SolidStandards

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

D2.1e

Wood briquette 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 briquette 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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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 briquettes 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Update: Most European standards mentioned in this document will be superseded within the next years by EN ISO standards.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 briquettes supply chain

Wood briquettes are solid biofuels which are mainly used in small scale, hand-loaded furnaces.

Wood briquette production still sticks to the idea of a cascade supply chain, using mainly by-products from the wood processing industry, namely saw dust which still has to be dried before further processing, and wood shavings, which can be compressed directly.

After cooling wood briquettes are packed in about 10 kg packages and are traded and sold through first traders and then retailers to the end consumers.

2. How to specify wood briquettes

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 14961-3:2011 Solid biofuels – Fuel specification and classes.
Part 3: Wood briquettes for non-industrial use

This product standard targets wood briquettes 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 briquettes are densified biofuel made with or without additives in the form of cubiform, polyedric or cylindrical units, produced by compressing pulverized biomass. [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 “woody biomass” can be utilized for the production of wood briquettes, EN 14961-3 only allows the use of specific raw material classes for the production of a certain wood briquette quality class.

[1] EN 14961-3:2011, paragraph 3.1

2.3.2. Specification of properties (EN 14961-1 or EN 14961-3)

Property classes according to EN 14961-1

In Table 3 of EN 14961-1 wood briquettes for **general use** are defined by the following properties:

Normative properties (mandatory, always to be specified)

Dimensions (mm) - Analysis according to EN 16127

Diameter (D) or equivalent (diagonal or cross cut), mm

Classes: **see EN 14961-1, Table 3**

Length (L), mm

Classes: **see EN 14961-1, Table 3**

Moisture, M (w-% as received) - Analysis according to EN 14774-1, 14774-2

Classes: **see EN 14961-1, Table 3**

Ash, A (w-% of dry basis) - Analysis according to EN 14775

Classes: **see EN 14961-1, Table 3**

Typical values for the ash content of pure wood without bark should range below 0.7 %.

Reasons for higher values can be: [2]

- Contamination with soil/sand
- Higher content of bark
- Inorganic additives
- Chemical treatment such as paint/preservation

Problems with ash: Disposal; risk of slagging

Figure 1: High temperature laboratory furnace according to method EN 14775 (Source: VTT)

Particle density (g/cm³) – Analysis according to EN 15150

Classes: **see EN 14961-1, Table 3**

Additive (w-% of pressing mass)

Type and content of pressing aids, slagging inhibitors or any other additives have to be stated. The maximum amount of additive is 20 w-% of pressing mass. Type stated as chemical substance (e.g. starch). If amount is greater, then raw material for briquettes is blend. [3]

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

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

see EN 14961-1, Table 3

Typical values for the net calorific value of wood briquettes with a moisture content below 12 % should be higher than 15.5 MJ/kg.

Reasons for lower values can be: [4]

- High moisture content
- High ash content
- Content of combustible material with lower calorific value (e.g. adhesives)

Reasons for high values can be: [5]

- Content of combustible material with higher calorific value than wood (e.g. resin, plastic, vegetable or mineral oils)

Figure 2: Bomb calorimeter according to method EN 14918 (Source: HFA)

Normative properties
Informative properties

Mechanical durability, DU (w-% of briquettes after testing) - Analysis according to EN 15210-2

Classes: **see EN 14961-1, Table 3**

Normative only if traded in bulk.

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

Classes: **see EN 14961-1, Table 3**

Normative only for chemically treated biomass (1.2.2; 1.3.2).

Typical values for Nitrogen N in pure wood without bark should range below 0.3 %.

Reasons for higher values can be: [6]

- High content of bark
- Adhesives (e.g. aminoplaste polymeres UF)
- Plastic (laminates)

Problems with N: Transition in nitrous gases during combustion.

Figure 3: CHN-analyzer according to method EN 15104 (Source: VTT)

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

Classes: **see EN 14961-1, Table 3**

Normative only for chemically treated biomass (1.2.2; 1.3.2).

Typical values for Sulphur S in pure wood without bark should range below 0.03 %.

Reasons for higher values can be: [7]

- High content of bark
- Organic additives (as e.g. corn or potato flour, lignosulphonates
- Inorganic additives containing sulphur compounds
- Treatment with chemicals containing sulphur (as e.g. sulphuric acid)

Problems with S: Transition in sulphur dioxide emissions during combustion. Condensation of the flue gases can lead to corrosion.

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

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

Classes: **see EN 14961-1, Table 3**

Normative only for chemically treated biomass (1.2.2; 1.3.2).

Typical values for Chlorine Cl in pure wood without bark should range below 0.02 %.

Reasons for higher values can be: [8]

- High content of bark
- Origin of wood from coast near locations (seawater exposed)
- Contamination during storage/transportation by road salting
- Preservation chemicals

Problems with Cl: Transition in HCl (hydrochloride acid), dioxines and furan emissions during combustion. Condensation of the flue gases can lead to corrosion; enables the formation of aerosols which leads to higher particle emissions

Figure 4: Analyzer for Cl according to method EN 15289 (Source:VTT)

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.

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

Classes according to EN 14961-3

Wood briquettes 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 14961-3. Class A1 represents the best quality for wood chips with low ash and moisture content. Next to chemically untreated wood residues, stemwood is allowed as raw material basis for class A1 wood briquettes. For quality class A2 also 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 then physical/chemical analyses may not be needed. [9]

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

a) using typical values [10]

- e.g. laid down in annex B of EN 14961-1 or obtained by experience
- For ash, gross/net calorific value, CHN, S, Cl, metals, ... typical values are stated on dry basis.
- Moisture content and particle size depend on many different factors (not only on the raw material) and therefore there are no typical values stated. Nevertheless the fact that e.g. wood shavings which derive from dry wood beams used for composite lumber have a moisture content of below 15 w-% can be seen as a typical value.

b) calculation of properties [11]

- e.g. for mixtures/blends properties can be calculated out of typical values or analyzed values of the respective unmixed/-blended raw materials

c) carrying out of analysis (with simplified methods if available or with reference methods) [12]

The responsibility of the producer or supplier to provide correct and accurate information is exactly the same whether laboratory analysis is performed or not! [13]

[9] EN 14961-1:2010, paragraph 7.2
[10] EN 14961-1:2010, paragraph 7.2
[11] EN 14961-1:2010, paragraph 7.2
[12] EN 14961-1:2010, paragraph 7.2
[13] EN 14961-1:2010, paragraph 7.2

3. How to guarantee a specific quality of wood briquettes

3.1. Relevant standards

EN 15234-1:2011	Solid biofuels – Fuel quality assurance. Part 1: General requirements
EN 15234-3:2011	Solid biofuels – Fuel quality assurance. Part 3: Wood briquettes for non-industrial use

3.2. How to implement EN 15234-1 and/or EN 15234-3

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. [14]

Quality control = controlling the quality of a product or process [15]

- 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 [16]

- 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

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

- Allocation of responsibilities
- Training of the staff (concerning the required quality demands)
- Quality control in the production process
  - Raw material reception (e.g. documentation on the delivery note or the invoice)
  - Results of wood briquettes analyses (if necessary)
  - Outgoing wood briquettes (e.g. delivery agreement with the customer or documentation on the delivery note).
  - Non-conforming raw material or wood briquettes
- Complaint management system

[14] EN 15234-1: 2011, paragraph 6.1
[15] EN 15234-1: 2011, paragraph 6.2
[16] EN 15234-1: 2011, paragraph 6.2

Depending on the position of a market actor in the wood briquettes 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 [17] and thus guarantee the traceability of the wood briquettes.

The **wood briquette 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 briquette producer has to follow 6 consecutive steps to guarantee quality assurance and quality control throughout the whole production process (supply chain).

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

The **wood briquette consumer** has to check whether the properties of the received wood briquettes are in compliance with the product declaration given by the wood briquette producer/trader. In the case of wood briquettes the consumers will mostly be small-scale end user, who won´t be able to assess the quality of the wood briquettes. Therefore the voluntary implementation of a certification system for wood briquettes production is recommended.

3.2.2. Implementation process

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

The example described in the following represents wood briquettes for non-industrial use according to EN 14961-3 and EN 15234-3 (the same method is applicable for wood briquettes for industrial use according to EN 14961-1 and EN 15234-1).

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

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 5: Wood shavings (Source: HFA)

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:	---
Origin:	**1.2.1.2**
Country:	Austria (or more detailed location if needed)
Traded Form:	Wood shavings (spruce)
Chemically treated material	No x Yes ☐
Normative properties – EN 14961-1	
Moisture (w-%)	M12
Ash content (w-%)	A0.7

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

Wood briquette 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 15234-1:2011

Production

Start

mandatory documentation !

The wood briquette 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. If there doesn´t exist a 'declaration of origin and source' the producer is responsible for preparing this declaration for the first time.

An adjacent planing mill delivers dry wood shavings directly via their suction system into a storage silo of the briquette producer. In addition a certain amount of wood shavings has to be purchased from other companies and arrives per lorry at the production site, where it is discharged at a roofed storage place with a moving floor and fed into the silo. The briquette producer trades the raw material for the first time as biofuels and therefore has to prepare the 'declaration of origin and source' and include it on e.g. the delivery note or the invoice after the transaction only.

Figure 6: Wood shavings (Source: HFA)

Process

Step 1

The fuel quality is described by 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).[18] *Usually the fuel quality requirements are written in sales contracts.*

Many boiler- and stove-manufacturers require heating material with a certain quality. To meet these market demands the wood briquette producer decides to produce briquettes according to EN 14961-3, property class A1.

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

Process Step 2

mandatory documentation !

To document the steps in the process chain the wood briquette producer can elaborate a flow chart, in which he defined – based on the influencing factors (step 3) - Critical Control Points CCP (step 4).

Step 2, 3 and 4 should be part of a 'company-manual', which has to be elaborated independently of a specific commission for the usual processes of the company. A flow chart for wood briquette production and transport including critical control points is attached below.

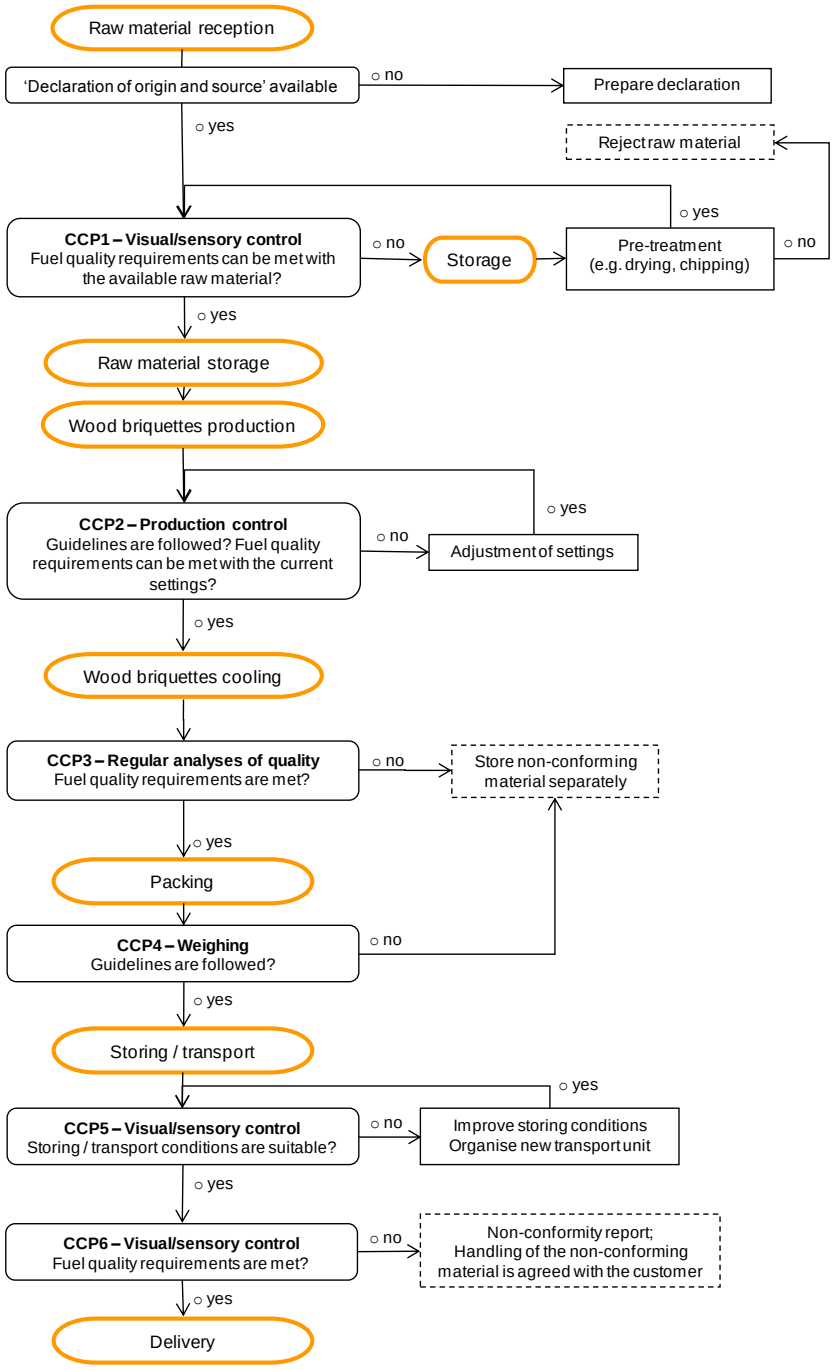

Figure 7: Flow chart with CCP

Process Step 3

All activities referring to both technical processes and management issues should be examined. The following factors determine the quality of the wood chips 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.*[19]

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 retailer.

Influencing factors	Influenced fuel property
Raw material • wood species (with or without bark) • traded form (sawdust, wood shavings) • moisture content • chemical treatment (e.g. adhesives) • storage conditions (e.g. covering, silo, impurities)	• ash content • net calorific value • moisture content • chemical properties
Production unit • type of briquette press (eccentric machine, extruder, RUF) • amount and type of additives, water (residence time)	• density • moisture content • chemical properties
Storage conditions, transport • means to protect briquettes from water uptake (covering, shrink foil, bags)	• moisture content
knowledge, competence and qualification of the staff	• all

Process Step 4

mandatory documentation !

Critical Control Points are points within or between processes at which properties can be most readily assessed and that offer the greatest potential for quality improvement. [20]

See Figure 7.

[19] EN 15234-1:2011, paragraph 6.4 c)
[20] EN 15234-1:2011, paragraph 6.4 d)

Process Step 5

mandatory documentation !

Appropriate measures to give confidence to the customer, that the specifications are being realized, include besides product control the following management issues:

- *Allocation of responsibilities*
- *Training of staff*
- *Work instructions*
- *Establishment of quality control measures*
- *Proper documentation of processes and test results*
- *System of procedures for complaints*[21]

In the 'company-manual' it is defined that the manager of the production company is quality manager at the same time and is responsible for the training of the staff and the allocation of responsibilities. Work instructions exist for each Critical Control Point (CCP). Based on the flow chart of the production process a shift protocol was elaborated to assure that quality issues are taken into consideration and documented at all times.

Step 5 - **CCP1 (raw material reception):**

As part of the raw material reception it must be ensured by the wood briquette producer that the declaration of origin and source is in order.

- *Visual or other sensory inspections of the delivered raw material (general evidence of suitability can be obtained from knowledge of the type of wood and type of processing, contamination with impurities, etc.).*
- *Delivery declaration of the supplier (e.g. that the raw material doesn´t include chemically treated wood, …)*
- *Contract with 'terms of delivery'*[22]

The company only processes dry wood shavings. The adjacent planing mill has an in-line moisture meter for the planed wood boards - the moisture content of the boards mustn´t exceed 15 %. The wood briquette producer has the experience that with raw material of this moisture content the requirements of the briquettes according to EN 14961-3 are fulfilled. For the additionally purchased raw material 'terms of delivery' are agreed on in a purchase contract and the quality of the incoming material is checked visually and if necessary with a moisture control analysis.

Figure 8: Moisture control of the boards (Source: Mosser, HFA)

Figure 9: Raw material storage (Source: Mosser, HFA)

[21] EN 15234-1:2011, paragraph 6.4 e)
[22] EN 15234-3:2012, paragraph 5.6.1

Step 5 - **CCP2 (production):**

- *Regular control of settings, function and condition of the equipment*
- *Production control (e.g. power demand of presses, temperature of the die)* [23]

During briquetting the settings of the press are checked continuously and adjusted if necessary.

Figure 10: Briquetting press (Source: Mosser, HFA)

Figure 11: Cooling (Source: Mosser, HFA)

Step 5 - **CCP3 (cooling):**

- *The quality (dimensions, moisture content, particle density) of the produced wood briquettes shall be determined regularly; see formula below to calculate the frequency of the analyses (particle density has to be checked at least once a shift)* [24]

$$\frac{N \cdot days}{tonne}$$

N …… number of samples in24 hours
days ….. annual working days
tonne … annual quantity of pellets in tonnes

With an annual production of 5000 tonnes and 220 working days the number of samples which have to be taken and analysed result in 1 time per 24 hours. In the case of non-conformity of the briquettes the whole batch since the last quality control has to be stored separately.

[23] EN 15234-3:2012, paragraph 5.6.2
[24] EN 15234-3:2012, paragraph 5.6.2

Step 5 - **CCP4 (packing):**

The cooled down briquettes are wrapped in shrinkage foil. After packing the weight of the 10 kg packages is checked regularly. This way, deviations of density and/or dimensions of the briquettes can be detected in between of regular analyses.

Figure 12: Packing
(Source: Mosser, HFA)

Step 5 - **CCP5 (storing / transport):**

- *Protection of wood briquettes from moisture e.g. snow, rain or damp walls, also from condensation moisture through suitable storage/transport unit. This should be controlled.*
- *Protection of wood briquettes from contamination with impurities (e.g. stones, soil and grain). This should be controlled.*
- *Wood briquettes of different quality have to be stored separately.*[25]

The briquettes are stored on pallets in the production hall and are loaded onto covered transport units. Briquettes which do not fulfil the requirements are stored separately in bags and are sold without declaration.

Figure 13: Storing of conforming and nonconforming briquettes
(Source: Mosser, HFA)

Step 5 - **CCP6 (delivery):**

On delivery the consumer (e.g. retailer or trader) checks the quality of the briquettes. Most times the control only concerns the performance of the package and unintentional water uptake due to e.g. damaged shrinkage foil. Further complaints may occur only later on during use.

[25] EN 15234-3:2012, paragraph 5.6.3

Process Step 6 **mandatory documentation** !	• *If raw materials or the produced wood briquettes are not fulfilling the requirements (due to e.g. high moisture content), these batches have to be stored separately from conforming ones.* • *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.*[26] Example 1: At the raw material reception it is noticed that the delivered wood shavings contain particles of adhesives. This doesn't meet the requirements of class A1 of EN 14961-3. The loading is sent back to the supplier. Example 2: The responsible employee realizes at CCP3 that the moisture content of the briquettes does not fulfil the requirements. He checks with the planing mill, if there happened to be a problem with the moisture content of the boards, makes sure that the problem is solved and evaluates the amount of non-conforming briquettes. The nonconforming briquettes can be sold as industrial briquettes or they are fed back into the raw material (if the moisture content wasn´t too high).

[26] EN 15234-3:2012, paragraph 5.7

Result

mandatory documentation !

The quality of the produced briquettes corresponds to that defined in step 1 of the process. If the producer/trader delivers wood briquettes 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);*
- *Origin and source (according to the EN 14961-1:2010, Table 1);*
- *Country/countries (locations) of origin;*
- *Specification of properties (according to the relevant part of EN 14961):*
  - *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 or stamping of the packages 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.[27]

Product declaration – wood briquettes	
Supplier:	---
Quality assurance standard	EN 15234-3
Origin:	1.2.1.2
Country:	Austria 3263 Randegg
Traded Form:	Wood briquettes (10 kg shrinkage foil)
Chemically treated material	**No x** Yes, class B ☐
Class	**A1 x** A2 ☐ B ☐

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

4. Certification schemes for high quality wood briquettes

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 to show the customers (distributors as well as end-customers) that the wood briquettes have been produced and handled in accordance with the scheme's requirements. A comprehensive certification scheme consists of three parts mainly:

- product requirements (e.g. EN 14961-3, class A1)
- internal quality assurance (e. g. EN 15234-3)
- external control of the product (by independent testing body)
- external control of the production (by independent inspection body)

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

Scheme	Subject	Related quality classes [1)]	Comment
ÖNORM C 4006 geprüft (former ÖNORM M 7135 geprüft)	Wood briquettes for non-industrial use	A1	Certification of production and product
DINplus (former DINgeprüft)	Wood briquettes for non-industrial use	A1	Product certification
ENplus woodbriquettes	Wood briquettes for non-industrial use	A1, A2	1) Certification of the trading company and the product 2) Certification of production and product (at the production company)

1) according to EN 14961, part 3

Annex

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)

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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

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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)

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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)

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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)

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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