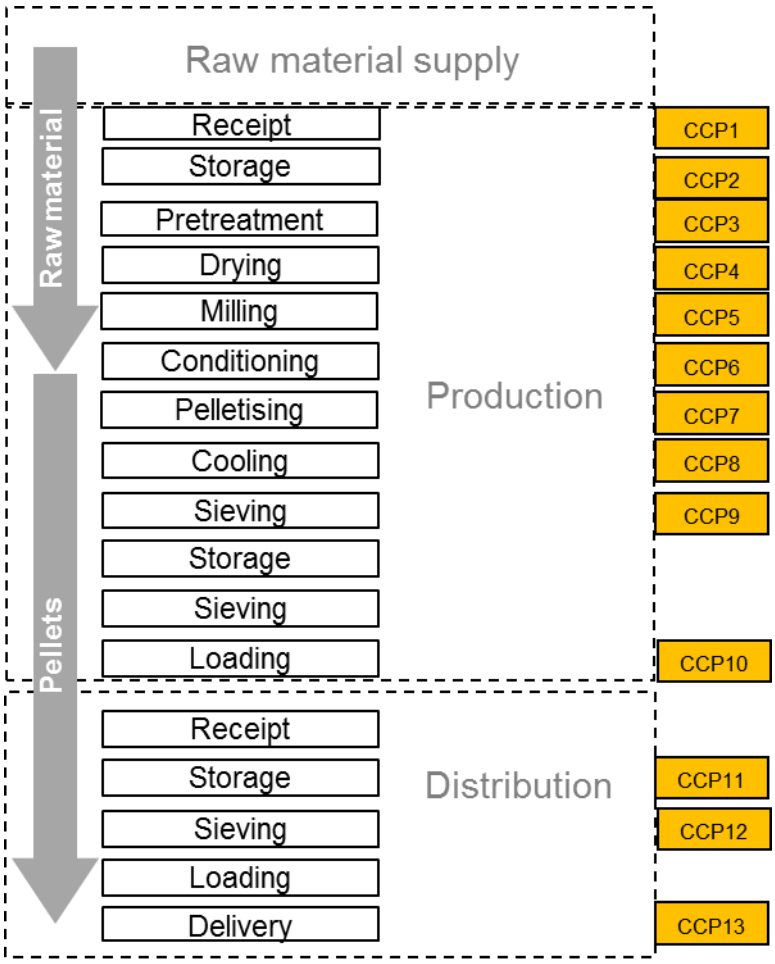

Figure 14: Process description (step 2) and Critical Control Points CCP (step 4)

Process 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.* [15]

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

The producer has to assess all influencing factors in the production process, beginning with the raw material reception and - in case of own delivery - including the transport to the heat plant. If he hires a forwarder for delivery and not a specialised trading company, the producer has to include transport in his evaluation process as well (to make sure, that the transport is handled in an appropriate way; e.g. control of the transport unit).

Example:

Influencing factors		Influenced fuel properties
Production	Receipt of raw material	• legitimacy of origin & source • impurities
	Storage conditions (Storage time, structural conditions)	• impurities • moisture
	Chipper/mill/grinder (if necessary) (condition & settings)	• particle size
	Dryer (drying temperature & output)	• moisture (influence on the performance of the pellet pres 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 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)
	Sieving machine (condition & settings)	• amount of fines • bulk density
	Suitability of the transport unit	• impurities • bulk density • amount of fines • length
Distribution	Receipt of pellets	• legitimacy of origin & source • impurities
	Storage conditions (Storage time, structural conditions	• impurities • moisture
	Sieving machine (condition & settings)	• amount of fines • bulk density
	Suitability of the transport unit	• impurities • bulk density • amount of fines • length
	Delivery	• amount of fines • bulk density

Process Step 4

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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.[16]

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 of raw material (before processing)
	Chipper, mill, grinder	CCP3: after chipper, mill, grinder
	Dryer	CCP4: after drying
	Mill	CCP5: after milling
	Conditioner unit	CCP6: before pressing
	Pellet press	CCP7: roller
	Cooler	CCP8: after cooling
	Sieving machine	CCP9: after sieving
	Loading	CCP10: when loading
Distribution	Storage conditions	CCP11: storage (before processing)
	Sieving machine	CCP12: after sieving
	Delivery	CCP13: when delivering

Process Step 5

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Selection of appropriate quality assurance measures

Appropriate measures to give confidence to the customer, that the specifications are being realised[17]*, 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*

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

Example (see example step 4):

At the beginning the most important thing is the moisture of straw picked up from the field from which bales are formed. The moisture of raw material has to be less than 18%. Moreover, picking up has to be performed carefully in order to avoid excessive contamination with soil and stones which would increase the ash content and could damage machinery.

Before the raw material is delivered to the producer it may be necessary to store it. At this point it is of essence to provide good storage conditions for the raw material. One should put the attention to e.g proper ventilation, moisture absorption, duration of storage, storage construction (e.g. risk of contamination from stony underground), size of storage etc. It is recommended to carry out periodical visual or other sensory inspections (e.g. colour, odour).

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

Pretreatment with chipper/mill/grinder

- Periodic visual inspections (particle size)
- Periodic maintenance
- If the bales prove to be wet inside while the process of chopping they should be rejected and composted

Dryer

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

Mill

- Periodic visual inspections (particle size)
- Periodic maintenance

Conditioner unit

- Periodic sensory inspections (condition)
- Periodic maintenance

Pellet press

- Periodic visual inspections 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
- Evaluation of the length of the produced pellets, bulk density, mechanical durability and moisture content is recommended.
- Archiving of representative retain samples.

Sieving machine

- Periodical visual inspections regarding the amount of fines (fines left after the pelletizing process can be recycled into the process again)
- Periodic maintenance

Pellet storage

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

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)
- Suitability of the transport unit
    - Visual inspection (vehicle type, equipment components)
    - Contamination (e.g. with soil, sand…)

Distribution

Receipt of pellets

- 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), weather conditions, storage time, impurities
- Periodical visual inspections

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
- Suitability of the transport unit
    - Visual inspection (vehicle type, equipment components)
    - Contamination (e.g. with soil, sand…)

Delivery

- Control of injection air and pressure during unloading, material and length of the tube
- Sieving of fines during unloading
- Design and conditions in the end-user/retailer storage
- Archiving of one representative retain sample per day

The quality of the produced pellets should be controlled after the production.

<u>The frequency of non-woody pellets control:</u> it is recommended to make an evaluation of the length of the produced pellets, the bulk density and the amount of fines at least once per shift. Mechanical durability and the moisture content should be evaluated as well at the frequency calculated on the basis of the following formula:

N – number of samples in 24 hours

days – annual working days

tonne - annual quantity of pellets in tonnes

[18]

Representative retain samples should be archived (at the frequency presented by the formula above).

Process Step 6

mandatory documentation !

Establishment and documentation of routines for separate handling of nonconforming materials and solid biofuels

- *If raw materials or the produced non-woody 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.* [19]

Examples:

- 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

- If mechanical durability of the fuel is too low it is redirected to the mill and pelletizing process

- If moisture content is too high, fuel is redirected to the mill and is mixed/blended with the material with lower moisture content

[18] EN 15234-6:2012, paragraph 5.6.2
[19] EN 15234-6:2012, 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 non-woody pellets to end-consumers the product declaration/labelling shall as a minimum include:

- *Supplier (body or enterprise) including contact information*
- *Traded form according to EN 14961-1:2010, Table 2 (here: pellets)*
- *Origin and source (according to EN 14961-1)*
- *Country/countries (locations) of origin*
- *Specification of properties (according to EN 14961-1 or EN 14961-6 for non-industrial non-woody pellets)*
- *Normative properties*
- *(Informative properties)*
- *Chemically treated material (yes/no)*
- *Signature, date. (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. [20]

Examples:

Simplified product declaration based on EN 14961-6	
Supplier:	---
Quality assurance standard:	EN 15234-6
Origin:	2.1.1.2
Country:	Poland 80-180 Gdansk
Chemically treated raw material	No x Yes □
Diameter (mm)	D06 x D08 □
Traded Form:	pellets
Class or raw material type	Cereal straw

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

Product declaration – non-woody pellets		
Supplier:	---	
Quality assurance standard:	EN 15234-6	
Origin:	2.1.1.2 (w-90%), 1.2.1.2 (w-10%)	
Country:	Poland 80-180 Gdansk	
Chemically treated material	No x Yes □	
Traded Form:	pellets	
Class or raw material type	A	
Normative properties – EN 14961-6	**Unit**	**Value**
Diameter (D), EN 16127	mm	10
Moisture (M), EN 14774-1, EN 14774-2	w-% as received	10
Ash (A), EN 14775	w-% dry	4,0
Mechanical durability (DU), EN 15210-1	w-% as received	97,5
Amount of fines (F), EN 15210-1	w-% as received	0,9
Additives, type	w-% dry	1,0 (starch)
Net calorific value (Q), EN 14918	MJ/kg or kWh/kg as received	16
Bulk density (BD), EN 15103	kg/m³	700
Nitrogen (N), EN 15289	w-% dry	0,5
Sulphur (S), EN 15104	w-% dry	0,1
Chlorine (Cl), EN 15289	w-% dry	0,1
Informative properties – EN 14961-6		
Arsenic (As), EN 15297	mg/kg dry	0,5
Cadmium (Cd), EN 15297	mg/kg dry	0,3
Chromium (Cr), EN 15297	mg/kg dry	10
Copper (Cu), EN 15297	mg/kg dry	8
Lead (Pb), EN 15297	mg/kg dry	5
Mercury (Hg), EN 15297	mg/kg dry	0,03
Nickel (Ni), EN 15297	mg/kg dry	5
Zinc (Zn), EN 15297	mg/kg dry	57
Signature of assigned person	*Place and date*	

Annex

Storing and Handling of non-woody 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 15234-6.

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 non-woody 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*		**International standards (ISO)** *If dated, the (draft) standard is published and publicly available*	
Terminology		**Terminology**	
EN 14588:2010	Solid biofuels – Terminology, definitions and descriptions	ISO/DIS 16559: 2013 01 31	Solid biofuels -- Terminology, definitions and descriptions
Fuel specifications and classes		**Fuel specifications and classes**	
EN 14961-1:2010	Solid biofuels – Fuel specifications and classes – Part 1: General requirements	ISO/FDIS 17225-1: 2013 11 28	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	ISO/FDIS 17225-2: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 2: Graded wood pellets
EN 14961-3:2011	Solid biofuels – Fuel specifications and classes – Part 3: Wood briquettes for non-industrial use	ISO/FDIS 17225-3: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 3: Graded wood briquettes
EN 14961-4:2011	Solid biofuels – Fuel specifications and classes – Part 4: Wood chips for non-industrial use	ISO/FDIS 17225-4: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 4: Graded wood chips
EN 14961-5:2011	Solid biofuels – Fuel specifications and classes – Part 5: Firewood for non-industrial use	ISO/FDIS 17225-5: 2013 11 28	Solid biofuels -- Fuel specifications and classes -- Part 5: Graded firewood
EN 14961-6:2012	Solid biofuels – Fuel specifications and classes – Part 6: Non-woody pellets for non-industrial use	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)

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

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