

PAS 111:2012

Specification for the requirements and
test methods for processing waste wood



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Foreword

This Publicly Available Specification (PAS 111:2012) has been commissioned by WRAP¹⁾ in collaboration with the British Standards Institution (BSI).

The aim of this PAS is to provide a specification for individuals and organizations recovering and processing post-industrial and post-consumer waste wood into wood products such that potential customers will be assured that they are procuring a material of consistent and verifiable quality.

If the minimum specification is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is non-compliant, even if an end user's specification is met.

The following markets account for the majority of recovered wood consumed in the UK and are covered by PAS 111:

- Panelboard manufacture²⁾;
- Biomass energy generation³⁾;
- Animal bedding;
- Mulches;
- Equine surfaces;
- Pathways and coverings; and
- Industrial and commercial applications.

¹⁾ WRAP (Waste & Resources Action Programme) works in England, Scotland, Wales and Northern Ireland to help businesses and individuals reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way. www.wrap.org.uk.

²⁾ For convenience, the term "panelboard manufacture" is used in this PAS, however, the term "wood-based panel manufacture" is more accurate.

³⁾ "Biomass energy generation" includes treatment processes that convert the energy in biomass into useful forms of energy, including electrical power, process steam, hot water, and combined heat and power processes.

Under current legislation, all forms of waste wood covered by this PAS are classified as waste until incorporated into an end use application. It follows that handling, transportation storage and use of these materials must comply with all regulations arising from the Waste Framework Directive (WFD)⁴⁾ [1].

NOTE 1 *Regulators may provide guidance on waste legislation and how it applies to waste wood e.g. the Environment Agency has a regulatory position statement which advises when wood is considered to be waste and what regulatory controls apply.*
www.environment-agency.gov.uk/static/documents/Research/PS_005_Regulation_of_wood_v3.0.pdf.

NOTE 2 *The Waste Protocols Project is working on the development of a Quality Protocol where waste wood processed in accordance with its requirements for specific end-uses would be considered a non-waste.*

Acknowledgement is given to the following organizations that have been instrumental in the development of this PAS:

- Association for Organics Recycling (AFOR);
- AW Jenkinson Forest Products;
- Consulting With Purpose;
- Environment Agency;
- Fichtner Consulting Engineers Limited;
- Hadfield Wood Recyclers & UK Wood Recycling;
- National Farmers' Union (NFU);
- Sembcorp Utilities (UK);
- SITA Power;
- Timber Research and Development Association;
- Wood Panel Industries Federation (WPIF);
- Wood Protection Association (WPA);
- Wood Recyclers' Association (WRA).

⁴⁾ EU Waste Framework Directive (2008/98/EC) [1].

Wider comments from other interested parties were invited by BSI. The expert contributions made by organizations and individuals consulted in the development of this PAS are gratefully acknowledged.

Technical authorship for this PAS has been provided by Oakdene Hollins⁵).

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This PAS will be reviewed at intervals not exceeding two years and any amendments arising from that review may be published as an amended PAS and publicized in *Update Standards*. Feedback on this PAS will be gratefully received.

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Presentational conventions

The provisions of this PAS are presented in upright, roman type. Its requirements are expressed in sentences in which the principal auxiliary verb is shall.

Commentary, explanation (guidance) and general informative material is presented in smaller italic type, and does not constitute normative elements (requirements). Much of this appears as notes in this PAS, each beginning with NOTE, and other such material appears in the annexes marked informative.

Requirements in this PAS are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. In addition, nothing in this publication implies that any product is fit for any particular end purpose.

Users are responsible for the correct application of the PAS.

Compliance with a PAS cannot confer immunity from legal obligations.

⁵) Oakdene Hollins Limited is an independent company specializing in consultancy and research in sustainable technologies, waste management and remanufacturing (www.oakdenehollins.co.uk).

Introduction

In 2010 the UK's annual arising of waste wood generated by households and businesses was estimated at 4.1 million tonnes⁶⁾. About 2 million tonnes were diverted or recovered from the waste stream for recycling or energy recovery, but the remainder continues to be sent to landfill, resulting in considerable environmental and economic costs.

NOTE WRAP's Closed Loop Economy Directorate is working with the wood recycling industry to boost the landfill diversion rate for waste wood.

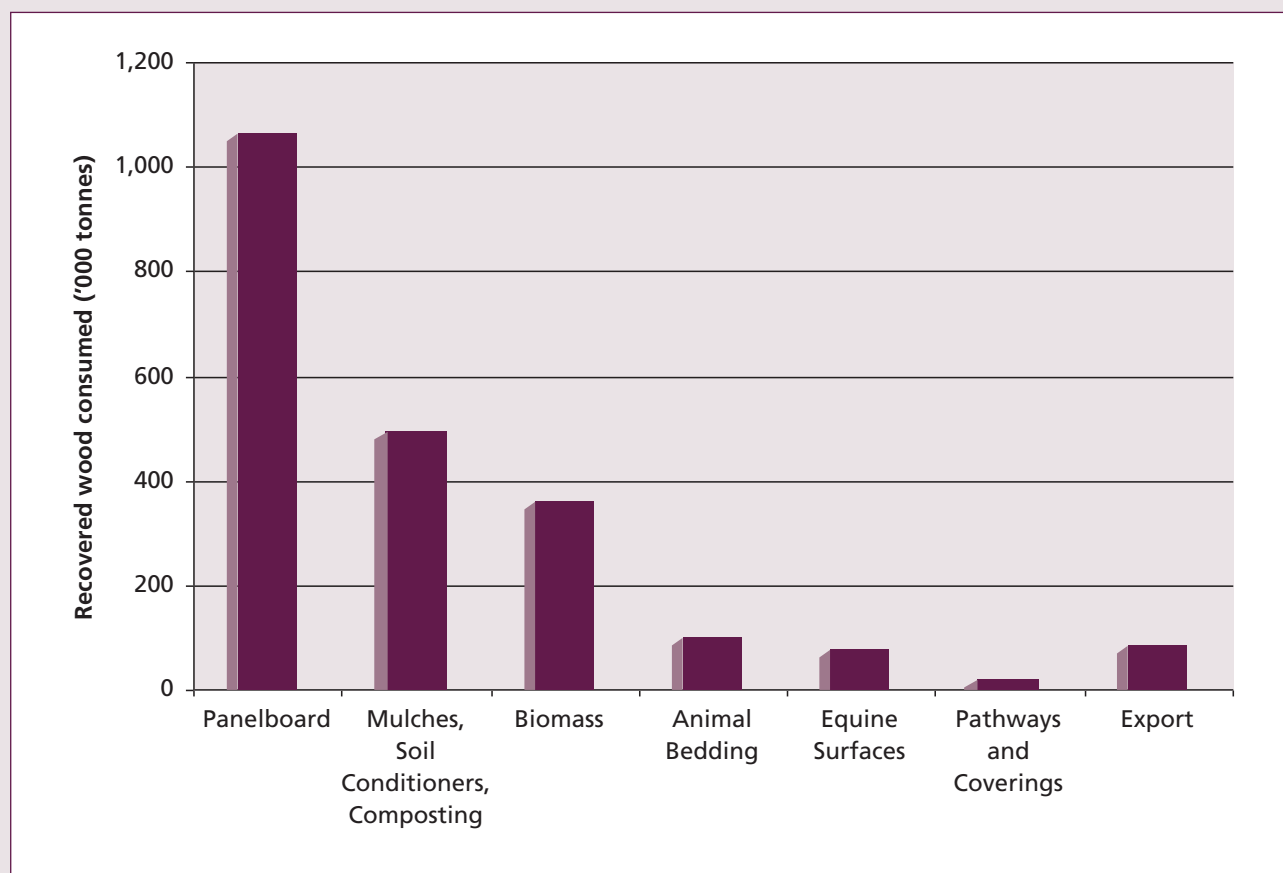
As Figure 1 shows, the panelboard manufacturing industry recycles most of the recovered material, with biomass energy generation and animal bedding production being the next largest markets⁷⁾. A large number of wood reprocessing companies of varying sizes and levels of sophistication have emerged in the UK to collect, grade, and process waste wood in order to supply these end markets.

Waste wood arises in a multitude of forms, and a lack of consistency in the way waste wood is accepted, graded and processed is a barrier to the industry's objective of increased recovery rates. Moreover, waste wood reprocessors supply material to a number of markets using unpublished (and sometimes confidential) agreements and, within a single end use market, specified material acceptance criteria may vary from customer to customer and from supplier to supplier. In more mature and well regulated markets, end users work with national and international standards, whereas many end users in less well regulated markets do not work to a single well recognized standard. End users need confidence in the uniformity and quality of recovered wood, while waste wood reprocessors need to know how to design their operations to meet the requirements of their customers and the regulators.



⁶⁾ WRAP, 2011. Wood Waste Market Situation Report.

⁷⁾ Wood Recyclers' Association. 2009. Waste Wood to Markets Statistics.

Figure 1 – Major end markets for recovered post-consumer waste wood in the UK, 2009

Source: Wood Recyclers' Association, Waste wood to markets statistics, 2009.

This PAS does not seek, therefore, to override other published standards or customer-specific material specifications. Its aim is to harmonize with such standards and regulations, and to establish a minimum set of criteria and processing requirements for material to be deemed to be suitable for onward sale, albeit as a waste derived material. PAS 111 only prescribes absolute limits on physical and chemical attributes of the recycled wood materials where such limits are not elsewhere established by the end user or by regulations. However, for the avoidance of doubt PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the limits established elsewhere such as by the end user or regulations are met.

In addition, waste wood other than that from virgin sources, such as forestry operations, sawmills, etc, comes under waste controls. As such, the processing and use of the material will be subject to waste regulations in order to ensure that there is no risk to the environment or to animal or human health from these operations until such time as it has ceased to be a waste.

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1 Scope

This Publicly Available Specification (PAS) provides the definitions, minimum requirements and test methods for processing waste wood into materials intended for use in suitable new applications or end products. It is applicable to the receipt, storage, grading, preparation and testing of waste wood intended for use in end markets, as outlined in Figure 2.

The primary audience for this PAS is the waste wood processing sector comprising companies of any operational size or level of sophistication.

NOTE 1 *Secondary audiences may include individuals and organizations generating waste wood and those end users of recovered wood.*

Major end markets include:

- panelboard manufacture (more accurately known as “wood-based panel manufacture”);
- biomass energy generation; and
- animal bedding.

Other end uses for recycled wood can be divided into:

- products for placement on porous soil surfaces, where the product will degrade (e.g. mulches, or for composting), following which the material may be incorporated under the surface (see Note 2);
- products for use on sealed surfaces where the intention may be to remove or to top-up the product at a later date (e.g. equestrian surfaces, paths and some mulches); and
- industrial and commercial applications (e.g. absorbents and odour filtration).

NOTE 2 *PAS 100:2012, sets out clear processing and testing requirements for composted materials using source-segregated biowastes, including waste wood. For this reason, the processing of waste wood for compost has been excluded from the requirements of PAS 111.*

This PAS does not apply to the reuse of wood products or to the processing of pre-consumer wood waste.

NOTE 3 *The term “pre-consumer” refers to wood products and residues from the forestry and saw mill industry, and not to wood waste arising from*

manufacturing or sub-manufacturing processes⁸⁾. For the purposes of this PAS, the latter is termed “post-industrial” wood wastes as many waste wood reprocessors in the UK will be handling significant quantities of such material.

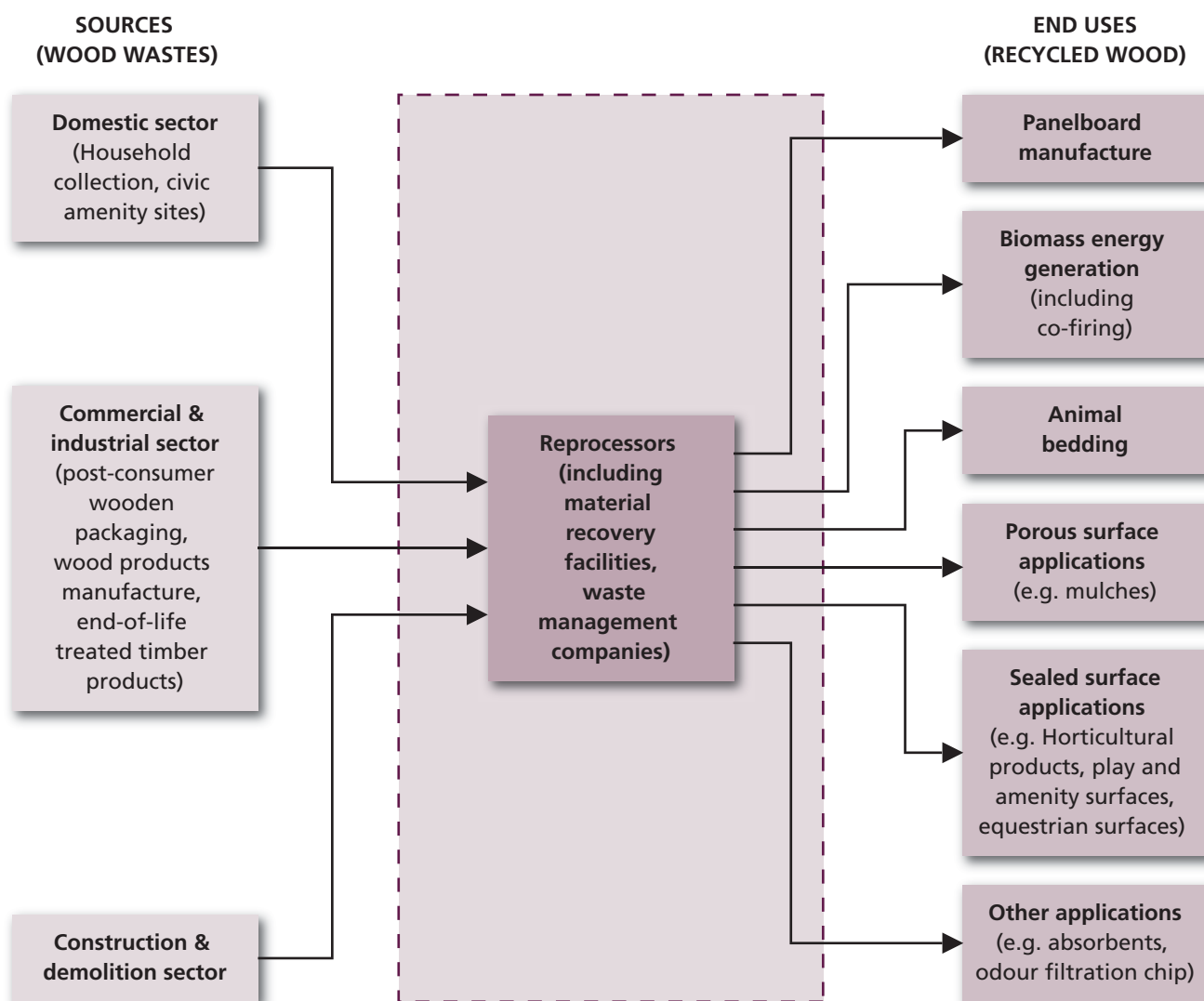
This PAS is not applicable to the growers of virgin biomass material.



⁸⁾ It is noted that ‘The European Panel Federation Standard for delivery conditions for recycled wood’ uses the term “pre-consumer wood” to refer to “by-products from processing and manufacturing sites”, i.e. “post-industrial” material in the terminology of this PAS.



Figure 2 – Applicability of the PAS in the waste wood collection and recycling supply chain



2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PAS 104:2004, *Wood recycling in the panelboard industry*



3 Terms and definitions

For the purposes of this PAS the following terms and definitions apply.

3.1 animal bedding

material, cut or shredded, to provide bedding and soiling material for livestock and domestic pets



3.2 biomass

fuel source derived from any recently living material, commonly plant or animal matter

3.3 chipboard

panel material manufactured under pressure and heat from particles of wood

3.4 collector

organization that aggregates post-consumer wood from various sources and delivers it to the reprocessor

3.5 compost

solid particulate material that is the result of composting, that has been sanitized and stabilized and that confers beneficial effects when added to soil, used as a component of a growing medium, or is used in another way in conjunction with plants

3.6 contaminant

non-wood item, material or chemical present in or on waste wood or recycled wood product

3.7 CCA

chromated copper arsenate

3.8 equine surfaces

surface comprising wood chips upon which horses are exercised or trained

3.9 feedstock

raw material for a wood processing facility

3.10 fibreboard

NOTE See 3.43.

3.11 grading

arranging of materials into categories according to quality, weight or size

3.12 hardboard

fibreboard made in a wet process where the primary bond is typically derived from the felting of fibres which are subsequently subjected to heat and pressure

3.13 hardwood

wood from broadleaved trees

NOTE Such as oak, beech, ash, birch, maple, iroko, rubberwood; it is often darker in colour, longer lasting, denser and more decorative than the wood of coniferous trees.

3.14 hazardous waste wood

waste wood that is covered by legislation on hazardous waste and subject to the associated controls

NOTE 1 Waste wood that has been treated with CCA or creosote is likely to be classified as hazardous waste.

NOTE 2 See also 3.20 for definition of non-hazardous treated waste wood.

NOTE 3 The classification of waste wood as non-hazardous or hazardous is in most cases a complex matter requiring information on the specific chemicals in the wood and their concentration⁹⁾.

3.15 heavy metal

a member of a loosely defined subset of elements with a high relative atomic mass and which exhibit 'metallic properties'

NOTE Heavy metals can have a high impact on human and animal life, due to their persistence and propensity to accumulate.

3.16 load

material from a collection or shipment that is presented as one delivery

3.17 medium density fibreboard (MDF)

fibreboard manufactured in a dry process with the application of heat and pressure and where the primary bond is formed by the addition of a synthetic binder

3.18 moisture content

mass of water contained in wood, expressed as a percentage of the total mass of the wood, including the water

3.19 mulch

material spread and allowed to remain on the soil surface to conserve soil moisture, suppress weeds and shield soil particles from the erosive forces of raindrops and runoff

⁹⁾ See Wood Protection Association Guidance Note Dealing with treated wood related waste streams. Third edition, October 2009.

3.20 non-hazardous waste wood

waste wood that is not covered by legislation on hazardous waste and is not subject to the associated controls

NOTE See also 3.14 for definition of hazardous treated waste wood.

3.21 oriented strand board (OSB)

multi-layered board made from strands of virgin wood of a predetermined shape and thickness, together with a binder

NOTE The strands in the external layers are aligned and parallel to the board length or width; the strands in the centre layer or layers can be randomly oriented, or aligned, generally at right angles to the strands of the external layers.

3.22 packaging recovery note (PRN)

document issued by accredited reproprocessors to show how much of a certain type of recyclable packaging material has been recovered or recycled

NOTE Attention is drawn to the Producer Responsibility Obligations (Packaging Waste) Regulations 1997 [2].

3.23 packaging

products made of wood and used for the containment, protection, handling, delivery and preservation of goods, from the producer to the user or consumer

NOTE Packaging waste includes pallets, cases and drums.

3.24 panelboard

wood-based panel

NOTE Examples include chipboard, fibreboard, hardboard, MDF, OSB, particleboard, plywood and softboard.

3.25 plywood

wood-based panel consisting of an assembly of layers glued together with the direction of the grain in adjacent layers usually at right angles

3.26 porous-surface application

product derived from recovered waste wood intended for use in or on a porous surface where the product will be allowed to breakdown naturally

NOTE Examples include some mulches and soil conditioners.

3.27 post-consumer wood

waste wood that is recovered from a consumer or commercial wood product that has been used for its intended purpose by individuals, households or by commercial, industrial and institutional facilities in their role as end users of the product

NOTE Definition taken from Forest Stewardship Council (FSC).

3.28 post-industrial wood

waste wood that is derived from a manufacturing or sub-manufacturing process

3.29 pre-consumer wood

waste wood that is recovered from a process of secondary manufacture, or further downstream industry, in which the material has not been intentionally produced, is unfit for end use and not capable of being reused on-site in the same manufacturing process that generated it

3.30 reprocessor

organization that recovers wood from the waste stream and converts it into a form suitable for use in a new product or other application

NOTE Reprocessing may include size reduction and contaminant removal.

3.31 recovered wood

wood diverted from the waste stream and prepared for incorporation into a new product or other application

NOTE This definition is used here for convenience. The strict legal definition is that waste is not recovered until it has been incorporated into a new product or other application.

3.32 recycled wood

recovered wood that has been processed (usually by mechanical means) to be used in the manufacture of a new product or to produce energy

NOTE This definition is used here for convenience. The strict legal definition is that a waste derived material is not recycled until it has ceased to be waste.

3.33 reuse

reutilization of products or components, in original form

NOTE Such as the salvage and reuse of floorboards and other architectural timber.

3.34 sealed surface application

product derived from recycled wood for temporary use on a surface from where it is intended to be removed and replaced prior to the opportunity for decomposition

NOTE Examples include, play surfaces, pathways and equestrian surfaces.

3.35 sharps

man-made contaminants that are greater than 1 mm in any dimension that can cause physical injury to a person or animal who comes into contact with recovered wood, including a person who handles these materials without protective gloves

3.36 softwood

wood from coniferous trees

NOTE For example, such as Scots pine, European larch, Douglas fir and Sitka spruce.

3.37 source

organization or sector that supplies waste wood to wood reprocessors

3.38 timber

natural or sawn wood in a form suitable for building or structural purposes

3.39 treated wood

wood that has been chemically treated to enhance the performance of the original wood

NOTE 1 Such treatment may be invisible.

NOTE 2 Treatments include coatings (e.g., paint and varnish), preservatives and flame retardants. The latter two can be applied by superficial application processes (e.g. brush or spray) or by penetrating processes (e.g. timed immersion and vacuum pressure in a pressure vessel). Treatments, such as heat treatment, which do not add to the potential risk to the environment, are not covered by this definition.

3.40 waste wood

wood-based material or object which the holder discards or intends, or is required, to discard

3.41 wood

hard fibrous substance which comprises the body of trees, shrubby plants and their branches

NOTE Wood consists chiefly of the carbohydrates cellulose and lignin.

3.42 wood chips

particles of wood derived from a mechanical size reduction process

3.43 wood fibreboard

panel material, with a nominal thickness of 1.5 mm or greater, manufactured from lignocellulosic fibres with the application of heat and pressure



4 Wood waste grades, sources, and end uses

4.1 Grades of wood for recycling

Wood entering the waste stream is placed into four grades, A, B, C and D, according to its general suitability for certain end uses. The grades are dependent upon the composition, chemical treatment, physical condition, levels of non-wood contamination, and other characteristics of the waste wood.

Annex A sets out the wood grading system to be used. It describes the main forms of wood material included in each grade and lists typical sources and typical end uses or markets.

NOTE 1 *This grading system has been developed by the Wood Recyclers' Association (see Annex A).*

NOTE 2 *Waste regulatory requirements may further limit inputs for specific end-uses. Check with the regulator for the most up to date information.*

NOTE 3 *Some waste wood is subject to various forms of chemical treatment. Although some of these chemicals are no longer added to new wood products in the UK, the waste wood reprocessing industry will continue to encounter material treated with older, previously-used chemicals for many years to come, as treated materials and products reach end-of-life and are disposed of, especially when recovered from civic amenity sites¹⁰⁾*

Each end use of recycled wood will have specific requirements for wood materials which are acceptable. In particular, some treated wood waste will contain chemical compounds which are not acceptable to some end use applications.

At the present time it is not technically or commercially viable to reliably identify and remove treated wood waste material during processing. Neither is it practical to test recycled materials for all chemicals that could be present.

The reprocessor shall maintain a formal schedule of the specification required by each end user which shall clearly list acceptable and unacceptable materials. The specification shall be either agreed between the reprocessor and each end user, or where no such agreement exists, shall meet the requirements of this PAS for each intended end use (see 4.3).¹¹⁾

4.2 Sources and qualities of waste wood

Some sources of waste wood may contain treated waste wood which might not be acceptable materials for the end-use. These items should be removed prior to processing.

Some wood treatments are visible to the naked eye and these items shall be removed from the waste, if hazardous, or if required by the end use application, following visual inspection on receipt at the reprocessing site (see 5.6), or prior to processing (see 5.7).



¹⁰⁾ A WRAP study on waste composition (Seabrook, Bridgewater and Network Recycling, 2004) found that, including laminated and veneered wood, on average 85% of the wood from the observed civic amenity sites and 23% from the observed C&D sites was treated. These figures should be treated as indicative only, and may not be representative of the national situation.

¹¹⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.



4.3 End uses and acceptable feedstock materials

4.3.1 Panelboard manufacture

Sourcing waste wood feedstock for panelboard manufacture shall be in accordance with the requirements of PAS 104.

NOTE Panelboard products are sheet materials in which wood is predominant in the form of strips, veneers, chips, strands or fibres. They are manufactured to a series of European Standards, published as national standards in the UK as BS ENs.

4.3.2 Biomass energy generation

The regulatory controls on emissions from biomass energy generation operations mean that risks and hazards are controlled through emission limits. The emission limits may be set as part of the Environment Permit required for the site.

NOTE 1 It should be noted that Waste Incineration Directive (WID) could apply to biomass energy generation from waste wood Grades B, C and D.

Recovered wood intended for biomass energy recovery may, therefore, be of any grade, assuming that the biomass plant has a permit¹²⁾ to process this material.

NOTE 2 The European Waste Incineration Directive (2008/98/EC) [3] applies to all combustion of waste for energy generation. Wood waste is exempted from the scope of the WID, with the exception of wood containing halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coatings, and includes in particular wood originating from construction and demolition sites, unless the user proves that his biomass fuel does not contain such treatments.

¹²⁾ The Environmental Permitting Regulations (England and Wales) 2010 [4].

4.3.3 Animal bedding

Recovered wood intended for PAS 111 compliant animal bedding shall meet minimum testing requirements as set out in PAS 111. Only grade A wood should be used as input, and should be tested in accordance with 6.3.1 and 6.3.2.¹³⁾

4.3.4 Porous-surface applications

Recovered wood intended for porous surface applications shall be either Grade A waste only, or, if lower grades (with the exception of Grade D) of feedstock are accepted, the reprocessor shall implement a material output testing programme. Such a testing programme shall be agreed with each end user, or, if no such agreement exists, shall be in accordance with Clause 6.¹⁴⁾

NOTE 1 It is recognized that some porous-surface products could be supplied in the form of a 'multi-use' product.

NOTE 2 A clear distinction exists between the use of recycled wood as a mulch or soil conditioner in agriculture, for the growing of food, and its use in horticultural or domestic applications.

4.3.5 Sealed surface applications

NOTE The Government, Health & Safety Executive (HSE) and Royal Society for the Prevention of Accidents (RoSPA) recommend that all materials, including recovered wood products, used for play surfaces should comply with BS EN 1177.¹⁴⁾

Recovered wood intended for sealed surface applications shall meet minimum testing requirements as set out in PAS 111. Grade A wood wastes shall be sampled and tested, after processing, in accordance with 6.3.1 and 6.3.2. Wood recovered from Grades B or C wood wastes shall be sampled and tested, after processing, in accordance with all of the Clause 6 requirements applicable to sealed surface applications.¹⁴⁾

¹³⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.

¹⁴⁾ WRAP (2004), Characterisation of emerging higher value markets for recycled wood products.

5 Processing waste wood

5.1 Background

Clause 5 describes good practice at each key stage of the receipt, storage, processing, preparation and testing of waste wood. Where appropriate it also provides the minimum requirements for key elements of the process to ensure that the end product is deemed to be suitable for onward sale for its intended use, albeit as a waste. Figure 3 shows the main processes involved.

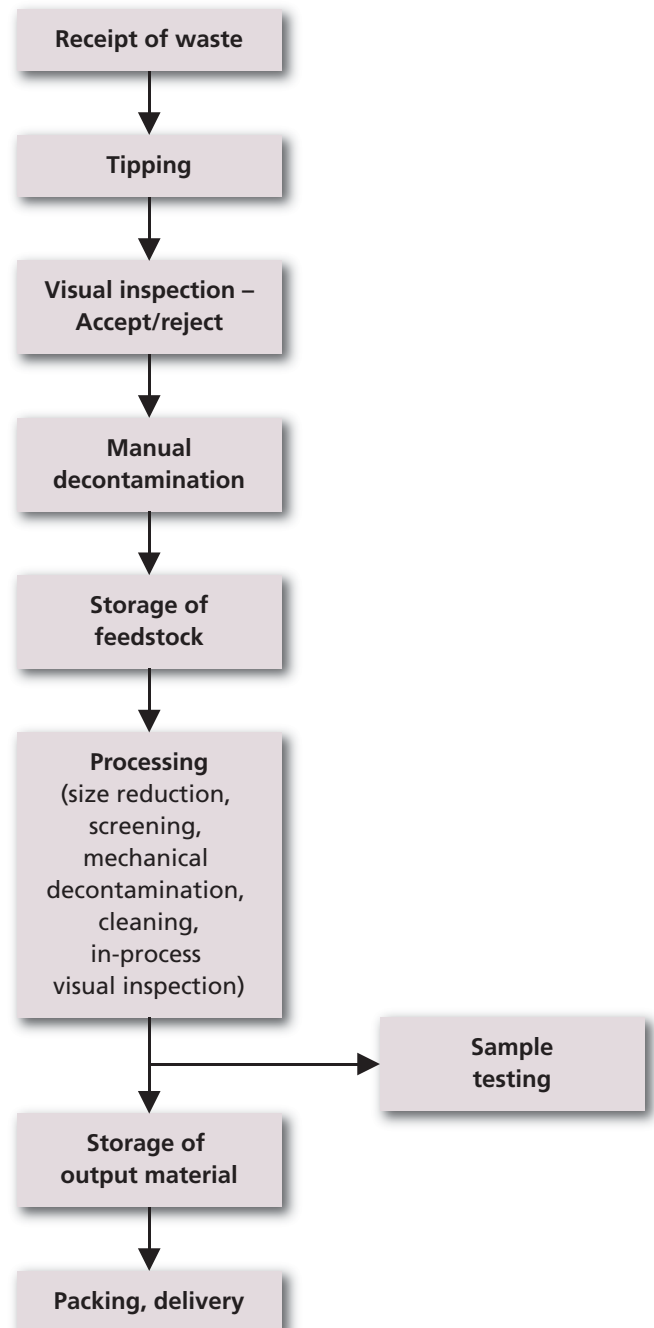
In all markets, the requirements set out in this PAS for the processing of waste wood, applicable to its receipt, storage, size reduction and quality control shall apply.

The requirements of this PAS for the testing of material outputs do not apply to well established markets, which include panelboard manufacture and biomass for energy generation, but shall apply in less well regulated markets where no agreed specification exists between the reprocessor and the end user.¹⁵⁾

NOTE 1 Attention is drawn to the requirements of the provisions of the Environmental Protection Act 1990, Part II [5], as amended, which define the legal framework of the Duty of Care for waste that should be complied with when storing, handling, recovering or disposing of waste, and the Waste (England and Wales) Regulations 2011.

NOTE 2 Where the requirements of Clause 5 refer to paper-based systems, it is noted that such systems may also be delivered electronically so long as the procedural and information recording requirements are met.

Figure 3 – Producing products from waste wood



¹⁵⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.

5.2 Output material specification and testing

In well-established markets, where a material specification is contractually agreed between the end user and the reprocessor, the material testing regime to be followed by the reprocessor shall meet the requirements of the contractually agreed specification.¹⁶⁾

Where there is no contractually agreed material specification, the minimum testing regime set out in Clause 6 shall apply.

5.3 Collection and delivery of waste wood

When sourcing waste wood, the reprocessor shall provide the following:

- a) written specification of feedstock materials (4.1); and
- b) documented procedures covering collection, transportation and delivery.

5.4 Receipt of waste wood at the reprocessor

If waste wood is coming from a supplier with whom the reprocessor has no previous trading experience, a representative of the reprocessor may, where practical, visit the supplier in advance to check that the material is of the correct form.

The reprocessor shall ensure that the carrier delivering the material possesses valid waste carrier's registration.

Where the delivery to the reprocessor is to be made by the supplier, the supplier shall confirm, in advance to the wood reprocessor, the following:

- a) the form and estimated mass of material;
- b) the form of container in which it is to be transported; and
- c) the existence of valid waste carrier's registration.

Site conditions at the reprocessor, including lighting if deliveries are accepted out of daylight hours, shall allow a delivery of the material to be properly and safely inspected on receipt.

The net mass of input material accepted on the site shall be recorded. The net mass may be taken from the delivery note, and checked with weighbridge records where available.

Where the input material indicated on the delivery note is not acceptable under the conditions of the wood reprocessor's Environmental Permit, the load shall not be tipped at the site, and the driver shall be requested to remove the load from the site.

5.5 Tipping

Each load shall be fully deposited at the designated tipping area which shall be a clear area of the site, with a concrete or equivalent hard floor. The input material shall be tipped so as to ensure that there is no contact with any previous loads and that the supplier of the load may be identified.

When receiving material, the reprocessor should, where appropriate, operate to *Materials Handling Guidance Note No.1 Mechanised unloading of wood fibre products from curtain-sided vehicles*.¹⁷⁾

NOTE This provides guidance on unloading wood fibre products, including sawmill chips, sawdust, bark and recycled wood fibre from curtain sided vehicles, also known as 'chipliners'.



¹⁶⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.

¹⁷⁾ Published by the Wood Panel Industries Federation, the Wood Recyclers' Association and the UK Forest Products Association.



5.6 Visual inspection of received material

5.6.1 Inspection procedure

The visual inspection shall be sufficient to determine, as far as is practical by visual means, that the load conforms to all end user, regulatory and site-specific requirements in that it:

- a) only contains material matching the form or grade entered on the Waste Transfer Note (WTN) or Delivery Ticket and the Waste Validation Form, and that, where visible, the physical and chemical contaminants are within agreed limits;
- b) contains no material for which the reprocessor has no licence or permit to handle;
- c) contains no material deemed unacceptable under the terms of the agreement between supplier and reprocessor or by 4.3, and by the site's schedule of acceptable materials (see 4.1).

The material may be spread out prior to inspection; for health and safety reasons, where it occurs, the spreading shall be performed by mechanical means. The spread-out material shall not be in contact with previously unloaded material.

The visual inspection of physical contamination shall be conducted by a trained member of staff working with the Waste Validation Form.

NOTE A portable metal detector can help to find large pieces of ferrous metal if set to low sensitivity; high sensitivity will detect every incoming nail.

5.6.2 Contaminant materials that could be present in waste wood

5.6.2.1 Physical contamination

The following materials represent examples of physical contaminants that could be present in waste wood:

- a) waste wood of a form not conforming to agreements between supplier and reprocessor, or which is not permitted under the conditions of the reprocessor's site Environmental Permit and is listed in the feedstock materials schedule for the site;
- b) hazardous waste including:
 - waste electrical and electronic equipment (WEEE);
 - oil, tar;
 - other hazardous waste.¹⁸⁾

¹⁸⁾ www.environment-agency.gov.uk/business/topics/waste/32180.aspx

c) organic material including:

- paper, cardboard, hardboard;
- food and other non-wood biodegradable waste;
- foliage and twigs.

d) plastic, including:

- bottles;
- films and bags;
- foam;
- plastic planks on the blue GKN pallets;
- plastics from old kitchen carcasses.

e) felt, rubber and silicone in all formats;

f) metal (ferrous and non-ferrous);

g) minerals, including:

- hardcore;
- aggregate;
- rubble;
- bricks;
- concrete;
- grit;
- glass;
- putty.

h) soil, stones;

i) plasterboard;

j) cane furniture, sofas, and textiles.

NOTE Information on identifying and separating out different forms of wood and contaminants is available in the *Guidance on separating wood for recycling at source. Step by step guide to understanding wood for recycling*.¹⁹⁾

5.6.2.2 Chemical contamination

A list of chemical compounds used in wood treatments that are of potential concern to human and animal health and to the environment are listed in Annex B. Table B.1 identifies which of these treatments are visible.

With a few exceptions where chemical wood treatment imparts a distinctive colour, most types of wood preservative cannot be identified by visual means. Identifiable items include utility transmission poles, railway sleepers, both typically though not exclusively creosote treated and wooden fencing products which

are typically treated with creosote or chromated copper arsenate or other copper-containing preservative.

The reprocessor shall remove for safe disposal material visibly treated with such chemicals identified during this inspection stage.

NOTE Other treatments listed in Table B.1 are invisible and non-odorous and are only detectable by laboratory analysis. Items that have been subjected to these treatments are not expected to be identified at this stage.

5.6.3 Acceptance of waste wood

On completion of the inspection, the inspector shall sign the Waste Validation Form for the load. The details shall be recorded onto the reprocessor's management system.

The driver or supplier shall be informed where the visual inspection reveals that the forms of material within the load do not conform to the information entered on the WTN or delivery ticket. The European Waste Catalogue List of Wastes (LOW) code shall be changed accordingly on the WTN and a Non-Conformance Report created.

NOTE It is recommended that in the case of repeated non-conformance events, the reprocessor should visit the site supplying the offending material to train the supplier in correct grading. Where economically viable, reprocessors can benefit from placing their own staff at a supplier's site (e.g. at a civic amenity site) to ensure grading is done properly at source. Ultimately, the reprocessor should refuse further trading with problematic suppliers.

Where non-conforming material does not contravene the conditions of the reprocessor's Environmental Permit, the reprocessor may choose to accept or reject the load depending upon an estimate of the proportion of the load which is not conforming to any contracts agreed between the reprocessor and the supplier.²⁰⁾ Where the load is rejected the reprocessor shall, either, return the non-conforming material to the delivery vehicle, or store it for subsequent, appropriate disposal.

Where the form of non-conforming material (e.g. hazardous waste) contravenes the conditions of the reprocessor's Environmental Permit and the waste has been supplied by an external party, the entire load shall be returned to the delivery vehicle and rejected from the site. Where the waste is supplied by a vehicle

¹⁹⁾ www.wrap.org.uk/recycling_industry/information_by_material/wood/guidance_on.html

²⁰⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.

belonging to the reprocessor, the entire load shall be photographed and quarantined.

The supplier from whom the reprocessor collected the material shall be informed by electronic mail with a digital photo included as an attachment and the supplier shall be given the chance to inspect the load within 24 hours of notification, prior to final disposal.

5.7 Initial de-contamination and picking stations

Prior to movement of input material to the appropriate stockpile for further processing, any larger visible contaminants not practically removed during the visual inspection shall be removed.

NOTE When accepting mixed waste inputs from sources where physical contamination is likely to be significant, such as civic amenity (CA) sites or the construction and demolition sector, manual decontamination is safer when done by a picking station.

Contaminants and non-conforming material removed at this stage shall be disposed of correctly or, where agreed by contract, returned to the supplier for disposal.

5.8 Storage of input material

Where the input material is not to be immediately processed, it shall be moved to a storage area of the processing site set aside for that specific grade. A stockpile of a certain input grade shall not be in contact with a stockpile of a different grade.

Material shall be stored on hard surfaces in storage areas of an adequate size to prevent overflows. Storage areas shall be physically separated from each other and signed.

The storage areas shall be swept to avoid re-contamination.

NOTE 1 Attention is drawn to the appropriate fire regulations in relation to the storage of input materials.

NOTE 2 See PAS 104 for further guidance on storing and transporting material at wood processing sites.





5.9 Size-reduction, screening and mechanical de-contamination

Input material shall be reduced in size, where necessary, to facilitate handling and storage, to make transportation more economic, and to meet the end use specification.

NOTE 1 Various terms refer to size reduction processes employed by recovered wood reprocessors including shredding, chipping, milling, crushing and comminution. In practice, these words are used interchangeably and arise from the types of technology employed.

NOTE 2 The precise size threshold to which the material is reduced varies as specified by the end user, or as required for the intended general end uses.

Smaller items of physical contamination and visibly chemically treated wood items shall be removed to the extent required by the end use specification.

Where the same shredder is used to process different grades of wood, a risk of cross-contamination between grades may exist. Before processing higher grade material, any lower grade material remaining in the machine from a previous shredding may, if required, be “flushed out”. This may be done by passing through sufficient quantities of the higher grade material and transferring the resulting mix of high and low grade chip to the lower grade stockpile.

Where tests show that a batch of material falls outside the size or quality specification for the appropriate end use, it shall be re-entered into the shredder or other relevant machines for further processing.

5.10 Storage of output material

5.10.1 Background

The material shall be stored to minimize quality loss through contamination or water ingress. The length of time for which chip can be stored may be prescribed by the customer.

NOTE Attention is drawn to the appropriate fire regulations in relation to the storage of processed materials.

5.10.2 Loose output material

When stored in loose form, the material shall be kept in storage bays with a concrete or other equivalent hard floor. The material shall be stored short of the full length and height of the bay to avoid spillage of the contents of the bay into adjacent bays and exposure to excess rainfall.

Different loose output material types shall be stored separately from one another to prevent cross-contamination.

5.10.3 Packaged output material

When the moisture content of the material is acceptable, as proven by the test described in 6.3.5, it shall be placed in packaging that will prevent water ingress.

Each package shall be labelled with the following information:

- a) material specification (including description of the material and the LOW code, taken from the applicable List of Waste Regulations, where the material is still classed as waste);
- b) material description;
- c) nominal particle size;
- d) weight or volume of package content;
- e) batch number; and
- f) reference to PAS 111.

NOTE Separate Lists of Waste Regulations apply in each country within the UK.

5.11 Dispatch and transport of output material

Output material shall be loaded for onward shipment to the end user on secure vehicles.

The material shall be accompanied by a delivery note which complies with relevant legislation and which includes reference to PAS 111.

5.12 Export of output material

NOTE Any organization wishing to export recovered wood material has a statutory duty to comply with the rules of the recipient territory's competent authority. In addition, export of any form of waste is governed by the Transfrontier Shipment of Waste Regulations 2007 [7].

5.13 Fire risk

Fire safety regulations and guidance vary from region to region, so the reprocessor shall consult with the local fire authority for guidance on safe procedures and to obtain a Fire Safety Certificate.

The following precautions shall be implemented:

- a) Smoking shall be forbidden throughout the site.
- b) Appropriate heat detection apparatus shall be available to measure the temperature of stockpiles.
- c) Remotely operated internal fire monitor stations shall be in place.
- d) Water, at sufficient pressure, shall be available to these stations.
- e) Spark arrestors shall be installed at appropriate locations.
- f) Stockpile heights shall be controlled and appropriate fire breaks shall be in place.

NOTE 1 Given that quantities of flammable material (both inputs and outputs) are being handled and stored, fire is a significant safety, environmental and economic risk. If left for a sufficient length of time in damp conditions, a small risk exists that a pile of wood chip could self-ignite due to exothermic reactions occurring within the pile. In addition, where significant quantities of dust are present in the air, a risk of explosion exists.

NOTE 2 Attention is drawn to the minimum statutory fire prevention regulations.

5.14 Health, safety and environmental issues

NOTE 1 See PAS 104, Annex A.6.2 for guidance on controlling and minimizing health and safety and environmental risks at waste wood processing sites.

NOTE 2 Reprocessors should refer to appropriate HSE (Health & Safety Executive) regulations and also the conditions of their site permit. Relevant legislation includes:

- a) Health and Safety at Work Act 1974 [8];
- b) Management of Health and Safety at Work Regulations 1999 [9];
- c) Provision and Use of Work Equipment Regulations 1998 (PUWER) [10];
- d) Control of Substances Hazardous to Health Regulations 2002 (COSHH) [11];
- e) Manual Handling Operations Regulations 1992 [12].

Reprocessors shall have the following documents available to present to end users, suppliers and regulators:

- a) Environmental Policy Statement; and
- b) Health & Safety Policy Statement.

NOTE 3 The reprocessors' attention is drawn to the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) [13] for airborne wood dust presents a risk of unwanted and dangerous explosions. DSEAR is the UK enactment of the following two EU Directives:

- a) Directive 99/92/EC (also known as "ATEX 137" or the "ATEX Workplace Directive") on minimum requirements for improving the health and safety protection of workers potentially at risk from explosive atmospheres [14]; and
- b) Directive 94/9/EC (also known as "ATEX 95" or "the ATEX Equipment Directive") on the approximation of the laws of Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres [15].

NOTE 4 Compliance with the ATEX directives has been mandatory for new equipment since June 2003, and for existing equipment since July 2006 ²¹⁾.

²¹⁾ Further information on ATEX and DSEAR is available at: <http://www.hse.gov.uk/fireandexplosion/>.

6 Output material testing

6.1 Background

Visual inspection of material outputs shall be carried out and reported once per operating shift as a minimum. This is to ensure that the recycling process is under control and that the apparent quality of the output material meets the requirements of PAS 111 for its end user.

Sample testing of a range of quality parameters of recycled wood chip shall be carried out in accordance with a formalized sample testing procedure.

Where an agreed specification exists, the sample testing procedure shall be agreed contractually in writing between the reprocessor and the end user.²²⁾

Where no agreed specification is in place, the minimum sample testing procedure set out in 6.3 shall be applied on samples taken from the reprocessor's material output stream.

6.2 Material attributes

The attributes of recycled wood that could require sample testing are:

- a) particle size range, including fines content;
- b) moisture content;
- c) colour;
- d) calorific value;
- e) non-wood physical contamination, including grit;
- f) chemical contamination;
- g) pathogen content; and
- h) biomass content.

NOTE Some of the attributes of the recycled wood identified may not be critical to either the intended application or end use or for regulatory, health, safety and environmental considerations. In addition, the limit of, or the acceptable range of values, for any given attribute will depend on the end use market.

Recycled wood shall contain no more than the maximum specified levels of non-wood physical

particles, hazardous chemicals and pathogens, and it shall have a moisture content appropriate to the end use. Test procedures for these attributes shall be tested in accordance with 6.3.

Whilst not mandatory, test procedures for the other attributes listed, i.e. particle size range, colour, calorific value and grit (non-wood physical contamination particles less 2 mm in size), are included for completeness, and these tests may be carried out by, or on behalf of the reprocessor at regular intervals to ensure that the recycling process is under control.

6.3 Sample testing programme for output material where there is no procedure within an agreed specification

6.3.1 Testing programmes

The reprocessor shall carry out regular sample testing of batches of output material in order to ensure that quality parameters for the batch are either within limits set by this PAS or, if no limit is set by this PAS, that measures do not vary excessively.

The sample testing procedure in operation shall be formalized in the reprocessor's quality management system.

The frequency of sample testing shall be a minimum of one test per month. However, the frequency shall be increased if:

- a) there is a significant change in feedstock mix and quality, as could be the case when switching to a new source of supply; or
- b) there is a significant change in processing parameters; or
- c) testing demonstrates that the sample fails the limit set by this PAS for any attribute.

To ensure that each sample for testing shall be representative of the throughput of the reprocessor during the period between tests (nominally one month), an adequately sized sample shall be taken from each production shift for each product type during the period. Each sample taken shall be representative of the batch from which it is obtained. Each sample shall be captured in such way as to ensure that no undue contamination is introduced during the procedure (e.g. concrete

²²⁾ PAS 111 sets out minimum requirements. If the minimum is met or exceeded then the material is PAS 111 compliant; if the minimum requirements are not met, then the material is not PAS 111 compliant, even if the end user's specification is met.



scrapings from the storage bay), and shall be prepared in accordance with Annex C. At the end of the period, all samples shall be added together and mixed and a final representative sample for testing shall be selected from the mix.

Final sample size shall be appropriate to the test being applied.

Where sample testing is to be carried out by a third party laboratory (e.g. for testing for pathogens or chemical contamination), all batch samples shall be taken and supplied to the testing laboratory within 1 working day.

NOTE For pathogen testing, sample transit is recommended under chilled conditions.

For each sample tested, the following information shall be included in the records kept by the reprocessor:

- a) sampling date;
- b) product description;
- c) identity of the batch or batches from which the sample was taken;
- d) name of the person who carried out the sampling, or, if the sample taker is not employed by the reprocessor, on whose behalf the sample taker is acting and his/her contact details; and
- e) full test results.

6.3.2 Physical contamination

Given the variety of sources from which waste wood is recovered, wood products may still contain a range of

physical contaminants (see Introduction). These may be clearly visible objects or smaller particles, present as grit.

NOTE 1 Testing for grit contamination is excluded from the requirements of this PAS and, therefore, no limit has been set for grit content.

Upon visual inspection the output material shall contain no sharps. Sharps are unacceptable in any application where recycled wood is bagged or supplied for any use where it is handled without protective gloves.

Upon visual inspection the output material shall contain no particles of contamination greater than 1 mm in size and minimal volumes of any combination of the following contaminants:

- a) inorganic material (e.g. bricks, stones, ceramics and glass);
- b) non-wood organic materials (e.g. plastics, rubber and paper);
- c) ferrous and non-ferrous metals; and
- d) material treated with CCA or creosote-like substances.

The percentage by weight of physical contaminants shall be determined in accordance with the methodology set out in Annex F.

NOTE 2 The procedure described in Annex F is derived from PAS 104.

The total quantity of physical contaminants in the sample tested, shall be less than 0.5% by weight of the

sample, for particles less than 1 mm in any dimension. There shall be no particles in the tested sample that are greater than 1 mm in any dimension.

The percentage by weight of grit shall be determined in accordance with the methodology set out in Annex H.

NOTE 3 *The procedure described in Annex H is derived from PAS 104.*

The total grit contamination of the sample shall be recorded.

6.3.3 Chemical contamination

Clauses 4 and 5 sets out requirements in the selection of varying grades of wood waste from diverse sources, depending on the intended end use of the recycled wood. A key element of good practice is for the reprocessor to ensure that all wood waste feedstocks are from known sources and of a consistent mix of waste wood forms, suitable for the intended end market applications. Together with visual inspection of incoming feedstocks and initial decontamination procedures, as set out in 5.6 and 5.7, the risk of unacceptable levels of potentially toxic elements (PTEs) being present in the recycled wood should be minimized.

Virgin wood contains naturally occurring chemical contaminants²³⁾ and wood waste can contain a variety of chemical treatments. Many of these chemicals cannot be detected visually either at the inspection stage or by the methodology used for assessing physical contamination (see 6.3.2).

Some hazardous chemicals could remain in the wood presented for reprocessing and these will, therefore, remain in the recycled wood. It is not commercially viable, given current technology, to test recycled material for all chemicals that may be present. Sample testing of output materials shall be carried out to establish the levels of the most common PTEs and hazardous chemical compounds present in waste wood.

Chemical testing for invisible contaminants is unlikely to be practical for reprocessors at the present time. Samples for testing, therefore, may be sent to accredited third party organizations.²⁴⁾

The range of, and acceptable upper limits for PTEs and hazardous chemical compounds to be tested shall depend on the end use application.

The chemical contamination of wood waste intended for biomass energy recovery is controlled by emissions limits which are set as part of the Environmental Permit required for the site.

The upper limits for chemical contamination for other end use applications are, where agreed by the appropriate industry and the regulators, set out in Table 1.



²³⁾ WRAP (2005) Assessment of types of naturally occurring contaminants in virgin wood sources.

²⁴⁾ Third party laboratories may be accredited by UKAS, the United Kingdom Accreditation Service. See www.ukas.com/ for more information regarding UKAS.

Table 1 – Chemical contamination – upper limits

Main contaminants in treated wood	Upper limit for each end use (mg/kg dry matter)		
	Panelboard manufacture [Source: WPIF & EPF Standards]	Porous surface applications (excluding agriculture) [Source: PAS 100]	Non-porous surface applications
PTEs			
Arsenic (As)	25	–	–
Cadmium (Cd)	50	1.5	1.5
Chromium (Cr)	25	100	100
Copper (Cu)	40	200	200
Fluorine (F)	100	–	–
Chlorine (Cl)	1,000	–	–
Lead (Pb)	90	200	200
Mercury (Hg)	25	1.0	1.0
Nickel (Ni)	–	50	50
Zinc (Zn)	–	400	400
Compounds			
Heavy metal compounds (e.g. CCA) and halogenated organic compounds (e.g. Lindane)	4,000 combined	Trace	Trace
Creosote (Benzoapyrene)	0.5	Trace	Trace
Pentachlorophenol (PCP)	5	–	–

NOTE The test results for PTEs may vary with the method used. The upper limits for mercury for porous surface applications are based on the method of test set out in BS ISO 16772. The upper limits for the other listed PTEs for porous surface applications are based on the method of test set out in BS EN 13650.

6.3.4 Pathogens

Pathogens present in recycled wood can pose a risk to human and animal health. *Salmonella* spp. and *Escherichia coli* (E. coli) are commonly used indicator species for human and animal pathogens.

Sample biological testing for the presence of pathogens shall be carried out on recycled wood intended for animal bedding and porous surface applications only.

Where sample testing is to be carried out, it should be carried out by an independent third party laboratory. The method of test and the associated upper limits are set out in Table 2.

Table 2 – Biological testing – Test methods and upper limits

Parameter	Method of test	Unit	Upper limit
<i>Escherichia coli</i>	BS ISO 16649-2	CFU/g fresh mass	1,000
<i>Salmonella</i> spp	Schedule 2, Part II of BS EN ISO 6579	25 g fresh mass	Absent

6.3.5 Moisture content

Moisture is a natural constituent of recycled wood, but high levels of moisture can lead to rapid deterioration of the product and will serve to accelerate the growth of mould and pathogens.

Upon visual inspection of the output material there shall be no visible water on the surface and the batch shall not have a generally wet appearance.

The percentage by weight of moisture in test samples taken from any batch shall be determined in accordance with the methodology set out in Annex E.

NOTE The procedure described in Annex E is derived from PAS 104.

The moisture content of the sample shall not be more than 30% by wet weight.

6.4 Particle size range

Particle size range is an important measure of consistency for recovered waste wood since it often directly affects the performance of the material in the end use application. The range of particle size required will vary by end use and therefore this PAS does not set limits for this.

Given that the process will control the particle size range, the need for testing is limited.

Where required, however, the percentage by mass of particles within a given size range may be determined in accordance with the methodology set out in Annex D.

NOTE The procedure described in Annex D is derived from PAS 104.

The percentage of particles in the sample within the given size range shall be recorded.

6.5 Calorific value

The need for the testing for calorific value of recycled wood is limited to the biomass energy sector and is carried out by, or on behalf of, the end user.

6.6 Colour

For certain end users, the recycled wood may need to meet specific colour requirements. The colour of the test sample may be determined in accordance with the methodology set out in Annex G.

NOTE The procedure described in Annex G is derived from PAS 104.



Annex A (informative) Grades of recycled wood

Grade	Typical markets	Typical sources of raw material for recycling	Typical materials	Typical non – wood content prior to processing	Notes
Grade A “Clean” recycled wood	A feedstock for the manufacture of professional and consumer products such as animal bedding and horticultural mulches. May also be used as fuel for renewable energy generation in non-WID installations, and for the manufacture of pellets and briquettes.	Distribution. Retailing. Packaging. Secondary manufacture, e.g. joinery. Pallet reclamation.	Solid softwood and hardwood. Packaging waste, scrap pallets, packing cases, and cable drums. Process off-cuts from the manufacture of untreated products.	Nails and metal fixings. Minor amounts of paint, and surface coatings.	Some visible particles of coatings and light plastics will remain. Is a waste for the requirements of Waste Management Regulations. Does not require a WID installation. Should not contain lower grade material.
Grade B Industrial feedstock	A feedstock for industrial wood processing operations, such as the manufacture of panel products, including chipboard and medium density fibreboard.	As Grade A, plus construction and demolition operations transfer stations.	May contain up to 60% Grade A material as above, plus building and demolition materials and domestic furniture made from solid wood.	Nails and metal fixings. Some paints, plastics, glass, grit, coatings, binders and glues. Limits on treated or coated materials as defined by WID.	The Grade A content is not only costly and difficult to separate, it is essential to maintain the quality of feedstock for chipboard manufacture, and for PRN revenues. Some feedstock specifications contain a 5% to 10% limit on former panel products such as chipboard, MDF and plywood. Should not contain lower grade material. Is a waste for the requirements of Waste Management Regulations. May require a WID installation, unless the operator of the biomass energy plant can demonstrate to the Regulator adequate quality controls in the supply chain to ensure no Grade C material is included.
Grade C Fuel	Biomass fuel for use in the generation of electricity and/or heat in WID compliant installations.	All above, plus municipal collections, recycling centres transfer stations and civic amenity recycling sites.	All of the above plus fencing products, flat pack furniture made from board products and DIY materials. High content of panel products such as chipboard, MDF, plywood, OSB and fibreboard.	Nails and metal fixings. Paints coatings and glues, paper, plastics and rubber, glass, grit. Coated and treated timber (non CCA or creosote).	Suitable only For WID installations. Material coated and treated with preservatives as defined by WID may be included. Should not contain lower grade material. Is a waste for the requirements of Waste Management Regulations.
Grade D Hazardous waste	Requires disposal at facilities licensed to accept hazardous waste.	All of the above plus fencing, track work and transmission pole contractors.	Fencing, transmission poles, railway sleepers, cooling towers.	Copper / chrome / arsenic (CCA) preservation treatments and creosote.	Is a waste for the requirements of Waste Management Regulations. Requires disposal as a hazardous waste incinerator.

Source: Derived from Wood Recyclers' Association

NOTE 1 There will be some coated or treated wood in all grades, as it is impossible to identify or exclude every particle of such material.

NOTE 2 Waste regulatory requirements may further limit inputs for specific end-uses. Check with the regulator for the most up to date information.

Annex B (informative) Chemicals used in wood preservatives and their identification

Chemical	Preservative types	Possibilities of identification in a waste stream
Creosote	Derived from tar oil. Waste wood treated with creosote is likely to be classified as hazardous waste.	Distinctive odour, golden to dark brown colour.
Copper	<p>Present in chromated copper arsenate (CCA). Waste CCA-treated wood is likely to be classified as hazardous waste.</p> <p>Present in non-arsenical copper based preservatives such as chromated copper, chromated copper boron, chromated copper phosphate and copper-organic types. The waste classification of these types of treated wood depends on the concentration of component substances in treated wood.</p> <p>Present in copper naphthenate and acypetacs copper. Treated wood is a distinctive deep green colour.</p>	<p>Pale green or blue/green colour (these colours are imparted to treated wood by both copper and chromium compounds).</p> <p>Colour reagents are available to identify copper in treated wood but they do not distinguish CCA from other copper-containing types.</p>
Other inorganic chemicals	<p>Chromium: when present always occurs with copper.</p> <p>Boron: may be mixed with copper and chromium or is used alone when it is colourless.</p> <p>Phosphorus: when present is always mixed with copper and chromium.</p> <p>The waste classification of these types of treated wood depends on the concentration of component substances in treated wood.</p>	Chromated copper mixtures impart a pale green or blue/green colour.
Organic insecticides and fungicides	<p>Many different compounds used in treated wood. May be entirely organic or may be metallo-organic. Widely-used examples of the latter are organotin compounds typically tri-n-butyl tin oxide (TBTO) and acypetacs zinc. Formulated in VOC or water-diluted emulsions. Do not impart a colour to treated wood.</p> <p>The waste classification of these types of treated wood depends on the concentration of component substances in treated wood.</p>	Identification of individual substances requires laboratory facilities.

NOTE A dye (typically red, blue or yellow) is sometimes added to clear preservative treatments for commercial identification and marketing purposes. Such dyes are normally light fugitive but wood retaining a colour from dye could enter waste streams. Such colours are not useful for identification purposes.

Annex C (normative)

Preparation of test samples

C.1 Principle

A bulk sample is collected from the tipped load and then reduced to appropriately sized test samples.

C.2 Apparatus

C.2.1 *Shovel or trowel.*

C.2.2 *Balance(s)*, calibrated and accurate to within 0.1% of the initial or maximum test sample.

C.2.3 *Containers*, for collecting the increments of a sample, clean and non-absorbent, such as a plastic bucket.

C.2.4 *Containers*, clean and impervious, such as clear bags made of plastic at least 100 µm thick, for sending samples to laboratories.

C.3 Procedure

C.3.1 Collect a bulk sample of at least 3 kg from the tipped load using a suitable tool (**C.2.1**) and suitable containers (**C.2.3**), ensuring that the sample is representative of the load.

C.3.2 Determine the required testing sample weight, based on the test(s) to be conducted.

C.3.3 Place the bulk sample on a dry, clean non-absorbent surface where material will not be lost and foreign material will not be introduced.

C.3.4 Thoroughly mix the bulk sample.

C.3.5 Weigh out each test sample and place in a suitable container (**C.2.4**). Record the weight of the test samples. Label the test samples and the remainder of the bulk sample.

C.4 Labelling of samples

C.4.1 Store the retained portion of the bulk sample in suitable containers (**C.2.4**). Label with the date, sample number, load number and/or reference number from the delivery note.

C.4.2 Store and label test samples in suitable containers (**C.2.4**) with the date, load number and/or reference number from the delivery note, a description of the load, a unique test sample number, sample weight and name and signature of the sampler.

Annex D (informative)

Determination of particle size range

D.1 Principle

From a test sample, pieces smaller than the minimum permitted size are removed by sieving and pieces larger than the maximum permitted size are removed by hand sorting. The mass of the removed material is determined and the percentage of particles within the permitted range is expressed as a percentage by mass of the test sample.

D.2 Apparatus

D.2.1 *Drying oven*, ventilated, capable of being controlled at $(103 \pm 2) ^\circ\text{C}$.

D.2.2 *Balance(s)*, calibrated and accurate to 1 g.

D.2.3 *Test sieve*, perforated plate with square holes, conforming to BS 410-2, with an aperture size equal to the specified minimum permitted size, with a lid and receiver.

D.2.4 *Accessories for cleaning sieves*, such as brush, vacuum cleaner, air hose.

D.2.5 *Mechanical sieve shaker* (optional).

D.3 Procedure

D.3.1 Obtain a test sample of (500 ± 25) g in accordance with Annex C. Dry the test sample in an oven (**D.2.1**) at $(103 \pm 2) ^\circ\text{C}$ for not less than 16 h.

D.3.2 Weigh the dried test sample to the nearest 1 g (**D.2.2**). Record this mass as m .

D.3.3 Spread the test sample out on a clean, flat surface. Separate by hand any pieces larger than the specified maximum permitted size.

D.3.4 Weigh the separated material to the nearest 1 g and record the mass as m_1 .

D.3.5 Ensure the test sieve (**D.2.3**) is clean and dry.

D.3.6 Place the test sieve (**D.2.3**) on the receiver, add the test sample and cover with the lid.

D.3.7 Either by hand or using the mechanical sieve shaker (**D.2.5**), shake the sieve assembly for a sufficient time (see Note), using a vibratory or side-to-side motion, to separate out the material under the specified minimum permitted size.

NOTE Allow 10 minutes for mechanical sieving and up to 30 minutes for hand sieving.

D.3.8 Carefully open the assembly, avoiding spillage.

D.3.9 Weigh the material that passed through the sieve screen to the nearest 1 g. Record mass as m_2 .

D.4 Calculations

D.4.1 Calculate the percentage mass of oversize material (% m_1) using the formula:

$$\% m_1 = \left(\frac{m_1}{m} \right) 100$$

D.4.2 Calculate the percentage mass passing through the screen (% m_2) using the formula:

$$\% m_2 = \left(\frac{m_2}{m} \right) 100$$

D.4.3 Calculate the percentage mass of particles within the permitted size range as:

$$100\% - \% m_1 - \% m_2$$

Annex E (normative)

Determination of moisture content

E.1 Principle

Determination, by weighing, of the loss of mass of a test sample between its state at the time of sampling and its state after drying to constant mass, and calculation of this loss of mass as a percentage of the mass of the test sample before drying.

E.2 Apparatus

E.2.1 *Balance*, scale interval 0.1 g.

E.2.2 *Drying oven*, ventilated, capable of being controlled at $(103 \pm 2) ^\circ\text{C}$.

E.3 Procedure

E.3.1 Take a (100 ± 5) g test sample in accordance with Annex C.

E.3.2 Weigh the test sample in the as sampled state to an accuracy of 0.1 g. Carry out this initial weighing immediately after sampling or, where this is impossible, take precautions to avoid changes in the moisture content of the test sample after sampling.

E.3.3 Place the test sample in the drying oven (E.2.2) at a temperature of $(103 \pm 2) ^\circ\text{C}$ for not less than 16 hours.

E.3.4 After the test sample has been cooled to approximately room temperature, weigh the test sample to an accuracy of 0.1 g, rapidly enough to avoid an increase in moisture content greater than 0.1%.

E.4 Expression of results

Calculate the moisture content H of each test sample, as being the percentage of total moisture in the sample to the total wet mass of the sample, to the nearest 0.1%, in accordance with the following formula:

$$H = \left(\frac{m_H - m_0}{m_H} \right) \times 100$$

where

m_H is the initial mass of the test sample, in grams;

m_0 is the mass of the test sample after drying, in grams.

Annex F (normative)

Determination of physical contamination levels

F.1 Principle

A test sample of a load is hand sorted into its constituent types of particles. The mass of each of these types of particles is determined and expressed as a mass fraction of the test sample.

F.2 Apparatus

F.2.1 *Ventilated oven*, thermostatically controlled to maintain a temperature of $(40 \pm 5) ^\circ\text{C}$.

F.2.2 *Balance*, calibrated, and accurate to 1 g.

F.2.3 *Horseshoe magnet* (or equivalent), with lift strength of at least 100 g.

F.2.4 Sampling and preparation of test portions

F.2.5 Obtain a test sample of (1 ± 0.1) kg in accordance with Annex C.

F.2.6 Dry the test sample to constant mass at a temperature of $(40 \pm 5) ^\circ\text{C}$ (F.2.1).

NOTE *Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1% of the mass of the test pieces.*

F.3 Procedure

F.3.1 Weigh and record the mass of the test sample as W_{total}

F.3.2 Spread the particles of the test sample onto a flat surface and separate by hand into the following types of particles:

- wood chips;
- inorganic contaminants (e.g. bricks, stones, ceramics and glass);
- non-wood organic contaminants (e.g. plastics, textiles, rubber and paper);
- ferrous metals;
- non-ferrous metals;
- treated wood.

NOTE *Upon a visual inspection only the most obvious of treated timbers will be found.*

Identify and separate any particles of contaminants from the above list that are greater than 1 mm in size in any dimension. Such contaminants will cause the batch to be rejected.

Where no such particles exist, proceed to step F.3.3.

F.3.3 In order to separate the ferrous metals, hold a clean sheet of paper between a magnet and the sample.

Pass the magnet slowly over the test sample. Hold the paper and magnet above a weighing container, then lift the magnet from the paper, transferring the magnetic materials into the container. Continue this process until all the sample has been exposed to the covered magnet. Non-magnetic ferrous metals, such as stainless steel, should be searched for visually and removed by hand.

F.3.4 Weigh the separated pile of each type of particle listed in F.3.2 less than 1 mm in size and record the result, $W_{\text{subscript}}$, where the subscript is one of the contaminants, i.e., inorganic, non-wood organic, ferrous, non-ferrous or treated wood material.

F.3.5 Calculate the mass fraction expressed as a percentage by mass of each group of contaminant particles from the equation:

$$\% W_{\text{subscript}} = \left(\frac{W_{\text{subscript}}}{W_{\text{total}}} \right) \times 100$$

where the subscript is as specified in F.3.4.

F.4 Expression of results

Record the test result for each type of particle less than 1 mm in size. The total contamination level of the sample, $\%W$, is the sum of these values.

Annex G (informative)

Determination of acceptability of colour of load

G.1 Principle

A clear plastic bag containing a reference sample is compared visually, in natural daylight, to a clear plastic bag containing a test sample.

G.2 Apparatus

G.2.1 *Clear plastic bags*, made of plastic at least 100 µm thick, large enough to hold (1 ± 0.1) kg of wood chip.

G.3 Procedure

G.3.1 Take a (1 ± 0.1) kg test sample in accordance with Annex C and place it in a plastic bag (G.2.1).

G.3.2 Place a (1 ± 0.1) kg reference sample in a plastic bag (G.2.1).

NOTE *The reference sample is a sample that has been agreed between the reprocessor and the panelboard manufacturer as being representative of the main source of post-consumer wood.*

G.3.3 Place the bags next to each other. View them under natural daylight. Visually compare the colours of the samples.

G.3.4 The test sample is deemed unacceptable if it is noticeably darker in colour than the reference sample.

G.4 Expression of result

The result of the test is expressed as “accept” or “reject” as determined in G.3.4.

G.5 Test report

The test report shall include the following information:

- a) identification of the sample;
- b) date of testing;
- c) persons present during sampling;
- d) result of testing (G.3.4).

Annex H (informative)

Determination of grit content

H.1 Principle

The mass of incombustible, acid-insoluble residue, remaining after ignition of the test specimen, is measured.

H.2 Reagents

H.2.1 *Hydrochloric acid solution*, one part concentrated hydrochloric acid to one part distilled water, by volume.

H.2.2 *Distilled water*.

H.3 Apparatus

H.3.1 *Ventilated oven*, thermostatically controlled to maintain a temperature of $(40 \pm 5) ^\circ\text{C}$.

H.3.2 *General*, where the accuracy of the apparatus is specified, the apparatus shall be calibrated at least annually.

H.3.3 *Flat bottomed stainless steel pan*, approximately 1 litre.

H.3.4 *Gas ring*.

H.3.5 *Furnace*, capable of maintaining a temperature of $(800 \pm 50) ^\circ\text{C}$.

H.3.6 *Balance*, capable of determining mass to the nearest 0.01 g.

H.3.7 *Ceramic crucible*, capacity approximately 50 ml.

H.3.8 *Glass beaker*, capacity 250 ml.

H.3.9 *Air circulating oven*, capable of maintaining an internal temperature of $(103 \pm 2) ^\circ\text{C}$.

H.4 Test specimen

H.4.1 Obtain a test sample of (100 ± 5) g in accordance with Annex C.

H.4.2 Dry the test sample to constant mass at a temperature of $(40 \pm 5) ^\circ\text{C}$ (**H.3.1**).

NOTE *Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1% of the mass of the test pieces.*

H.5 Procedure

H.5.1 Weigh and record the mass of the test sample to the nearest 0.01 g (**H.3.6**).

H.5.2 Place the test specimen in the pan (**H.3.3**) over the lighted gas ring (**H.3.4**) and continue heating until the wood chips are reduced to ash.

H.5.3 Transfer the ash residue to the crucible (**H.3.7**). Place the crucible containing the ash in the furnace (**H.3.5**) for approximately 1 h until the sample is free from carbon.

H.5.4 Cover with 75 ml of the hydrochloric acid solution (**H.2.1**). Boil gently for 2 min. Allow to cool. Add 75 ml of distilled water and then decant as much water as possible without the loss of solid residue.

WARNING Hydrochloric acid is corrosive. Suitable skin and eye protection should be worn when carrying out this procedure.

H.5.5 Dry the residue in the oven (**H.3.9**) and determine the mass to the nearest 0.01 g.

H.6 Calculation and expression of results

The grit content of the test sample G , expressed as a percentage by mass, shall be calculated from the following equation:

$$G = \left(\frac{m_o}{m_i} \right) \times 100$$

where

m_i is the mass of the dried wood chips before ignition, (in g);

m_o is the mass of the residue after drying, (in g).

The result shall be expressed to the nearest 0.01%.

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