SolidStandards

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

D2.1f

Firewood 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.

SolidStandards is coordinated by:

WIP Renewable Energies
Sylvensteinstrasse 2
81369 Munich, Germany
Cosette Khawaja & Rainer Janssen
cosette.khawaja@wip-munich.de
rainer.janssen@wip-munich.de
Tel. +49 (0)89 72012 740

About this document

This document is part of **Deliverable 2.1** of the SolidStandards project. It is the training guidebook for the firewood module and provides background information to the corresponding presentation slides. This document was prepared in **March 2012 and updated in March 2013** by:

VTT
P.O. Box 1603 (Koivurannantie 1)
40101 Jyväskylä, Finland

Eija Alakangas

eija.alakangas@vtt.fi
Tel. +358 20 722 2550

Intelligent Energy Europe

The SolidStandards project is co-funded by the European Union under the Intelligent Energy Europe Programme (Contract No. EIE/11/218).

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

Firewood - Implementation of quality standards

Table of contents

Annex

List of EN standards with reference to respective EN ISO numbers

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Update: Most European standards mentioned in this document will be superseded within the next years by EN ISO standards.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

In principle, firewood supply chain consists of three basic phases: supply of raw material, production and distribution (delivery). Within this basic supply chain, several alternatives can be found for different phases (Figure 1).

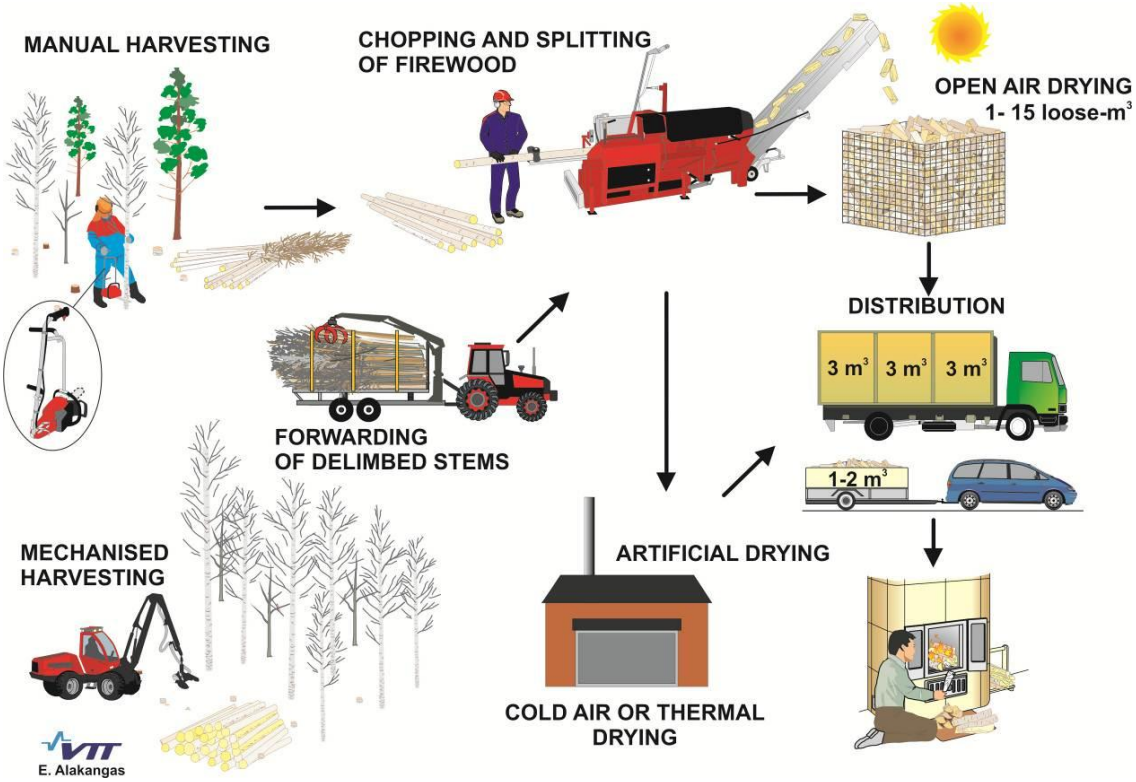


Figure.1 Firewood chain options (source: VTT)

1.2.1. Harvesting trees

A chainsaw is generally used when harvesting trees by oneself, whereas forest harvesters are used for larger amounts (Erkkilä & Alakangas 2008). During mechanical harvesting the trees are partially debarked, which improves drying and helps prevent the wood from rotting. Trees with their bark intact deteriorate rapidly already during the second summer. If the trees are left for the entire year or more, the bark should be broken. Logs that are protected from the rain and with broken bark dry well.

The moisture content of growing trees varies according to the season. The moisture content of broadleaf trees peaks in April and May. Since the best weather for drying the logs is from April to July, trees are harvested and cut into long and straight logs during the winter months and chopped for drying in the early spring. The appearance of the firewood also benefits from this, especially if the drying logs are protected from the rain.

In a good summer and in a good drying place, wood that has been harvested during the winter can be dried for use as firewood in a single summer. However, the wood must then be chopped by the end of May at the latest. If it is not possible to chop the wood in the same spring, the bark of the felled and lopped stem should be broken or peeled in strips. The bark can be broken with a chainsaw already during the harvesting process. With the bark thus broken or removed, the logs will begin to dry well during the spring.

Firewood is sometimes also harvested by leaf seasoning which means leaving the trees where they fall in a cleared forest. The trees then release moisture through their live treetops. The moisture content of the trees is reduced to the saturation point of the cells when the leaves or needles dry and fall off. The saturation point of the cells of tree species equals moisture content of 27 to 30 per cent. If it is possible to harvest the trees in the late winter and chop them immediately into logs, it is not worth to wait the leaf seasoning time. Trees dry faster when chopped into logs. The leaf seasoning can be used if the intention is to make dry firewood for the following year.

The trees are transported out of the forest by tractor, all-terrain vehicle or snowmobile pulling a trailer or sledge. The tree trunks are then stored on top of supporting logs to prevent moisture from the ground from rising up and reaching the wood. If the pile is left for the entire year or more, it should be covered to protect it from rain. Plenty of space should be left between the cover and the top of the pile. If there is no space for the air to circulate, the wood will become mouldy.

1.2.2. Chopping the wood

Cutting and splitting the trunks is referred to as chopping (Erkkilä & Alakangas 2008). Chopping the wood accelerates the drying process. Splitting the wood and breaking the bark increases the surface area from which water can evaporate. Bark restricts water from passing through it and slows the drying process. Thin trunks do not need to be split, but the bark should still be broken.

In addition to facilitating the drying process, chopping the wood reduces its size for burning. The length of the logs depends on the intended fireplace. Several tools can be used for chopping, from saws and splitting axes to professional automatic chopping machines.

Once cut using a chainsaw, the logs must be split into appropriate sizes. The traditional tool for this is an axe. Tools that rely on human muscle power are ideal for chopping small amounts of wood. Special splitting axes are available for splitting logs, and a number of other products can also be used.

Hydraulic splitters are the simplest mechanical splitting tools. The force is usually generated by an electrical hydraulic pump, which transfers pressure to a hydraulic cylinder. The cylinder pushes the log against a blade, which splits the wood. Many different types of hydraulic splitter are available. Tractor-driven hydraulic splitters use the tractor’s own hydraulics to generate the force.

Two-stage chopping machines both saw and split the wood. The trunk is cut with either a chainsaw or buzz saw, and the log is then split hydraulically in the same manner as a hydraulic splitter. Advanced chopping machines increase productivity by accelerating the return action of the hydraulic cylinder or by utilizing double alternating hydraulic cylinders. The least expensive chopping machines split the wood using a cone screw.

Some chopping machines use a cutting blade that splits and cuts the log at the same time. These machines are suitable for trunks with a diameter of less than 15 cm.

1.2.3. Drying logs

Several factors are affecting the drying of firewood, such as the species of the tree, the diameter of the tree, the drying method, the conditions where the wood is being dried, the arrangement of the wood and the weather (Erkkilä & Alakangas 2008). The place where the wood is seasoned should be open and sunny. A storage place that is higher than its surroundings will remain dry from flowing water.

Logs can be dried either stacked or unstacked. Drying unstacked logs requires less work than stacking the wood. Supporting logs, pallets and various frames can be used to elevate the logs off the ground and into an ideal arrangement for drying. It is essential to prevent ground moisture from rising up into the woodpile, to ensure the flow of air around the logs, and to prevent rainwater from soaking the pile. The woodpile can be protected against the rain using a canopy already from the start of summer. Space should be left between the canopy and the logs to allow air to flow. Covering the woodpile will not slow down the drying process, but it will prevent rainwater from getting inside the pile. The logs will also maintain their colour better without getting mouldy. However, the woodpile must not be covered too tightly, it is important that air can flow freely also on the top of pile.

Drying logs in a stack reduces the amount of space required. Supporting logs are needed under the stack to prevent ground moisture from reaching the wood and to facilitate airflow also beneath the pile. Sturdy trunks, pallets or other similar items should be used for the supporting structure. The lowest logs should be at least 10 cm above the ground. The supporting logs can be raised and prevented from sinking into the ground by placing logs every 50 to 100 cm under them in the direction of the drying logs. Any grass should be mowed from around the stack. Stacks should not touch each other, as air must flow around them. Stacks of firewood are protected from the rain the same way as unstacked woodpiles.

In good conditions logs that have been chopped by the end of May will dry into firewood over the summer in dry weather conditions. Birch, aspen and some other broadleaf wood species dries slower than other tree species due to its tight bark. If the bark is broken sufficiently, birch logs will also dry over the spring and summer in dry weather conditions. Before the arrival of the autumn rains woodpiles and stacks should be protected also from the sides, leaving enough space between the cover and the logs to ensure ventilation.

It is possible to fasten the drying process using artificial drying with either cold or warm artificial blowing.

1.2.4. Storage

The moisture content of even dry wood varies according to the temperature and humidity of the surrounding air (Erkkilä & Alakangas 2008). The equilibrium moisture content of wood in a covered outdoor woodshed can vary between 15 and 25 per cent depending on the season. Storing firewood correctly helps prevent the accumulation of rot and funguses. For this reason it is important to keep dried wood dry.

The ideal woodshed is spacious, well ventilated and protected from dampness and rain. The less air and open space there is within the woodshed, the drier the logs should be before storing them there. Air should flow freely under, around and between the logs. Space should be left between the stacks whenever possible (see photos below).

Photos: Lauri Sikanen and VTT

2. How to specify firewood

2.1. Relevant Standards

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

Table 7 – Specification of properties for log wood, firewood

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). This standard can be used especially when traded 1 metre wood logs or firewood, which is not oven-ready.

EN 14961-5:2011: Solid biofuels – Fuel specification and classes. Part 5: Firewood for non-industrial use

This product standard targets firewood for non-industrial use especially in household markets. In these small scale applications the importance of fuel quality is pronounced. Properties are bound together to form a class A1, A2 or B. Some of them are normative, while the others are informative.

2.2. Definition (EN 14588)

Firewood is cut and split oven-ready fuelwood used in household wood burning appliances like stoves, fireplaces and central heating systems. Typically firewood has a uniform length, which typically is in the range of 15 cm to 100 cm.[1]

[1] EN 14961-5 :2011, paragraph 3.1

2.4. Specification

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

Examples of classification for typical firewood material.		
--	Whole trees without roots from mixed species (1.1.1.5)	
--	Chemically untreated wood residues (1.2.1)	e.g. core of plywood
--	Stemwood from broadleaf (1.1.3.1)	
Requirements of origin for firewood for non-industrial use according to EN 14961-5		
class: A1 [2]	Stemwood (1.1.3) Chemically untreated wood residues (1.2.1)	
class: A2, B [3]	Whole trees without roots (1.1.1) Stemwood (1.1.3) Logging residues (1.1.4), big branches and tops. If logging residues or branches and tops are used they need to be delimbed before cutting and splitting.	 

[2] EN 14961-5, Table 1
[3] EN 14961-5, Table 1

2.4.2. Specification of properties (EN 14961-1 or EN 14961-5)

Classes according to EN 14961-1

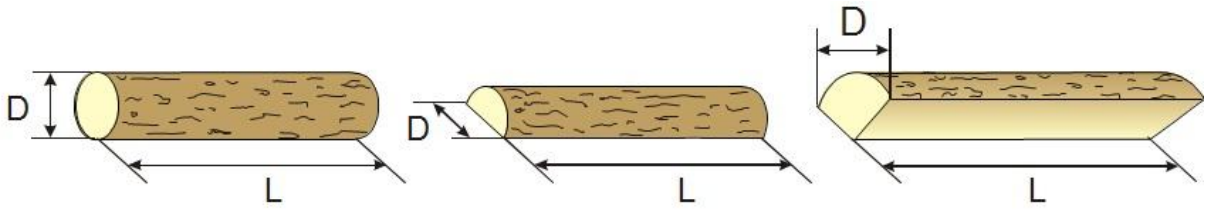
In Table 7 of EN 14961-1 log wood and firewood are defined by the following properties:

Normative properties (mandatory, always to be specified)

Dimensions (cm), Length (L) and diameter (D)

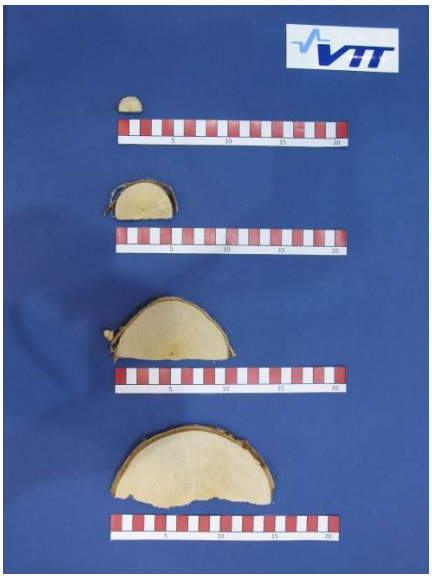
Length, L – maximum length of a single chop, cm

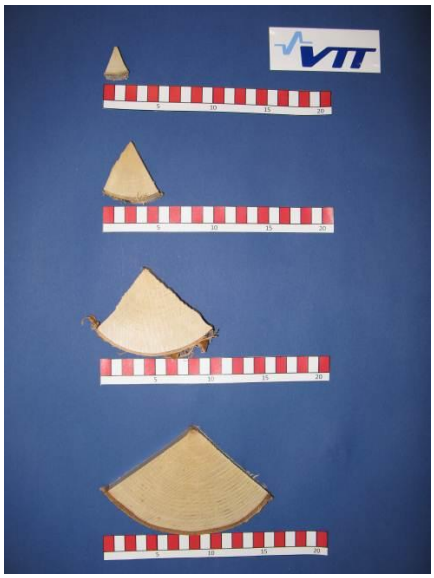
Classes: **see EN 14961-1, Table 7**



Diameter, D – maximum diameter of a single chop, cm

Classes: **see EN 14961-1, Table 7**



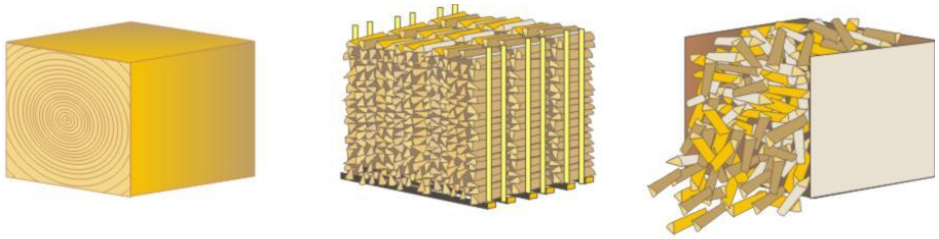


Moisture, M (w-% as received) – Analysis according to EN 14774-1, EN 14774-2

Classes: **see EN 14961-1, Table 7**

Volume or weight, m^3 stacked or loose or kg as received

When retailing and/or packaging log wood and firewood , the volume unit that is used (stacked or loose m^3, kg) has to be stated



Solid cubic metre **Stacked cubic metre** **Loose cubic metre**

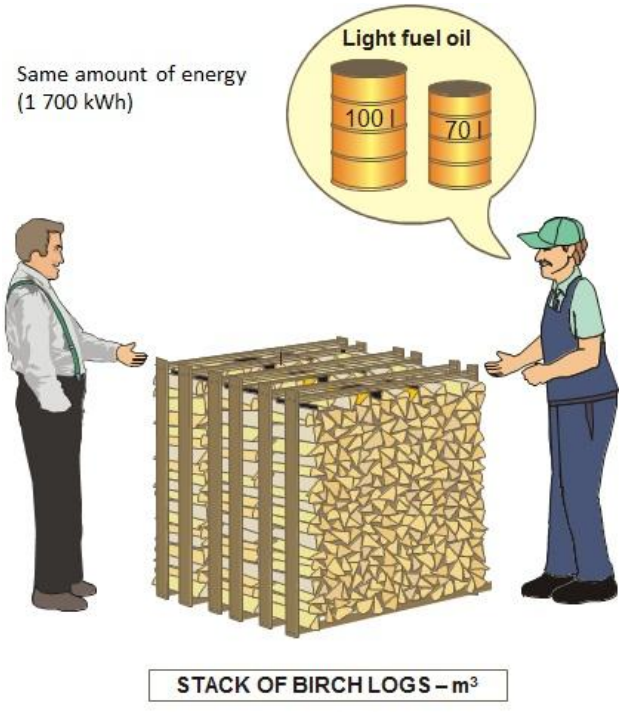
3 loose m^3 equals to 2 stacked m^3.

Informative properties (voluntary, but recommended to be stated)

Energy density, E (kWh/kg or kWh/m^3 stacked or loose)

The energy density is recommended to be specified when log wood or firewood is retailed. [4]

The energy density is calculated on the basis of the bulk density and the net calorific value of the dry wood.



[4] EN 14961-1, Table 7

Proportion of split volume	
"No split" means that the firewood is mostly round wood. "Split" means that at least 85% of the firewood volume is split. "Mixture" means that the firewood is partly (less than 85%) split, partly round wood. [5]	
The cut-off surface	
Information on whether the cut-off surfaces of firewood are even and smooth or uneven. If chainsaw has been used in cutting, the ends are considered to be even and smooth. [6]	
Mould and decay	
Significant existence of mould and decay should be stated. More than 10% of weight is considered to be significant. Particle density or net calorific value can be used as indicator in cases of doubt. [7]	

[5] EN 14961-1, Table 7
[6] EN 14961-1, Table 7
[7] EN 14961-1, Table 7

Quality classes according to EN 14961-5

Oven-ready firewood 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 1 of EN 14961-5. Class A1 represents the best quality for fire wood with low moisture content, a high amount of split surface and no decay. In addition to the moisture content class as received (M) the moisture content class on dry basis (U) has to be stated.

Fuel analysis and specification

When specifying a class within a property, the average numerical value from the whole lot (e.g. 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. [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]

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 firewood net calorific value as dry basis can be taken from literature. See App.2.
   - Moisture content and dimensions depend on many different factors (not only on the raw material) and therefore there are no typical values stated.

b) Carrying out measurements and calculation of properties [11]
   - E.g. determination of moisture content according to standard EN 14774-2.
   - Moisture content of firewood can also be analysed by rapid moisture meters e.g. for mixtures/blends properties can be calculated out of typical values or analysed values of the respective unmixed/-blended raw materials

c) By using values set for production
   - Length will be stated by setting cutting length in chopping machine.
   - Diameter and amount of split firewood will be set by using appropriate splitting blade based on the diameter of stem used.

Mould and decay will be estimated by visual inspection.

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

3. How to guarantee a specific quality of firewood

3.1. Relevant Standards

EN 15234-1:2011: Solid biofuels – Fuel quality assurance.
Part 1: General requirements

EN 15234-5:2012: Solid biofuels – Fuel quality assurance.
Part 5: Firewood for non-industrial use

3.2. How to implement EN 15234-1 and/or EN 15234-5

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. [12]

Quality control = controlling the quality of a product or process [13]

- 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, ...

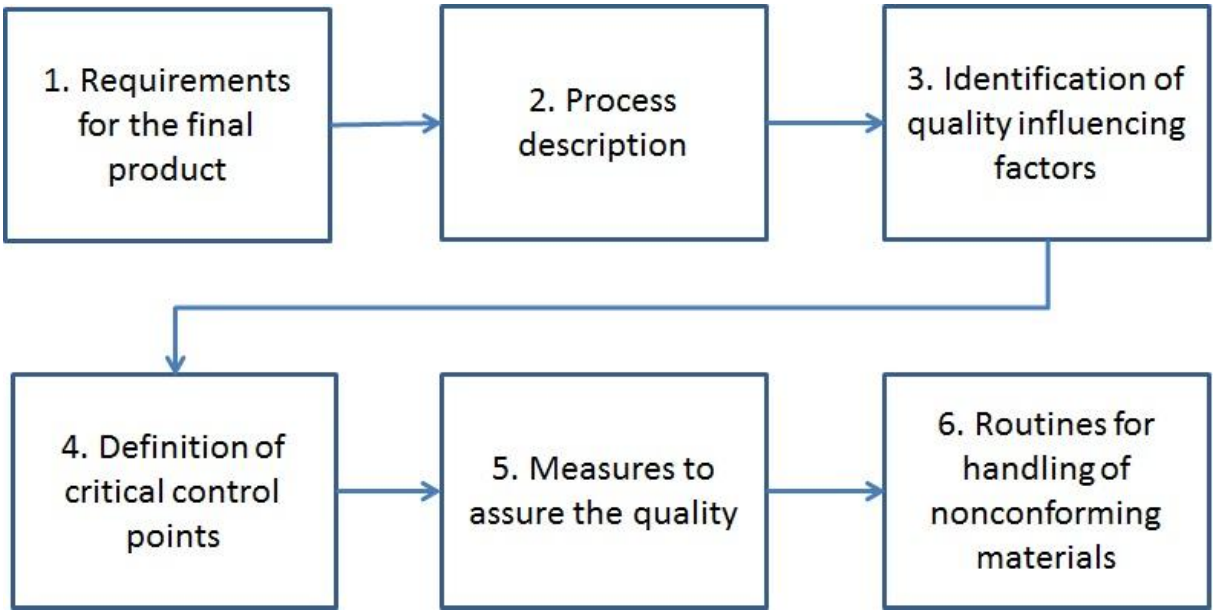
Quality assurance = reviewing the products and processes [14]

- 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

The firewood supply chain consists of three basic phases: raw material supply, production and distribution. These phases can be carried out by single or several market actors. Each market actor is responsible for taking care of the traceability of the origin and source of each material batch delivered by him. The first market actor in the supply chain, i.e. the one responsible for the raw material supply, prepares the necessary documents for the first time. These documents are then forwarded throughout the whole supply chain and provided available on request.

Every actor in the supply chain has to follow six consecutive basic steps to fulfill the requirements for a stable quality production chain. However, these steps can be adjusted to meet the requirements of the specific firewood production chain in question.

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



In the following the fuel quality implementation processes for raw material supplier and firewood producer/trader are described on the basis of a few examples.

3.2.2. Raw material supplier

Start	Biomass first time traded as solid biofuel
Process	Classification of origin according Table 1 in EN 14961-1:2010
Result	Product declaration according to EN 15234-1:2012

Example 1

Start

Stemwood, broad-leaf, birch

Process

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

1 Woody biomass

1.1 Forest, plantation and other virgin wood

1.1.3 Stemwood

1.1.3.1 Broad-leaf

Result

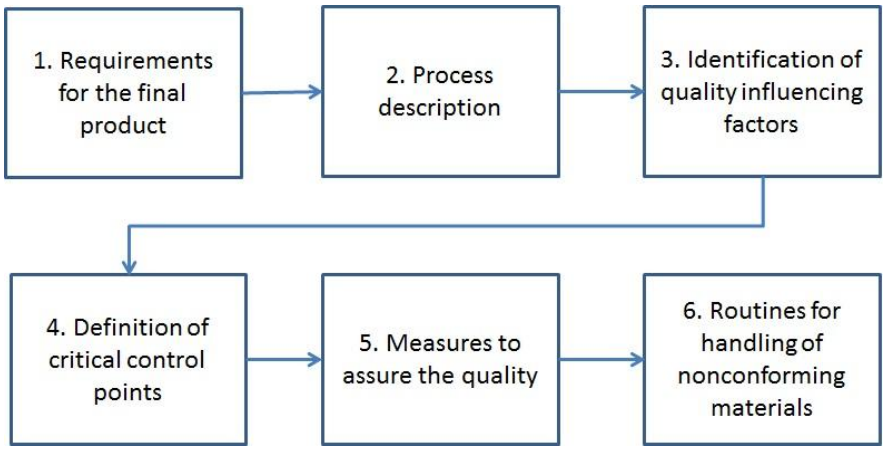
Product specification

Traceability **mandatory documentation** !

Firewood	
Producer	Pasi Sironen Karstulantie 929 FI-43480 Pääjärvi, Finland Tel.+358 40 566 5634
Origin	1.1.3.1 Broad-leaf stemwood (birch)
Traded form	Firewood (oven-ready), CLASS A 1
Country of origin, location	Pylkönmäki, Finland
Normative (EN 14961-5)	**CLASS A1**
Dimensions (cm) Diameter (D) and length (L)	D15 (10 ≤ D ≤ 15 cm), 85% in requested diameter L33 (33 cm± 2 cm), L50 (50 cm± 2 cm) 15% of firewood are shorter than requested length
Moisture (M) (w-% as received)	M20 (10 ≤ M ≤ 20 w-%)
Volume, (m^3 loose)	Values stated per 1 m^3 loose
Proportion of split volume	All split
The cut-off surface	Even and smooth
Mould and decay	No visible mould and decay
Informative (EN 14961-5)	
Energy density, E (kWh/loose m^3)	E1100 (1100 kWh/loose m^3)
Drying method	Natural seasoning

Product declaration according to EN 15234-4. Information can available e.g. on the invoice, delivery note, internet... This example does not include value U, because it is not so commonly used.

3.2.3. Firewood producer/trader

Start	Raw material specified by a ‘declaration of origin and source’
Process	
Result	Product declaration according to EN 15234-1:2012

Example 2

Start

Traceability **mandatory documentation** !

The firewood 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 doesn´t exist a ‘declaration of origin and source’ the producer is responsible for preparing this declaration for the first time.

Example: Most often the firewood producer/trader uses raw material from his own forest and thus prepares the declaration of origin and source.

Process Step 1	The fuel quality is described by the specification of the fuel in accordance with the EN 14961-5 and should be the result of an agreement between the producer and his customer (or according to anticipated market demands). Usually the fuel quality requirements are written in sales contracts. The firewood producer shall determine key properties of the firewood in accordance with the end-user needs. [15] *Example: The firewood producer has a customer, who can only use firewood with a length of L33 or smaller, a diameter of D150 or smaller and a moisture below 25%. The producer defines 'length', 'diameter' and 'moisture' as key properties, which need to be checked continually during the production process. The specification 'Firewood L33-D10-M25' defines the maximum values of the required properties. Firewood producers can also print special precompleted forms, in which properties are written when deliver (see end of example 2)*
Step 2	To document the steps in the process chain the firewood producer can elaborate a flow diagram, in which he defines – 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.

Process description & Critical Control Points **mandatory document-tation**

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

Step 3

All activities referring to both technical processes and management issues should be examined. The following factors determine the quality of the firewood 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]

Example: 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 customer.

Influencing factors	*Influenced fuel property*
raw material • *wood species* • *weather conditions*	• *energy density* • *moisture content*
storage conditions • *covering (weather conditions)* • *storage time (e.g. long storage can lead to dry material or to wet and even partially decayed material – depending on the place of storage and the weather conditions)* • *storage place (impurities of raw material - e.g. soil and stones depending whether the material was stored on a paved road or on forest ground)*	• *moisture content* • *energy density* • *mould and decay*
cutting and splitting • *sawing and splitting machine*	• *homogeneity of length and diameter* • *amount of split logs* • *the cut-off surface*
drying and storing • *natural seasoning or artificial drying (cold or hot air dryer)* • *air circulation* • *weather conditions* • *temperature and time*	• *moisture content* • *mould and decay*
packaging • *bulk material* • *small/big sacks or pallets, package material*	• *volume or weight*
transport unit • *handling conditions, covering (e.g. increasing moisture content due to precipitation)*	• *moisture content*
knowledge, competence and qualification of the staff	• *all*
	•

Step 4

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. [17]

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

Step 5 selected methods & transport/storage **mandatory documentation** !	Appropriate measures to give confidence to the customer, that the specifications are being realised, include besides product control the following management issues, which should be part of the 'company-manual', which has to be elaborated independently of a specific commission for the usual processes of the company. • 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 [18] *Example: In the 'company-manual' work instructions exist for each Critical Control Point (CCP). Based on the flow diagram of the production process a checklist has been elaborated to assure that quality issues are taken into consideration and documented at all times.*
Step 6 Non-conforming fuels **mandatory documentation** !	• If raw materials or the produced firewood are not fulfilling the requirements (due to e.g. excessive amount of mould or decay), 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. [19] *Example: During raw material reception the producer realizes that one lot of the raw material is partially degraded already. He decides to cut and split it nevertheless but fills a separate container with this material and sells it as class B firewood. The checklist for the production process is filled in accordingly to document the whereabouts of the material.*

Result
 	
Final fuel specification **mandatory documentation** !
	If the producer/trader delivers firewood to end-consumers the product declaration/labeling shall as a minimum include:
	• Supplier (body or enterprise) including contact information
	• Origin and source (according to EN 14961-1)
	• Country/countries (locations) of origin
	• Traded form (firewood)
	• Specification of properties (according to EN 14961-1 or EN 14961-5 for non-industrial firewood)
	  ○ Normative properties
	  ○ (Informative properties)
	• 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 EN 14961-1 or EN 14961-5)
	With the product declaration the supplier (producer) confirms, that the properties of the end product are in accordance with the requirements of the EN 14961-1 or EN 14961-5 according to EN 15234-1 or EN 15234-5. The supplier shall date the declaration and keep the record for a minimum of one year after the delivery. [20]

[18] EN 15234-1:2011, paragraph 6.4 e)
[19] EN 15234-5:2012, paragraph 5.7
[20] EN 15234-1:2012, paragraph 7

Example 1 of product declaration:

Firewood

Producer	Pasi Sironen Karstulantie 929 FI-43480 Pääjärvi, Finland Tel.+358 40 566 5634
Origin	1.1.3.1 Broad-leaf stemwood (birch)
Traded form	Firewood (oven-ready), CLASS A 1
Country of origin, location	Pylkönmäki, Finland
Normative (EN 14961-5)	**CLASS A1**
Dimensions (cm) Diameter (D) and length (L)	D10 (5 ≤D≤10 cm), D15 (10≤D≤15 cm), 85% in requested diameter L33 (33 cm±2 cm), L50 (50 cm±2 cm) 15% of firewood are shorter than requested length
Moisture (M) (w-% as received)	M25 (10 ≤ M ≤ 25 w-%)
Volume, **(m^3 loose)**	Values stated per 1 m^3 loose
Proportion of split volume	All split
The cut-off surface	Even and smooth
Mould and decay	No visible mould and decay
Informative (EN 14961-5)	
Energy density, E (kWh/loose m^3)	E1010 (1010 kWh/loose m^3)
Drying method	Natural seasoning

In this model requested U-value is not stated.

Example 2 of product declaration

PRODUCT DECLARATION ACCORDING TO EN 14961-5

Producer: Eija´s Quality Firewood Oy
Koivurannantie 1, FI-40400 Jyväskylä, tel. +358 20722 2550
Delivery lot: …….. loose m^3 or …… kg
Production date:……**Delivery date:**……

Origin and source (EN 14961-1)……

Quality class (EN 14961-5): ☐ A1 ☐ A2 ☐ B

Wood species : ☐ Beech, ☐ Oak, ☐ Birch, ☐ Pine, ☐ mixed wood
Length class: L……cm **Diameter class**: D …….cm
Moisture, wet basis: (M)……w-% dry basis: (U)……w-%
Amount of split: ☐ A1 > 90%, ☐ A2 > 50%, ☐ B……% of pieces
Cut-off surface: even ☐ uneven ☐
Decay: ☐ A1 no visible decay, ☐ A2 ≤ 5% of pieces, ☐ B…… % of pieces
Energy content: …… kWh/kg or …… kWh/ loose m^3
Delivery batch, total …….. kWh
Drying: natural seasoning ☐, cold air dryer ☐, hot air dryer ☐

5. References

EN 14588:2011, Solid biofuels — Terminology, definitions and descriptions

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

EN 14961-5:2011 Solid biofuels – Fuel Specification and classes, Part 5 – Firewood for non-industrial use.

EN 15234-1:2012. Solid biofuels – Fuel Quality Assurance, Part 1 – General requirements.

EN 15234-5:2012 Solid biofuels – Fuel Quality Assurance, Part 5 – Firewood for non-industrial use.

Erkkilä, A. & Alakangas, E. 2008. Manual for firewood production. EU BioHousing project, EIE/05/067/SI2.420197. VTT-R-11021-08, Jyväskylä, Finland. 33 p. + app. 1 p.

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*		**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

--	
--	
--	
--	
--	
--	

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