WOOD PELLETS[1]

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

Pellets are typically used in three different scales of heat plant, namely:

- Small – generally for residential home heating;
- Medium – generally for small to medium sized commercial/institutional/industrial heat plant; and
- Large – generally for large industrial process heat plant and for substitution for coal, or for cofiring with coal or low grade hog fuel such as bark.

Wood pellets are able to be consistently produced to relevant standards because they are an engineered wood product. In small scale heating applications such as for residential home heating the electronic control of the heater operation and the consistency of the quality of the wood pellet fuel provides a means of control of the emissions from combustion[2] . This ensures that emissions are within Air Plan rules and avoids the need for monitoring emission outputs as they are controlled by the technology and fuel inputs. In larger heat plant where air emission resource consent conditions require external monitoring and reporting the amount of monitoring can be reduced significantly because of the consistent quality of the fuel input. Control of the quality of fuel ensures that combustion plants will operate within the consent conditions.

There are four categories of wood pellet standard based on the classes of ISO 17225-2 and are named as follows:

- Grade A1 - premium pellets - for use in any residential heater or commercial boiler;
- Grade A2 – large premium pellets - for use in selected boilers;
- Grade B – commercial grade pellets for use in selected boilers subject to resource and boiler manufacturer consents.
- Grade I – industrial grade

There are also grades of pellet produced from non-woody biomass to the standard ISO 17225-6

- Grade NWP – pellets produced from non-woody biomass.

[1] Wood pellets section revised and adapted October 2017 from ISO 17225-2: 2014 „"Solid biofuels – Fuel specifications and classes – Part 2: Graded wood pellets". ISO 17225 supersedes EN 14961-1:2010

[2] Consent process – When a resource consent is applied for, the boiler supplier must clearly state what category of pellets are to be 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.

ISO 17225

Under the international standard ISO 17225-series there are standards for the production of pellets: ISO 17225-1 (general requirements for all kind of pellets), ISO 17225-2 (graded pellets from wood for household and commercial[3] applications and for industrial us) and ISO 17225-6 (non-woody graded pellets for household and commercial applications.

General requirements – ISO 17225-1

This ISO standard includes the raw material classification of solid biofuels, which is based on their origin and source. Stating origin and source is mandatory for all solid biofuels.

ISO 17225-1 includes the following raw materials:

1. Woody biomass
2. Herbaceous biomass
3. Fruit biomass
4. Aquatic biomass
5. Blends and mixtures.

Chemically treated wood (e.g. glued, lacquered, painted) shall not include halogenated organic compounds or heavy metals at levels higher than those in typical virgin material values or higher than typical values of the country of origin.

If the raw material includes chemically treated biomass, then also nitrogen, sulphur and chlorine content have to be stated. It also has additional properties like fixed carbon and volatile matter, which are specified only for thermally treated biomass such as torrefied pellets.

The types of wood indicated in *Table 2* can be used according to the standard ISO 17225-2 as raw material for the production of wood pellets. The raw material assortments are defined in ISO 17225-1.

Table 2: *Wood types that are permitted to be used for wood pellet production*

A1	A2	B
- Stem wood[a] - Chemically untreated by-products and residues from the wood processing industry[b]	- Stem wood[a] - Chemically untreated by-products and residues from the wood processing industry[b] - Whole trees without roots[a] - Logging residues[a]	- Forest, plantation and other virgin wood[a] - Chemically untreated by-products and residues from the wood processing industry[b] - Chemically untreated used wood[c]

[3] Commercial applications means a facility that utilise solid biofuel burning appliances or equipment that have the similar fuel requirements as residential appliances.

a) Wood which was externally treated with wood preservatives against insect attack (e.g. lineatus), is not considered as chemically treated wood. If all chemical parameters of the pellets comply with the limits and/or concentrations are too small to be concerned with.
b) Negligible levels of glue, grease and other timber production additives used in sawmills during production of timber and timber product from virgin wood are acceptable, if all chemical parameters of the pellets are clearly within the limits and/or concentrations are too small to be concerned with.
c) Demolition wood is excluded. Demolition wood is used wood coming from the demolition of buildings or civil engineering installations.

Manufacturers of wood pellets must keep records on the origin of their wood including a list of the suppliers of raw wood recognized by the manufacturer and their confirmation to delivery exclusively chemical untreated wood for the wood pellet production.

Contamination, foreign substances

Foreign substances are not permitted except negligible levels of glue, grease and other timber production additives used in sawmills during production of timber and timber product from virgin wood, if all chemical parameters of the pellets are clearly within the limits and/or concentrations are too small to be concerned with.

Requirements on additives

An additive is a material which is intentionally introduced into pellet production, or is added after production, to improve the quality of fuel, reduce its emissions, make production more efficient or mark the pellets. Additives are allowed to a maximum of 2% of the total mass of the pellets. The amount of additives in production shall be limited to 1,8 w-%, while the amount of post-production additives (e.g. coating oils) shall be limited to 0,2 w-% of the pellets. The type (material or trade name) and quantity (in w-%, as received) of all additives shall be documented. Water, steam and heat are not regarded as additives.

Additives, such as starch, corn flour, potato flour, vegetable oil, lignin from sulphate kraft process etc., shall originate from processed or unaltered farming and forestry products.

Identifying marking

The packaging and/or the accompanying papers (with unpacked consignments) must be durably indicated by the following data:

- Name or registered trademark of the manufacturer or the supplier/distributor
- Source of raw biomass from which the pellets have been produced eg A1 or A2
- Designation of the product with indication of the diameter (in mm) e. g. wood pellets – diameter 6 mm
- Nominal weight and/or mass of the packaging content
- Ash melting temperature (optional)
- Notice-
    - that during transport and storage the pellets are to be protected from moisture.
    - The pellets must only be combusted in heat-producing appliances that are suitable and permissible for this type of fuel (cf. operating instructions for the heat-producing appliance).

- For clear identification of the delivery, every product or its packag-ing/insert/accompanying documents must be labelled with the year of manufacture and, in the case of several monitored production sites, the production site. This can take the form of an identification code and/or a serial number providing information on the year of manufacture and the production site.For reasons of traceability the marking with the actual date is recommended.
- Reference to relevant external certification process.eg WFSAS, EN Plus

Graded wood pellets – ISO 17225-2

This standard includes pellets for household and commercial application and industrial use like co-firing in power stations. Bio-pellets in ISO 17225-1 and industrial wood pellets in ISO 17225-2 also include additional class for particle size distribution for disintegrated pellets.

Wood pellets for household and commercial application can be stated in three different classes A1, A2 and B. The property class A1 for wood pellets represents virgin woods and chemically untreated wood residues low in ash and nitrogen content. Fuels with slightly higher ash content and nitrogen content fall within A2. In property class B, forest residues, bark, chemically untreated industrial wood by-products and residues, and chemically untreated used wood is also allowed.

Torrefied pellets are excluded from the scope of this standard and are instead included in ISO 17225-1. ISO member countries has also agreed to start prepare a product standard for graded thermally treated densified biomass ISO 17225-8.

Graded non-woody pellets – ISO 17225-6

Non-woody pellets include those made from blends and mixtures, including herbaceous, fruit or aquatic biomass. Blends and mixtures can also include woody biomass. ISO 17225-6 includes two classification tables:

1. A and B class pellets produced from herbaceous and fruit biomass and blends and mixtures
2. Those made from straw, miscanthus and reed canary grass pellets.

Non-woody pellets have high ash, chlorine, nitrogen and sulphur contents, as well as major element contents, so non-woody pellets are recommended to be used in appliances which are specially designed or adjusted for this kind of pellets.

When using non-woody materials for combustion, special attention should be paid to the risk of corrosion in small- and medium-scale boilers and flue gas systems. Herbaceous or fruit biomass may influence the fuel ash composition differently depending on growth and soil conditions. The content of chlorine, phosphate and potassium in the material may form chlorides and phosphates and other chemical compounds resulting in high hydrochloric emissions and chemically active ash with low melting temperature, causing corrosion.

In general, non-woody biomass materials have higher content of ash-forming elements and produce ashes with lower melting temperature compared to most woody biomass. This may result in fouling,

slagging and corrosion inside boilers. These problems are especially related to materials that contain high contents of potassium and silicate and low levels of calcium.

Compliance for sale in New Zealand, Australia and the Pacific
This guide has been produced for the purpose of assisting the sale and purchase of biomass fuel and the pellets component is based on the International Standard ISO 17225 (graded pellets for household and commercial applications and for industrial use) and outlines the main elements required to demonstrate compliance for retail and contract based sale. For diagnostic activities reference should be made to the full standard.

Wood pellets for use in residential wood pellet heaters may only be produced from untreated wood. The following wood A1 class is permitted according to ISO 17225-2, table 1:

- Stem wood
- Chemically untreated wood residue

Packaged pellets must be marked with a traceability identification on the package.

Retailed pellets should be certified by an authorised independent certification body as being produced to the standard claimed. In Europe, the two main certifications of quality for pellets in the European market are DIN Plus (German) or EN Plus (EU). In New Zealand and Australia the Bioenergy Association offers a Wood Fuel Supplier Accreditation Scheme (WFSAS). Each of these certification schemes are based on the production of pellets to ISO 17225. The WFSAS accepts the certification from the two European schemes within its own scheme.

Sampling testing and certification
Guidelines for sampling testing and certification are set out in Bioenergy Association Technical Guide 5 – Standard methods for verifying the quality of solid biofuels.

Grade A1 - Premium pellets

Application – for use in any residential heater or commercial boiler.
This grade represents the highest level of quality. 'Grade A1' pellets can be used in any residential wood pellet heater or wood boiler. Grade A1 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 commercial boilers and for boilers that require high quality fuels. 'Grade A1' pellets are suitable also for use in controlled air sheds and often allow residential wood pellet heaters to be a permitted use.

Grade A1 Premium wood pellets align with the international wood pellet standard ISO 17225-2.
A1 wood pellets may only be produced from untreated wood with the addition of pressing aids according to table 2.

Table 5- Specification parameters for Grade A1 Premium wood pellets.

Specification	Measurement	Comment	Testing standard
Diameter	6±1 mm		ISO 17829
Length	3.15 ≤ L ≤ 40 mm	Max of 1% of the pellets may be greater than 40mm, no pellets > 45mm allowed	ISO 17829
Ash	≤ 0.7 %	By weight	ISO 18122
Additives	≤ 2.0 %	By weight. Type of additives to be defined. Examples are slagging inhibitors or any other additives like starch, corn flour, vegetable oil, or lignin.	-
Moisture	≤10 %	By weight	ISO 18134
Bulk density	600 ≤ BD ≥ 750 kg/m^3	As received basis. It is recommended actual value of bulk density to be stated on packaging.	ISO 17828
Net calorific value	≥ 16.5MJ/kg	As received basis	ISO 18125
Mechanical Durability	≥98 %	As received. By weight.	ISO 17831-1
Fines	≤1.0% truck load delivery ≤0.5% Large sacks and bulk ware	By weight, ex gate. Particles of size less than 3.15mm	ISO 18846
Ash deformation temperature	≥ 1200 ^oC		CEN/TC 15370-1
Chlorine	<20ppm		ISO 16994
Sulphur	<0.04%	By weight	ISO 16994

Grade A2 – Large premium pellets

Application – for use in selected residential and commercial boilers

This grade also represents high quality pellets but is for larger scale applications, such as for school boilers. This grade can also be used in controlled air shed areas. Grade A2 pellets are suited to use in large boilers (depending on design). Grade A2 pellets differ from Grade A1 pellets only in terms of their physical qualities (likely to be larger diameter compared to Grade A1 pellets); the pellet quality remains largely unchanged compared to Grade A1 pellets.

Table 6 - Specification parameters for Grade A2 wood pellets

Specification	Measurement	Comment	Testing standard
Diameter	8 ±1 mm		ISO 17829
Length	3.15 ≤ L ≤ 40 mm	Max of 1% of the pellets may be greater than 40mm, no pellets > 45mm allowed	ISO 17829
Ash	≤ 1.2 %	By weight	ISO 18122
Additives	≤ 2.0 %	By weight. Type of additives to be defined. Examples are slagging inhibitors or any other additives like starch, corn flour, vegetable oil, or lignin.	-
Moisture	≤10 %	By weight	ISO 18134
Bulk density	600 ≤ BD ≥ 750 kg/m^3	As received basis. It is recommended actual value of bulk density to be stated on packaging.	ISO 17828
Net calorific value	≥ 16.5MJ/kg	As received basis	ISO 18125
Mechanical Durability	≥97.5 %	As received. By weight.	ISO 17831-1
Fines	≤1.0% truck load delivery ≤0.5% Large sacks and bulk ware	By weight, ex gate. Particles of size less than 3.15mm	ISO 18846
Ash deformation temperature	≥1100^oC		CEN/TC 15370-1
Chlorine	<20ppm		ISO 16994
Sulphur	<0.05%	By weight	ISO 16994

Grade B – Commercial grade pellets (wood)

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

This grade of wood pellets is for larger scale applications which are installed outside controlled air shed areas or where air emission consents are required. Large boilers (dependent on design) can utilise a variety of wood fuels. Grade B pellets offer the benefits of a pelletised fuel (easy handling) but does not necessarily offer some of the advantages associated with Grade A1 and A2 pellets (i.e., low ash and low emission levels). Where this grade of pellets is to be used, it would be necessary to confirm that the fuel is compatible with the boiler and any consent conditions. Furthermore, it may be necessary to add further specifications to those outlined below to adequately define the fuel for a proposed industrial application.

Table 7 - Specification parameters for Grade B wood pellets.

Specification	Measurement	Comment	Testing standard
Diameter	8±1 mm		ISO 17829
Length	3.15 ≤ L ≤ 40 mm	Max of 1% of the pellets may be greater than 40mm, no pellets > 45mm allowed	ISO 17829
Ash	≤ 2.0 %	By weight	ISO 18122
Additives	≤ 2.0 %	By weight. Type of additives to be defined. Examples are slagging inhibitors or any other additives like starch, corn flour, vegetable oil, or lignin.	-
Moisture	≤10 %	By weight	ISO 18134
Bulk density	600 ≤ BD ≥ 750 kg/m^3	As received basis. It is recommended actual value of bulk density to be stated on packaging.	ISO 17828
Net calorific value	≥ 16.5MJ/kg	As received basis	ISO 18125
Mechanical Durability	≥96.5 %	As received. By weight.	ISO 17831-1
Fines	≤1.0% truck load delivery ≤0.5% Large sacks and bulk ware	By weight, ex gate. Particles of size less than 3.15mm	ISO 18846
Ash deformation temperature	≥1100 ^{o}C		CEN/TC 15370-1
Chlorine	<30ppm		ISO 16994
Sulphur	<0.05%	By weight	ISO 16994

Grade I1 – Industrial grade pellets (wood)

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

This grade of wood pellets is for larger scale applications which are installed outside controlled air shed areas or where air emission consents are required. Large boilers (dependent on design) can utilise a variety of wood fuels. Grade I1 pellets offer the benefits of a pelletised fuel (easy handling) but does not necessarily offer the advantages associated with Grade A and B pellets (i.e., low ash and low emission levels). Where this grade of pellets is to be used, it would be necessary to confirm that the fuel is compatible with the boiler and any consent conditions. Furthermore, it may be necessary to add further specifications to those outlined below to adequately define the fuel for a proposed industrial application.

Table 8 - Specification parameters for Grade I1 industrial grade wood pellets.

Specification	Measurement	Comment	Testing standard

Diameter	8mm		ISO 17829
Length	3.15 ≤ L ≤ 40 mm	Max of 1% of the pellets may be greater than 40mm, no pellets > 45mm allowed	ISO 17829
Ash	≤ 1.0 %	By weight	ISO 18122
Additives	≤ 2.0 %	By weight. Type of additives to be defined. Examples are slagging inhibitors or any other additives like starch, corn flour, vegetable oil, or lignin.	-
Moisture	≤10 %	By weight	ISO 18134
Bulk density	600 ≤ BD ≥ 750 kg/m^3	As received basis. It is recommended actual value of bulk density to be stated on packaging.	ISO 17828
Net calorific value	≥ 16.5MJ/kg	As received basis	ISO 18125
Mechanical Durability	≥97.5 %	As received. By weight.	ISO 17831-1
Fines	≤1.0% truck load delivery ≤0.5% Large sacks and bulk ware	By weight, ex gate. Particles of size less than 3.15mm	ISO 18846
Chlorine	<30ppm		ISO 16994
Sulphur	<0.05%		ISO 16994

There are three industrial grades of pellet made from woodI1, I2 and I3. Only the I1 grade is listed here. If there is a need for the I2 and I3 grades to be listed please contact the Bioenergy Association Administrator with your requirement.

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Grade NWP – Non-woody biomass pellets

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

This grade of wood pellets is for large scale industrial applications which are installed outside controlled air shed areas or where air emission consents are required. Large boilers (dependent on design) can utilise a variety of wood fuels. Where this grade of pellets is to be used, it would be necessary to confirm that the fuel is compatible with the boiler and any consent conditions. Furthermore, it may be necessary to add further specifications to those outlined below to adequately define the fuel for a proposed application.

Pellets made from non-woody biomass such as herbaceous plant material, fruit biomass, aquatic biomass and blends and mixtures are covered by Class B of ISO 17225-6. Pelletising specific energy crop such as miscanthus or other grass species improves their handling characteristics and improves bulk density. A number of agricultural crop residues such as straw and stover can be pelletised to turn them from being a waste into an easy useable fuel.

The specification parameters below should be taken as a guide for the production of non-woody pellets. The actual pellet characteristics may depend on the feedstock and pelletising equipment. If there are other grades required of pellet based on non-woody feedstock contact the Bioenergy Association Administrator who will discuss requirements.

Table 9 - Specification parameters for pellets produced from non-woody biomass.

Specification	Measurement	Comment	Testing standard
Diameter	10 – 20 mm		ISO 17829
Length	3.15 ≤ L ≤ 40 mm	Max of 1% of the pellets may be greater than 40mm, no pellets > 45mm allowed	ISO 17829
Ash	≤ 10.0 %	By weight	ISO 18122
Additives	≤ 2.0 %	By weight. Type of additives to be defined.	-

		Examples are slagging inhibitors or any other additives like starch, corn flour, vegetable oil, or lignin.	
Moisture	≤15 %	By weight	ISO 18134
Bulk density	600 ≤ BD ≥ 750 kg/m^3	As received basis. It is recommended actual value of bulk density to be stated on packaging.	ISO 17828
Net calorific value	≥ 14.5MJ/kg	As received basis	ISO 18125
Mechanical Durability	≥96 %	As received. By weight.	ISO 17831-1
Fines	≤3.0 % truck load delivery ≤3.0 % Large sacks and bulk ware	By weight, ex gate. Particles of size less than 3.15mm	ISO 18846
Chlorine	<30ppm		ISO 16994
Sulphur	<0.3%		ISO 16994