Wood Fuel Classification Guidelines

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Contents

Note – The production of these Guidelines is an industry initiative facilitated by the Bioenergy Association of New Zealand (BANZ).

The aim is to encourage a broad commitment to the delivery of high quality and consistent quality wood fuel. These Guidelines are voluntary.

BANZ will monitor the uptake of the Guidelines. Once proven and in use, they could be formalized as a Technical Standard.

Wood Fuel Classification Guidelines

1. Introduction

The sale and purchase of wood fuels has highlighted the need for the seller and the purchaser of wood fuel to be confident with respect to the description and quality of the wood fuel sought or supplied. These guidelines for classification of wood fuel have been prepared to provide a common methodology for classifying, specifying and declaring the quality and properties of the traded wood fuel in New Zealand.

The additional benefits of the classification of wood fuel include:

- Increase in use of wood energy
- Improving consumer confidence in wood fuel
- Educate and provide confidence to Regional councils in wood fuels.
- Provide fuel quality assurance to heat plant manufacturers and wood fuel users
- Promote wood energy as a sustainable energy source
- Ensure environmental damage through inappropriate use is controlled.

The Classification Guidelines have been produced as a voluntary industry standard and have been prepared to meet specific New Zealand requirements. The parameters set out are based on formal international standards but have been simplified so as to meet New Zealand needs.

The Guidelines have been prepared on the basis of having a working document that the wood energy industry can use to develop a trade in wood fuel. The Guidelines are intended to be flexible and allow a framework for defining the different kinds of wood fuels. As experience with the Guidelines is obtained they will be adjusted from time to time to best meet market needs. Once established, it is anticipated that the Classification Guidelines will be used as a base for adoption as a formal Technical Standard.

Additional categories of wood fuel will be considered on request.

The Guidelines have been developed jointly by the Bioenergy Association of New Zealand (BANZ) and The Energy Efficiency and Conservation Authority (EECA). Comments on the current version of the Guidelines are welcomed and should be provided to the:

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2. Classification Parameters

The classification of wood fuels is based on the following classification parameters:

Size – This is an important parameter for many boilers and stove heaters as their fuel feed systems are designed with certain sized fuel in mind. The size specifications for wood chips are adapted from the Austrian Chipped Wood standard and for Hog Fuel, from the European Biomass Standard. Size distribution has an effect on the boiler/stove performance. Too much fines or too long a piece size will reduce the boiler/stove output considerably.

Moisture – Boilers and stoves are generally specified to be used with wood of certain moisture content. Furthermore in some regions of New Zealand only dry wood is allowed to be burned.

Ash – Some boilers and stoves specify certain ash levels in their fuel. Some Regional Plans also specify ash content limits on solid fuels. Excessive ash reduces fuel heating value and increases maintenance and disposal costs.

Bulk density – By combining moisture content figures with those stated for bulk density, wood fuels can be sold on an energy basis by simply measuring a certain volume of wood chips. This has cost advantages as in many applications it is more practical to measure a volume of wood fuel for sale rather than to weigh it.

Energy density – It is important for consumer confidence that wood fuels being sold with a specific classification have a consistent energy content rather than one that varies by weight or volume.

3. Classification Description

Wood fuel will be described by its grouped classification parameters e.g. Wood Chip S30 will be referred to as Woodchip S30M20A1 which indicates that it has a moisture content of 20% and an ash content of 1%. The actual Bulk Density (BD) and Energy Density (ED) are specified.

Example – Fuel spec for small wood chip boilers would be for example:

Wood chip S30 M35 A1 BD200 ED25

This would be a 30mm sized chip (S30), with a moisture content of 35% (M35), ash content of 1% (A1), bulk density of 200kg/m^3, (BD200) and an energy density of 25MJ/kg (ED25).

4. Test Standards

Table 1 following sets out the test methods that apply for the determination of fuel properties.

Table 1 – List of technical specifications to determine fuel properties[1].

Property	Technical Specification
Origin and source	To be specified
Classification title	To be specified
Preparation of Sample	Solid biofuels - Methods for sample preparation (CEN/TS 14780)
Sampling	Solid biofuels - Methods for sampling (CEN/TS 14778-1)
Total Moisture	Solid Biofuels - Determination of moisture content – Oven dry method – Part 2: Total moisture – Simplified method (EN 14774-2)
Moisture in Laboratory Sample	Solid Biofuels - Determination of moisture content – Oven dry method – Part 3: Moisture in general analysis sample (EN 14774-3)
Ash Content	Solid Biofuels - Determination of ash content (EN 14775)
Ash Fusion Temperature	Solid biofuels - Determination of ash melting behaviour - Part 1: Characteristic temperatures (CEN/TS 15370-1)
Volatile Matter Content	Solid Biofuels - Determination of the content of volatile matter (EN 15148)
Net calorific value	Solid biofuels - Determination of calorific value (EN 14918)
Particle size distribution	Solid Biofuels - Determination of particle size distribution - Part 1: Oscillating screen method using sieve apertures of 1mm and above (CEN/TS 15149-1) or Solid Biofuels - Determination of particle size distribution - Part 2: Horizontal screen method using sieve apertures of 3.15mm and below (CEN/TS 15149-2) or Solid biofuels - Determination of particle size distribution - Part 3: Rotary screen method (CEN/TS 15149-3)
Amount of fines	Solid Biofuels: Methods for the determination of particle size distribution. Part 2: Vibrating screen method using sieve apertures of 3, 15 mm and below (CEN/TS 15149-2)

[1] Revised Table 1 – This table is a combination of the Table 1 from Version 4 of this document and the table presented in Report No: 10-11013 - Review of Wood Fuel Testing Standards, June 2010.

Particle density	Solid Biofuels: Methods for the determination of particle density (CEN/TS 15150) to be published.
Bulk density	Solid biofuels - Determination of bulk density (EN 15103)
Mechanical durability of pellets and briquettes	Solid Biofuels: Methods for the determination of mechanical durability of pellets and briquettes, to be published (CEN/TS 15210)
Water soluble chloride (Cl) content, sodium (Na) and potassium (K)	Solid Biofuels: Methods for determination of the water soluble content of chlorine, sodium and potassium, to be published.
Sulphur (S) and chlorine (Cl) content	Solid biofuels - Determination of total content of sulfur and chlorine (CEN/TS 15289)
Major elements (Al, Si, K, Na, Mg, Fe, P and Ti)	Solid biofuels - Determination of major elements - Al, Ca, Fe, Mg, P, K, Si, Na and Ti (CEN/TS 15290)
Minor elements (As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Se, Te, V and Zn)	Solid biofuels - Determination of minor elements - As, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Sb, V and Zn (CEN/TS 15297)
Carbon, Hydrogen and Nitrogen Content (ultimate analysis)	Solid biofuels - Determination of total content of carbon, hydrogen and nitrogen - Instrumental methods (CEN/TS 15104)

5. Wood Chips[2]

Key aspects of wood chip quality are:

- moisture content
- contamination
- Particle size distribution

Definitions

- Coarse Fraction: Wood chips retained by the coarse screen
- Main Fraction: Wood chips that pass through the coarse screen but are retained by the medium screen
- Fine Fraction: Wood chips that pass through the fine screen

Table 2 – Specification of properties for wood chips

Size[3]		**S30**	**S50**	**S100**
Coarse Fraction ≥ 20% of total by weight	Cross sectional area max, (cm^2)	3	5	10
	Length max (cm) (Max of 1% of the total mass)	8.5	12	25
	Nominal mesh size – coarse screen (mm)	16	31.5	63
Main Fraction ≥ 60-100% by weight	Nominal mesh size – medium screen (mm)	2.8	5.6	11.2
Fine Fraction ≤ 5% by weight	Nominal mesh size – fine screen (mm)	1	1	1
Moisture % by weight (moist basis)				
M20	≤ 20%			
M30	≤ 30%			
M35	≤ 35%			
M40	≤ 40%			
M55	≤ 55%			
M65	≤ 65%			
Ash % by weight (dry basis)				
A.5	≤ .5%			
A1	≤ 1%			
A3	≤ 3%			
A6	≤ 6%			
A6+	> 6% - Actual Value Stated			
Bulk Density				
Kg/m^3	Actual value stated			
Energy Density				
MJ/Kg	Actual Value Stated – If sold by weight			

[2] Standard derived from ONORM M 7133

[3] S30, S50, and S100 – this relates to the cross sectional area in mm^2 of the chips

Contamination

- All wood chip categories must be made from untreated timber
- Classified wood fuels must be free from non wood contaminants

Wood chips S30 (fine wood chips):

Wood chips with a nominal cross sectional area of 3 cm^2. The percentage of wood chips retained by the coarse screen with a nominal mesh size of 16 mm and the percentage of wood chips passing through the medium screen with a nominal mesh size of 2.8 mm must not exceed 20 % of the total mass in both cases. The coarse fraction may include individual pieces with a cross section of max. 3 cm^2 and a length of maximum 8.5 cm but this portion must not exceed 1 % of the total mass. The finest fraction may constitute a maximum of 5 % of the total weight.

Wood chips S50 (medium wood chips):

Wood chips with a nominal cross sectional area of 5 cm^2. The percentage of wood chips retained by the coarse screen with a nominal mesh size of 31.5 mm and the percentage of wood chips passing through the medium screen with a nominal mesh size of 5.6 mm must not exceed 20 % of the total mass in both cases. The coarse fraction may include individual pieces with a cross section of max 5 cm^2 and a length of maximum 12 cm but this portion must not exceed 1 % of the total mass. The finest fraction may constitute a maximum of 5 % of the total weight.

Wood chips S100 (coarse wood chips):

Wood chips with a nominal cross sectional area of 10 cm^2. The percentage of wood chips retained by the coarse screen with a nominal mesh size of 63 mm and the percentage of wood chips passing through the medium screen with a nominal mesh size of 11.2 mm must not exceed 20 % of the total mass in both cases. The coarse fraction may include individual pieces with a cross section of max. 10 cm^2 and a length of maximum 25 cm but this portion must not exceed 1 % of the total mass. The finest fraction may constitute a maximum of 5 % of the total weight.

Wood chips unsorted

This category covers the wood chips that are unsorted and are sold without reference to size, moisture content and degree of contamination. This is the lowest category of wood chip available and may be sold on a weight basis.

6. Hog Fuel[4]

Hog fuel is generally sourced from wood processing residues.

Table 3 – Specification of properties for Hog fuel

Dimensions[5]			
	Main Fraction > 80% of weight	Fine fraction < 5% of weight	Coarse fraction – max length of particle < 1% of weight
S63 S100 S300	3.15mm ≤ P ≤ 63mm 3.15mm ≤ P ≤ 100mm 3.15mm ≤ P ≤ 300mm	< 1mm < 1mm < 1mm	< 100mm < 200mm < 400mm
Moisture % by weight (moist basis)			
M20 M35 M55 M65	≤ 20% ≤ 35% ≤ 55% ≤ 65%		
Ash % by weight (dry basis)			
A.5 A1 A3 A6 A6+	≤ .5% ≤ 1% ≤ 3% ≤ 6% > 6% - Actual Value Stated		
Bulk Density			
Kg/m^3	Actual Value Stated		
Energy Density			
MJ/Kg	Actual Value Stated – If sold by weight		

Contamination

- All hog fuel categories must be made from untreated timber
- Wood Fuels must be free from non wood contaminants

[4] Standard adapted from CEN/TS 14961:2005
[5] 'S' refers to the hole diameter in the screens used.

7. Wood Pellets[6]

Wood pellets are produced from high quality wood residues and their production is standardised to specific standards according to the wood feedstock used.

There are three main scale of heat plant in which wood pellets are used:

- small – generally for domestic home heating,
- medium – generally for small to medium sized commercial/industrial boiler plant, and
- large – generally for large industrial process heat boilers.

In small scale heating applications such as for domestic home heating the control on the quality of the wood pellet provides a means of control of the emissions from combustion. This avoids the need for monitoring emission outputs as they are controlled by the fuel inputs. In larger heat plant where air emission resource consents may be required the analysis of air emission outputs will be based on the quality of the fuel input. Control of the quality of fuel ensures that combustion plant operates within the consent conditions.

In addition different standards of pellet may be used according to whether the heater/boiler is in a controlled air emission zone or not.

Three categories of pellet standard are outlined as follows:

- Category A - premium pellets - for use in any residential heater or commercial boiler
- Category B – large premium pellets - for use in selected boilers
- Category C – industrial grade pellets for use in selected boilers subject to resource and boiler manufacturer consents.

Consent process – When a resource consent is applied for, the boiler supplier must clearly state what category of pellet is capable of being used in the appliance. This must also be stated in the warranty conditions of the boiler. This requirement will give confidence to the consent issuer that the appropriate technology and fuel are being used. Testing of both the fuel and boiler technology in advance is likely to lead to a more efficient consenting process.

Category A - Premium pellets

Application – for use in any residential heater or commercial boiler
This Category represents the highest level of quality. 'Category A' pellets can be used in any wood boiler. Category A pellets are only manufactured from virgin wood fibre, untreated and free from contamination. Their ash levels are extremely low as are the subsequent levels of emissions. The fuel and the resulting ash should be able to be certified as organic under 'BioGro' (which is driven by both the feedstock and the operating practices in the manufacturing process). This fuel is suited to small and least fuel tolerant boilers. 'Category A' pellets are suitable also for use in smoke control areas.

[6] Standard adapted from CEN/TS 14961:2005 and NZS 4014.6:2007

Category A Premium wood pellets align with the European wood pellet standard CEN/TS 14961:2005.

Table 4 - Specification Parameters for Category A Premium wood pellets

Specification	Measurement	Comment
Diameter	6mm	Smallest diameter
Length	<6 x dia mm	
Ash	<1%	Note – all EU stds list <1% ash
Additives	<1%	Starch binding agent only
Moisture	<10% (<8%)	By weight (Note - <8% limit used for test fuels when testing appliances)
Bulk density	>650kg/m3	
Energy content	>17MJ/kg	As received basis
Mechanical Durability	97.7 % (proposed)[7]	Tumbler 2000 test or equivalent test suggested;
Particle size	<3.0mm	
Fines	<1.0%	By weight, ex gate
Chlorine	<20ppm	
Sulphur	<0.05%	

Category B – Large premium pellets

Application – for use in selected boilers

This Category also represents high quality pellets but is for larger scale applications, e.g. school boilers. It can also be used in smoke control areas. Category B pellets are suited to use in large boilers (depending on design). Category B pellets differ from Category A pellets only in terms of their physical qualities (likely to be larger diameter cf Category A pellets), the pellet quality remains unchanged to a large degree.

Table 5 - Specification Parameters for Category B wood pellets

Specification	Measurement	Comment
Diameter	<10mm	Largest diameter
Length	<6 x dia mm	
Ash	<1%	
Additives	<1%	Starch binding agent only
Moisture	<10%	By weight
Bulk density	>600kg/m3	
Energy content	>17MJ/kg	
Mechanical	97.7 % (proposed)[8]	Tumbler 2000 test or equivalent test

[7] 97.7% limit is consistent with CEN/TS 14961 and DIN 51731 (briquettes and pellets)
[8] ibid

Durability		suggested;
Particle size	<3.0mm	
Fines	<4.0%	By weight, ex gate. Note – large boilers may be able to handle more fines
Chlorine	<50ppm	
Sulphur	<0.1%	

Category C – Industrial grade pellets

Application – for use in selected boilers (subject to resource and boiler manufacturer consents)

This Category is for larger scale applications which are installed outside smoke control areas or where air emission consents are required. Large boilers (dependent on design) can utilise a variety of wood fuels. Category C pellets offer the benefits of a pelletised fuel (easy handling) but does not offer the advantages associated with Category A and B pellets (i.e., low ash and low emission levels). There are no guarantees on emissions, boiler longevity and boiler efficiency when using this category of pellet. The boiler would need to clearly state that "Category C" pellets can be used , in addition it would need to place limits in terms of pellet content over and above the specification listed here.

Table 6 - Specification Parameters for Category C wood pellets

Specification	Measurement	Comment
Diameter	<10mm	
Length	<6 x dia mm	
Ash	<5%	
Additives	<10%	Either added or already in the pellet production material. Must be stated.
Moisture	<15%	By weight
Bulk density	>550kg/m3	
Energy content	>10MJ/kg	
Mechanical Durability	90 % (proposed)	Tumbler 2000 test or equivalent test suggested;
Particle size	<6.0mm	Must be stated.
Fines	<10.0%	By weight, ex gate
Chlorine		Must be stated
Sulphur		Must be stated
Pellet ingredients	Listed separately	Must be stated (including material source).

8. Construction and Demolition Waste Timber

Construction and demolition waste is often considered together as one category although in fact they produce quite different waste streams. The main wood wastes arising from each are listed below.

- Construction – off cuts from structural timbers, timber packaging, scaffolding, wooden hoardings, concrete form work.
- Demolition – used structural timbers, e.g. floorboards, joists, beams staircases and doors.

Refurbishment activities are likely to give rise to a combination of construction and demolition waste types.

The categories in terms of the types of waste arising are as follows:

- Treated wood waste
- Untreated wood waste
- Contaminated wood waste (reconstituted or coated wood products e.g MDF, plywood etc.

Treated demolition wood

A large proportion of the waste wood arising in each of the waste streams is treated in some way to prolong its life. Treatments commonly used now or in the recent past include surface coatings such as paints, varnishes and impregnated preservatives such as chromated copper arsenate (CCA), ammoniacal copper quat (ACQ), creosote, boric and pentachlorophenol. Treatments with lesser environmental impacts have been, and are being, developed and are likely to lead to more acceptable use of the 'end of life' wood as fuel. Different preservatives require different considerations when they are reprocessed, recovered or disposed of. Treated demolition wood should only be used in high temperature combustion plant that is specifically designed so that it can handle such wood fuel. Any such installation will require evaluation in the RMA process.

Further details on the incineration of treated wood waste - http://homepage.mac.com/herinst/CCAtimber/waste/incineration.html

Untreated Demolition Wood

Untreated waste wood can be hogged and should be classified as hogged wood fuel. The manner in which the wood has been assessed or analyzed to ensure absence of treated timber should be documented and stand up to evaluation under the RMA consent process.

Contaminated Waste Wood

Wood waste can come contaminated with wood preservatives, binders, paints, glues, chlorine bleach, plastic laminating materials, chlorinated adhesives, phenol and urea formaldehyde resins, nails/staples, or other non-wood materials. It may be mixed with other types of demolition waste, such as rubble, reinforcing bars, tiling or dry wall plasterboard. Contaminated demolition wood should only be used in high temperature combustion plant that is specifically designed so that it can handle such wood fuel. Any such installation will require evaluation in the RMA consenting process.

9. Compressed Firelogs and Briquettes[9]

It is noted that compressed Firelogs refer to artificially produced logs. Both are typically made from sander /router / process dust, sawdust and/or wood shavings. The following section, Section 10 refers to Firewood.

Table 7 – Specification of the properties for Firelogs and Briquettes[10]

Diameter (mm) (Firelogs)	
D40	≤ 40mm
D50	≤ 50mm
D60	≤ 60mm
D80	≤ 80mm
D100	≤ 100mm
D125	≤ 125mm
D125+	> 125+
Length (mm)	
L50	≤ 50mm
L100	≤ 100mm
L200	≤ 200mm
L300	≤ 300mm
L400	≤ 400mm
L400+	> 400mm
Moisture (by weight, wet basis)	
M10	≤ 10% Moisture
M15	≤ 15% Moisture
M20	≤ 20% Moisture
Ash (by weight, dry basis)	
A.5	≤ .5%
A1	≤ 1%
A3	≤ 3%
A6	≤ 6%
A10	≤ 10%
Energy Density	
MJ/Kg	Actual Value Stated – If sold by weight
MJ/m^3	Actual Value Stated – If sold by volume

Contamination

- All fire log categories (and briquettes) must be made from untreated timber
- Wood Fuels must be free from non wood contaminants

[9] Standard adapted from CEN/TS 14961:2005
[10] Briquettes have a range of dimensions. Diameters above should be approximated for briquettes.

10. Firewood

Table 8 – Specification of the properties for Firewood

Diameter (mm)	
D40 kindling	≤ 40mm
D100	80mm≤ D100≤ 120mm
D100+	100mm≤D100+≤200mm
Length (mm)	
L300	300mm≤ L300≤ 350mm
L350	350mm≤ L350≤ 400mm
L400+	400mm≤ L400+
Moisture (by weight, wet basis)	
M15K (Kiln dried)	≤ 15% Moisture
M20S (Seasoned)	15%≤M20≤ 25% Moisture
MG (Green)	≤ 25% Moisture
Ash (by weight, dry basis)	
A1	≤ 1%
A2	1% ≤
Energy Density	
MJ/Kg	Actual Value Stated – If sold by weight
MJ/m^3	Actual Value Stated – If sold by volume

11. Bibliography

CEN/TS 14588:2003, *Solid biofuels – Terminology, definitions and descriptions.*

WI00335003[1] *Solid Biofuels – Fuel quality assurance*

CEN/TS 14774 – 1:2004, *Solid biofuels – Methods for determination of moisture content – Oven dry method – Part 1: Total moisture – Reference method*

CEN/TS 14774-2:2004. *Solid biofuels – Methods for the determination of moisture content – Oven dry method – Part 2: Total moisture – Simplified method*

CEN/TS 14774-3:2004. *Solid biofuels – Methods for the determination of moisture content – Oven dry method – Part 3: Moisture in general analysis sample*

CEN/TS 14775:2004. *Solid biofuels – Methods for the determination of ash content*

prCEN/TS 14778-1[1], *Solid biofuels – Sampling – Part 1:Methods for sampling*

prCEN'TS 14778-2[1], *Solid Biofuels – Sampling Part 2: Methods for sampling particulate material transported in lorries*

prCEN'TS 14779[1], *Solid Biofuels – Sampling - Methods for preparing sampling plans and sampling certificates*

prCEN/TS 14780[1], *Solid Biofuels – Methods for sample preparation*

prCEN/TS 14918[1], *Solid Biofuels – Method for the determination of calorific value*

prCEN/TS 14961:2005 - *Solid Biofuels – Fuel Specifications and CLasses*

prCEN/TS 15103[1], *Solid Biofuels – Method for the determination of bulk density*

prCEN'TS 15149-1[1], *Solid Biofuels. Methods for the determination of particle size distribution. Part 1: Oscillating screen method using sieve apertures of 3, 15 mm and above*

prCEN'TS 15149-2[1], *Solid Biofuels. Methods for the determination of particle size distribution. Part 2: Vibrating screen method using sieve apertures of 3, 15 mm and below*

prCEN'TS 15149-3[1], *Solid Biofuels. Methods for the determination of particle size distribution. Part 3: Rotary screen method*

prCEN/TS 15150[1], *Solid Biofuels. Methods for the determination of particle density*

WI00335019[1] *Solid Biofuels – Methods for the determination of the density of pellets and briquettes*

prCEN'TS 15210, *Solid Biofuels. Methods for the determination ofmechanical durability of pellets and briquettes[1]*

WI00335024[1], *Solid Biofuels – Methods for the determination of oxygen (O) content*

prCEN/TS 15104[1], *Solid Biofuels – Determination of carbon hydrogen and nitrogen – instrumental methods*

WI00335026[1], *Solid Biofuels – Methods for the determination of water soluble chloridge (CI) content*

prCEN/TS 15105[1], *Solid Biofuels – Methods for the determination of the water soluble chlorine (CI) content*

WI00335028[1], *Solid Biofuels – Methods for the determination of the content of minor elements (As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Se, Te, V and Zn).*

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[1] to be published