

WOOD INFORMATION GUIDE



Version 3.3



CONTENTS

Welcome to the Accoya® Wood Information Guide which has been compiled to provide detailed information and recommendations for the handling and use of Accoya® wood.

This guide has been written for professionals wishing to use Accoya® wood to create beautiful, reliable and highly durable end products. Should you require further information or have any comments about this guide, please contact us.

This is version 3.3 of the Accoya® Wood Information Guide, to confirm currency and check for other potentially useful information please check the download section of accoya.com

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01 ACCOYA® WOOD PROPERTIES

Accoya® wood has been produced commercially since 2007 and used extensively around the world on a range of exterior applications. It represents a major development in wood technology that has made the consistent supply of durable, dimensionally stable and reliable wood a reality.

Accoya® wood's performance credentials have been extensively researched and repeatedly demonstrated. Accoya® has properties that exceed those of the world's best woods yet it is manufactured by modifying wood sourced from well-managed sustainable forests without the introduction of toxins.

KEY FEATURES



DIMENSIONALLY STABLE



OUTSTANDING DURABILITY



PERFECT FOR COATING

Accoya® wood is produced from sustainably sourced, fast growing wood and manufactured using Accsys' proprietary patented modification process from surface to core.



BAREFOOT FRIENDLY



NATURALLY INSULATING



EXCELLENT MACHINABILITY



INSECT BARRIER



CONSISTANT QUALITY THROUGHOUT



NATURALLY BEAUTIFUL WOOD



FROM SUSTAINABLE SOURCES



RETAINED STRENGTH & HARDNESS



NON-TOXIC & RECYCLABLE

APPEARANCE

Accoya® is supplied as rough sawn and planed wood in various sizes and grades. Finger jointed and glue laminated beams can be produced to meet larger needs. A data sheet with available dimensions is available through the download section of accoya.com.

TECHNICAL DATA

This table shows the average properties of Accoya® wood made from Radiata Pine and has been compiled using data extracted from official test reports, copies of which are available upon request. For information on a wider range of testing and property information please see the performance brochure, available through the download section of accoya.com.

PROPERTY	TEST METHOD	VALUE
Durability	EN 84, EN 113, ENV 807 and EN 252	Class 1
Density	65% RH, 20°C	512 ± 80 kg/m ³
Shrinkage (avg) Wet to 65% RH, 20°C	Radial	0.4%
	Tangential	0.8%
Wet to Oven Dry	Radial	0.7%
	Tangential	1.5%
Equilibrium Moisture Content	65% RH, 20°C	3 - 5%
Thermal conductivity	EN 12667	0.12 W/m K
E-Modulus*	EN 408	8,800 N/mm ²
Bending strength*	EN 408	40 N/mm ²
Janka Hardness	ASTM D143	Side 4,100 N
		End 6,600 N

* These are average values from EN 408 testing (full size beams); when assessed according to EN 384, Accoya® for non-structural use can be considered equivalent to strength class C16. Please see the structural guide for detailed information on the structural use of Accoya® (available through the download section of www.accoya.com).

ACETYLATION & DURABILITY

Accoya® wood is modified uniformly through the cross section, not just at the surface. Modification quality of each batch produced is validated by a range of sophisticated and proven tests that take place in Accsys Technologies' laboratories. This quality control approach is independently audited by organizations from USA, France and the Netherlands. All audits involve factory visits and destructive testing by the certification body. Thus consistent quality and performance in accordance with set standards is assured. Accoya® wood always meets the requirements of Durability Class 1 for Use Classes 1-4 in accordance with EN 350-1 & EN 335-1.

Accoya® has been proven in multiple tests against various fungal, termite and insect species in multiple regions to have improved performance.

Accoya® wood is resistant to salt and can be used around saltwater (for instance as marina decking). Permanent emersion of Accoya® in salt and brackish water (i.e. pilings) is not recommended since the acetylation treatment is not warranted for resistance against marine borers and other marine organisms. However, Accoya® has been tested in the waters of Northern Europe for more than 7 years and a 10 year service life position has now been established for that region. Testing in other regions is underway.

CLASSIFICATION OF THE NATURAL WOOD DURABILITY TO WOOD-DESTROYING FUNGI

Accoya® wood is guaranteed for 50 years above ground, 25 years in ground contact and freshwater immersion. A copy of the warranty is available for download at accoya.com.

DURABILITY CLASS	DESCRIPTION
1	Very Durable
2	Durable
3	Moderately Durable
4	Slightly Durable
5	Not Durable

	USE CLASS	CONDITIONS OF USE	WETTING	WOOD MOISTURE CONTENT
ACCOYA® APPROVED	1	No contact with the ground, sheltered and dry	Permanently dry	Permanently dry < 20%
	2	No contact with the ground, sheltered with little chance of becoming wet	Occasionally exposed to moisture	Incidental, short-term exposure >20%
	3	No contact with the ground, not sheltered in all weather conditions	Regularly exposed to moisture	Regular, short-term exposure >20%
	4	In contact with the ground	Permanently exposed or fresh water	Permanent exposure >20% to water
	5	In contact with salt or salt water splash zones ¹	Permanently exposed brackish water	Permanent exposure >20% to salt water

¹ Accoya® is approved for use in salt water splash zones, for instance Marina decking

DETAILED ACETYLATION INFORMATION

The Accoya® general brochure and website, accoya.com, provide a detailed description of the acetylation process and the properties of Accoya® wood. In addition, official test reports may be obtained upon request.

HEALTH AND SAFETY CONSIDERATIONS

Health and safety tests have been successfully performed against a wide range of standards in multiple regions. Details of tests performed are listed in section 12. The Accoya® Material Safety Data Sheet (MSDS) is available through the download section of accoya.com.

STRUCTURAL APPLICATIONS

The effects on strength characteristics of wood by the Accoya® process are minimal. The values reflected in the Technical Data table on the previous page are averages for Accoya® made of appearance grade wood. Accoya® is not graded for structural purposes.

Accoya® wood available in structural grades (Accoya® Structural) has much higher ratings and is recommended for any actual structural application. More information on Accoya® for structural applications can be found in the Structural Design Guide, available through the download section of accoya.com.

RESIDUAL ACETIC ACID

Accoya® contains a small amount of residual acetic acid from the acetylation process. Since acetic acid can create compatibility issues with coatings, glues, sealants and fixtures, this content is measured as part of the Quality Control procedures of Accoya® wood and within our KOMO® approved Quality System. Individual batches are only released for sale if the residual acetic acid level is within specification:

- Average residual acetyl compounds content of samples $\leq 1.0\%$ (mass / mass oven dry wood)
- Maximum residual acetyl compounds content of individual samples $\leq 1.8\%$

Although levels are controlled, freshly cut Accoya® will have a slight vinegar smell.

DESIGN AND ALLOWANCE FOR EXPANSION

Accoya® wood is extremely dimensionally stable but this does not mean it is completely inert. Changes in humidity can cause slight changes in its dimensions and these should be taken into account for product design and installation. In extreme conditions (and for the purposes of Accoya®'s warranty) the tolerances noted below should be allowed. Installation guides that cover dimensional stability considerations for normal wood products should be more than sufficient for Accoya® wood. In addition to that, cladding and decking guidelines are available through the download section of accoya.com. For more specific information on dimensional stability values and distortion risk, please contact Accsys through the website.

SPECIES	AVERAGE RADIAL	AVERAGE TANGENTIAL	WARRANTY MAXIMUM ³
Douglas Fir ¹	4.8%	7.6%	-
Teak ¹	2.5%	5.8%	-
Meranti ¹	3.0%	6.6%	-
Merbau ¹	2.7%	4.6%	-
Sapele ¹	4.6%	7.4%	-
Radiata Pine ²	3.4%	7.9%	-
Accoya® (Radiata Pine) ²	0.7%	1.5%	2.5%

DIMENSIONAL STABILITY COMPARISON

¹ Wood Handbook, USDA Forest Products Laboratory. Green to Oven Dry measurements

² Dimensional stability of Accoya® wood under different moisture conditions, SHR Report 6.322

³ Accoya® wood - Certificate of Warranty

EXPANSION/ CONTRACTION ACROSS TYPICAL DECKING OR CLADDING

5 1/8" or 130 mm actual width

Although Accoya® wood's enhanced dimensional stability often allows for greater sizes than previously possible (for example, greater widths on cladding without excessive cupping), the amount of tolerance should still be adjusted proportionally with size.

SPECIES	AVG. QUARTER SAWN (INCH/MM)	AVG. PLAIN SAWN (INCH/MM)	WARRANTY MAXIMUM (INCH/MM)
Douglas Fir	0.26 / 6.7	0.42 / 10.6	-
Teak	0.14 / 3.5	0.32 / 8.1	-
Meranti	0.17 / 4.2	0.36 / 9.2	-
Merbau	0.15 / 3.8	0.25 / 6.4	-
Sapele	0.25 / 6.4	0.41 / 10.4	-
Radiata Pine	0.18 / 4.8	0.43 / 11.1	-
Accoya® (Radiata Pine)	0.04 / 1.0	0.08 / 2.1	0.14 / 3.5

02 TRANSPORTATION AND STORAGE

ACCOYA® WOOD PACKAGES

All Accoya® wood undergoes inspection before leaving the plant. Accoya® wood is strapped with banding straps into standard labelled packages, each with a unique number. The packages are covered with paper wrapping for dust protection - the wrapping is not water resistant. Accsys Technologies supplies Accoya® wood in rough sawn dimensions in dry condition and ready for use (wood moisture content <5% on average).

TRANSPORTATION

Accsys Technologies ships Ex Works under “Incoterms 2000” (as compiled by the International Chamber of Commerce in Paris - ICC) or to otherwise agreed handling terms for delivery in accordance with the accepted orders. The recipient at the delivery address must ensure that Accoya® wood packages are unloaded carefully, preferably using a forklift truck or another device with pallet jacks.

STORAGE

Accoya® wood that needs further processing, gluing or coating should be carefully stored (preferably horizontally), in closed and well ventilated sheds to prevent water/moisture uptake. Please see section 03 for more details on determining whether Accoya® has absorbed excess water and for drying considerations.

STORAGE OF MACHINED PARTS

Accoya® wood can be manufactured into parts, even with long intervals before assembly. Unlike many wood species, changes in size and shape of parts due to dimensional stability issues are minimal and thus it is typically possible to pre-manufacture days worth of assembly versus having to keep tight schedules between time of machining and assembly. Direct exposure to water and changing climate (temperature and relative humidity) should still be avoided. Note that all freshly machined surfaces have the best surface energy and give best coating and bonding results.

STORAGE & TRANSPORT

In order to prevent damage products made of Accoya® should be carefully transported. Protection of joints is especially important. To prevent water uptake during transport, storage and at the building site, it is strongly recommended that Accoya® is covered in a breathable barrier / “vapour-open” plastic.

As with other wood species, storage at the building site should be a minimum of 10 cm above concrete flooring and 30 cm above (unpaved) ground. Additional protection from rain with plastic sheets is strongly recommended but sufficient ventilation underneath the sheets is required to prevent surface moulds.

TRACEABILITY

Accoya® wood is primarily identified by its packaging labels, which feature the Accoya® wood and Accsys Technologies logos. In case of doubt, we will verify the product’s authenticity. In addition, Accoya® wood can generally be traced by its packaging number. It is therefore imperative to retain all relevant documents and to record the movements of each package through to the manufacture of the products.

This tracking is also needed if you intend to offer products with sustainable wood certifications. The packaging number is to be quoted in the case of any queries, complaints or warranty claims. Accoya® wood can be ordered as a certified sustainable wood, such as with FSC®.

INFORMATION TRANSFER

It may be important to inform the principal and third parties doing installation that Accoya® has been used in the production of your product. Portions of this guide such as proper storage at the building site, appropriate fasteners and fixtures to use for final installation and related considerations should be communicated.

03 WOOD MOISTURE CONTENT

INTRODUCTION

Wood releases moisture in dry climates and absorbs moisture in humid conditions. The moisture within wood takes two forms: "free water", which is contained in the cell cavities (or lumen), and "bound water", which is contained in the cell wall matrix.

While Accoya® wood in any conditions will have minimal bound water, which is what accounts for many of its superior properties, it can still contain free water. Final product quality can be harmed by excessive free water; it is therefore essential that the moisture content of the wood is determined prior to further processing such as gluing and coating.

DEFINITION

Wood moisture content, as expressed in this guide, is the mass of the water contained in wood, expressed as a percentage of the mass of absolutely dry wood.

WOOD MOISTURE CONTENT

We supply Accoya® wood in dry condition (wood moisture content <5% on average). This allows Accoya® wood to be processed into products for both interior and exterior applications directly after being delivered.

MEASURING FOR EXCESS WATER

The typical wood moisture content of Accoya® wood cannot be measured accurately with standard moisture meters prior to processing because its moisture content is below the measuring range. However, standard moisture meters may be used to determine whether Accoya® wood has an excess of "free water".

For pin-type (electric) moisture meters an Accoya® setting is not available. For indicative measurements either Radiata Pine or another Pine setting may be chosen. For capacitive meters a density setting of around 510 kg/m³ should be used. A measurement showing a moisture content of 8% or more may indicate the presence of "free water" and the wood should be allowed to dry before processing, gluing or coating.

WATER ABSORPTION PROPERTIES

End grain water absorption of Accoya is particularly high. Liquid water absorption can be deep and it takes longer to dry out than most species. Measurements for possible excess water should therefore be to the core of boards. Extra care should be taken in storage and effectively sealing end grain of coated wood, which is discussed further in section 09 on coatings.

04 PROCESSING

GENERAL

Processing of Accoya® wood does not affect its unique properties, such as durability and dimensional stability, as the wood is modified throughout the cross section and these properties are not leachable.

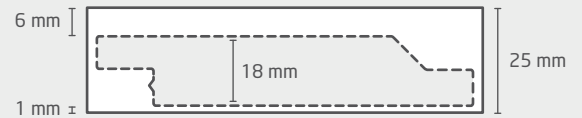
Accoya® is easy to process and can be compared, in general, to a harder softwood species. Exceptions are noted below. Special tools are not required, for example, to do cross cutting, ripping, planing, routing or drilling. Sanding before finishing is often not required, due to the particularly smooth surfaces of Accoya® after machining and subsequent resistance to grain raising from moisture pick up.

It should be noted that a light vinegar smell may become apparent when Accoya® wood is processed. With proper suction / ventilation this can be reduced to a minimum. Health and safety tests have been successfully performed against a wide range of standards in many regions and have shown no issues.

As with other wood species with higher acid levels, caution should be taken to prevent long term exposure of wood machinery and exhaust systems to high moisture levels combined with dust and shavings to prevent corrosion. Prior to machining the wood, moisture content should be checked (section 03). A moisture content reading showing <8% indicates suitability for processing.

VISUAL QUALITY

Accoya® wood is a high performance, all-natural solid wood and as such offers the beauty, versatility and charm of the original wood species. Accoya® is available in a range of different qualities. Consistent with the grade purchased, the timber may show certain visual defects after being processed, such as distortion, internal cracks, bark and resin pockets. For more information on grade names and definitions for Accoya® Radiata Pine, please see the Lumber Grading Specifications, available through the download section of accoya.com.



DISCOLORATION

The acetylation process can result in discoloration generally up to 5 mm in depth with sticker marks up to 6 mm in depth, and due to natural wood variation, occasionally deeper. Removal of surface discoloration is not typically required when using opaque coatings or for parts that will not be visible. As an example the drawing above shows a 18 mm thick cladding board produced from 25 mm Accoya® by setting the bottom knife to remove 1 mm from the back side and 6 mm (plus any over thickness) from the top side.

CHANGED PROPERTIES

Due to the acetylation process, a number of wood properties have been altered that are of importance for proper machining of Accoya® wood:

- The Janka hardness increases from the original wood used to produce Accoya®. Please see section 01 for ratings. As a rough guide, Accoya® wood is more comparable in machining to species like Hard Maple, American Cherry or American Walnut.
- Density has increased (avg. 512 kg/m³). Processing characteristics are equivalent to working with denser softwoods (for example Southern Yellow Pine).
- Since the moisture content of Accoya® is below 5% on average, this can make the material a little more brittle.
- Internal stress within the wood is reduced by the process. This eases the process of 'working' the timber compared to untreated Radiata Pine.

COLLECTION SYSTEMS

As Accoya® wood shavings are often finer than those of other woods, the dust collection system should have enough capacity to prevent shavings being thrown onto the material by the knives. If this happens an impression of the chip may show in the finished product. Impressions may not disappear even when dampened.

GENERAL PROCESSING ADVICE

To achieve best results:

- When planing Accoya® ensure that knives are aligned correctly and are sharp.
- Every flaw or dent in the knives may leave a permanent mark on the wood. If working with multiple species and knives that are rapidly dulled, it is advised to machine Accoya® first before the other species.
- Due to the smooth surface all cutter marks may show through the coating. Special care is needed and feed speeds should be adjusted accordingly.
- When moulding Accoya® feed speeds should be comparable to machining hardwoods.
- For optimal quality a feed speed of 500 linear meters per hour and spindle rotation velocity of 12000 rpm typically gives a very smooth result. In a typical production environment, a feeding speed of 1000 linear meters/hour and spindle speeds of 6000 rpm can be used.
- When you are machining Accoya® for the first time it is best to produce some test runs to see what the best parameters are. The in-feed rollers can be aluminium but the out feed rollers of equipment should preferably be rubber to prevent surface damage. The complete working table must be cleaned and aligned and the tables should not show any wearing of the steel to ensure the precise machining appropriate for Accoya®.
- Deep milling, rip-sawing or re-sawing Accoya® can reveal stresses created during drying and processing similar to what can occur when milling other wood species. Distortion (warp) and surface check limits of boards only apply to their state as received. Standard practice of selecting pieces with straight uniform grain for critical applications also applies to Accoya®.

SAWING, PLANING AND PROFILING

Accoya® is easy to cut in any direction. Skilful sawing will give a smooth appearance with very few flaws. Standard techniques such as using back boards can be used when very fine results are desired.

Accoya® is easily planed to a very smooth surface finish. Special tools are not required. It is important to avoid machining marks during processing and to avoid contact with products that will discolour the surface, such as oil or rust, particularly if the wood is to be coated or glued, as this can affect appearance and compatibility.

Accoya® has a low wood moisture content and shavings are fine and may become electrostatically loaded due to friction caused from machining. This can lead to impressions of shavings if the exhaust system has too low capacity and/or a large section of the wood is profiled in one run. Solutions include increasing the blade rotation velocity (rpm), improving the exhaust system, using anti-friction lubricants or otherwise reducing static energy at the rotary blades. It needs to be noted that not all anti-friction lubricants can be used when the wood needs to be finished due to incompatibility (for instance teflon spray). Please consult your supplier of the lubricant for compatibility.

Despite Accoya®'s improved properties, boards may harbour tension and flaws internally, similar to other comparable wood species. These typical wood guidelines also apply to Accoya®:

- Similar to other wood species, re-sawing, ripping or heavily planing Accoya® boards can reveal stresses created during drying and processing. The creation of thinner boards is not recommended if avoiding distortion is important.
- Checks can appear, especially after heavily planing or re-sawing.
- Although the Accoya® process relieves a lot of the stresses that can cause distortion, normal selection processes still apply for reducing the chances of change beyond acceptable limits. Thus, for critical parts wood with pronounced slope of grain, irregular growth rings and similar issues should be avoided or used in more tolerant areas.

DRILLING

Accoya® wood drills in a manner and quality consistent with most softwoods. For deep drilling, care may be needed to remove debris, given the fine smaller shavings that are produced by Accoya®. For dowel connections it is important that the diameter of the drill is no smaller than the diameter of the plug to prevent splitting.

SANDING

Sanding Accoya® wood presents no challenges. Tests have shown that it is often not necessary to sand Accoya® wood between coats of water based coatings since fibres scarcely 'bloom' or rough the surface after moisture absorbance.

FASTENERS & FIXINGS

Accoya® wood can be fixed in the same way as other commonly used softwood species and the same general rules regarding pre-drilling, countersinking and keeping sufficient distance from the edges should be applied. Like most durable woods, Accoya® contains a small amount of acid. It is therefore strongly recommended that corrosion-resistant fixings, such as high quality stainless steel, are used. For further information on stainless steel and other metal option, please refer to section 06.

WASTE WOOD & END OF LIFE CONSIDERATIONS

Accoya® wood waste can be handled in the same way as untreated wood. Accoya® wood is non-toxic and does not require any special disposal considerations. Given its long life, multiple applications and non-toxicity, Accoya® wood is suited for re-use and recycling.

In the end-of-life phase, we recommend the adoption of the "preferential sequence for waste management". This model largely follows the guidelines of the popular Cradle to CradleSM (C2C) philosophy developed by William McDonough and Michael Braungart to close biological and technological cycles as far as possible and re-use materials. The model consists of the following possible waste management scenarios in which prevention is the most desirable option and dumping is the least.

- Avoiding waste
- Designing products that integrate waste avoidance and re-use at the end of their life
- Re-use of the product
- Re-use of the material
- Use for energy production (incineration)
- Burning
- Dumping

We recommend integrating Accoya® wood's performance into the overall design strategy of a product and apply an appropriate maintenance interval for Accoya® wood for the intended application and service life requirements. Further we recommended to design in such manner that product or material re-use is warranted as the service life of Accoya® wood might be exceeding the (economical) service life of the product.

IF THIS IS NOT POSSIBLE, WE RECOMMEND THAT ACCOYA® WOOD IS USED FOR ENERGY PRODUCTION THROUGH INCINERATION. THE RENOWNED GERMAN WOOD RESEARCH INSTITUTE WILHELM-KLAUDITZ-ISTITUT (WKI) HAS CONFIRMED THAT ACCOYA® WOOD MAY BE INCINERATED FOR ENERGY PRODUCTION IN THE SAME MANNER AS UNTREATED WOOD.

The last resort should be composting where Accoya® wood can be handled in the same way as untreated wood. Please bear in mind that the decomposition process will be longer than for untreated wood because of Accoya® wood's resistance to fungal decay.

Use of shavings as animal bedding is not recommended due to the small amount of odour.

05 GLUING

GENERAL

As with all wood species, the optimal glue choice will depend on the application and the required performance of the glue bond. Accoya® wood has been tested with various types of adhesives for many applications. In general Accoya® can be glued using most commonly used wood adhesive systems. Particularly good results are obtained with polyurethane (PU), emulsion polymer isocyanate (EPI), epoxy and phenol resorcinol formaldehyde (PRF) adhesives. The results of gluing with polyvinyl acetate (PVAc) and melamine urea formaldehyde (MUF) can vary greatly.

When gluing Accoya® it is strongly recommended to test first and if needed contact your adhesive supplier(s) as they have in-depth knowledge of the gluing process and their adhesives. The System Partner leaflets, available through the download section of accoya.com, list adhesive manufacturers with experience of bonding Accoya®.

CHANGED PROPERTIES

Comprehensive testing has shown that Accoya® wood has good gluing properties. However, it is imperative that the product's modified properties are taken into account. This is of particular importance because common wood adhesives (PVAc, EPI, PU, PRF) either harden on contact with moisture or part of the water content of the adhesive needs to be absorbed by the wood.

The acetylation process substantially reduces the ability of the wood to swell. This can impact properties such as the ability of joints to 'self-clamp'. Another effect is that the equilibrium moisture content of Accoya® wood is substantially lower than untreated wood in the same climatic conditions. While this makes Accoya® wood dimensionally very stable, it can mean that absorption properties of the adhesive into the Accoya® wood are

different due to the hydrophobic nature of the wood surface, especially during the first few minutes after the adhesive is applied to the surface of Accoya wood. Adhesives that require water as a catalyst and those consisting of two or more components that could migrate differently may have weaker bonds.

For further information about the moisture content of Accoya® wood, please refer to section 03.

The aspects that require extra attention for the effective gluing of Accoya® wood are detailed hereafter. The presence of a low amount of acetic acid in Accoya® wood, as with many other durable woods, can affect the adhesive, especially acid catalysed adhesives and adhesives with a large amount of alkaline additives.

OPTIMIZING THE ADHESION PROCESS

It is highly recommended that you consult your adhesive supplier in order to obtain the best results for gluing Accoya® wood. Points to consider include:

- The quantity of adhesive to be applied should, if possible, be even on both sides in accordance with the adhesive manufacturer's instructions.
- Possibly a longer "open-closed" time, which gives Accoya® wood more time to absorb the water portion in the adhesive.
- The applied pressure during gluing should be adapted to the strength of Accoya® wood, as should the temperature if heat is applied. Accoya® should be treated as moderately hard softwood in this context.
- The curing time and the best curing conditions.

JOINTS

It is strongly advised that any end-grain that will be exposed be sealed using a suitable product as recommended by the supplier. This is particularly critical for joinery. For a long lasting result, we emphasize the importance of a proper frame corner joint. Despite the improved durability and dimensional stability of Accoya® wood, it is still important to make the frame corner joint connection watertight to avoid possible paint problems and other damage.

Dowels, biscuits and similar devices, if not made from Accoya® wood, may swell (much) more than Accoya®. For dowel connections it is important that the diameter of the drill is exactly the same as the diameter of the plug. This is to prevent splitting of the ends.

FINGER JOINTING

Good results have been achieved with EPI, PRF and PU. Special care is required in producing the fingers. Sharp, damage free knives need to be used to ensure high quality fingers as blunt knives can result in "broken" fingers.

Due to the short-term hydrophobicity of the Accoya® wood surface it might be necessary to increase pressing time and curing time. Press pressures should be adjusted to softwoods or to the specific settings recommended by the adhesive supplier.

LAMINATING

Good results can be achieved with PU (both 1 and 2 component types), PRF and EPI. It is important to work on a flat surface and not apply too much pressure because Accoya® wood is smoother and may expel adhesives from the gluing surface. Adhesive may also require more time to penetrate the tangential surface of the Accoya® wood.

For load bearing applications, in case of using Accoya® Structural, applicable local regulations should be followed. The same goes for non-structural private label certification such as the Dutch KOMO®.

Due to the high dimensional stability of Accoya® wood, the annual ring orientation and the amount of layers is of less importance. For instance vertical lamination (edge gluing) to 100 x 150 mm has been proven possible with two unevenly distributed lamella (2:3 configuration).

FURTHER INFORMATION

Further information may be obtained directly from adhesive suppliers. For a list of system suppliers in your region, please refer to the download section of accoya.com.

06 CONTACT WITH METALS

GENERAL

All wood contains organic acids, although the quantity varies by species. These organic acids contribute to the corrosion of metal fasteners used in wood. Accoya® wood has comparable acid levels to many other durable species such as oak and western red cedar.

Tests have shown that base metals and galvanized metals that are in direct or indirect contact with wood containing acids will corrode in damp climatic conditions. It is therefore strongly recommended that high quality stainless steel, corrosion resistant aluminium or naval brass products be used in areas exposed to moisture or condensation. When stainless steel, corrosion resistant aluminium or naval brass is not available it is important to take precautions using lesser grade metals. The metal and/or the Accoya® wood should be coated or otherwise separated to avoid direct contact between the wood and these metals.

Indirect contact issues can occur in non-ventilated high humidity areas with a high risk of condensation (for example lock rebates, bathrooms). High quality hardware and/or corrosion avoiding techniques described further on in this section should be considered for these areas. As with any installation, pit or galvanic corrosion must also be avoided by using fasteners that are compatible with the metals used in hinges, locks and other hardware.

Please consult your fixings supplier to avoid any issues. For a list of system suppliers in your region, please refer to the download section of accoya.com.

STAINLESS STEEL

The use of corrosion-resistant steel fasteners and fixtures that conform to EN 10088-1 is recommended, such as widely used A2 or A4 quality stainless steel. An international comparison of grade specifications is provided below:

These comparisons are approximate only. The list is intended as an example of commonly available highly corrosion resistant stainless steel fasteners known to work well with Accoya®. Many other grades of stainless steel exist, of which many are also highly corrosion resistant, but it is best to work with your supplier to understand the compatibility of these other grades with Accoya® wood.

USA	UNS NO	OLD BRITISH		EURONORM		ISO 3506	SWEDISH	JAPANESE
		BS	En	No	Name		SS	JIS
304	S30400	304S31	58E	1.4301	X ₂ CrNi 18-10	A2	2332	SUS 304
304L	S30403	304S11	-	1.4306	X ₂ CrNi 19-11	-	2352	SUS 304L
316	S31600	316S31	58H, 58J	1.4401	X ₂ CrNiMo 17-12-2	A4	2347	SUS 316
316L	S31603	316S11	-	1.4404	X ₂ CrNiMo 17-12-2	-	2348	SUS 316L

NAVAL BRASS AND ALUMINIUM

Corrosion testing on naval brass and higher quality aluminium products show that these metals are highly corrosion resistant in direct contact with Accoya® and may be considered as well.

For example the following aluminium grades did well in internal testing: 3003, 6005, 6063. We anticipate the following grades will also perform well: 6061, 5154, 5052, 3052 and 1100, since they are commonly used in industrial manufacture and transport of acetic acid.

COATED STEEL HARDWARE

When stainless steel fixtures or other corrosion resistant metals are not available, coated fixtures (such as with epoxy, lacquer or polyurethane) can be considered for those locations where moisture and condensation exposure risk is low (for example the dry side of windows and doors). Damage to the coating, e.g. during installation, should be prevented as these damaged areas will be more at risk of corrosion.

It should be noted that the performance of coated fixtures varies, with no particular standard that can be cited. Please contact us or visit the download section of accoya.com for a list of suppliers in your region offering proprietary products in this 'special coat' category.

OTHER METALS

Galvanized metals or zinc alloys are not corrosion-proof when used with Accoya® wood. The surface of certain aluminium alloys, copper, lead and other metals may also oxidize.

Experience to date on the use of solid brass has been positive, especially on brass that is factory clear coated to retain brightness. Chrome plated steel performed very well in testing but if the protective layer is compromised this product will be susceptible to local accelerated corrosion.

COATED FASTENERS APPROVED FOR PRESSURE TREATED LUMBER

Although stainless steel decking screws are commonplace and the best option, proprietary coated steel fasteners such as the coated deck screws approved for use in pressure treated lumber may be used as a lesser alternative. However, damage of the screw coating should be avoided and pre-drilling is advised.

AVOIDING CORROSION

Corrosion of lesser grade metals can be substantially reduced when direct contact with Accoya® wood is avoided, by:

- Coating the wood or the metal component with an effective sealer to provide a protective barrier.
- Physically isolating hardware from direct contact such as the use of plastic (or stainless steel) spacers, providing enough space for sufficient water drainage and fresh airflow is allowed for.
- Metals in confined areas, such as door lock houses, should also be sealed (for example with a vapour-proof epoxy) even without direct contact between metal and Accoya® wood, as the concentration of acetic acid in these confined spaces can rise and increase the risk of accelerated corrosion.

For additional temporary protection it is recommended to spray all sides of the metal hardware before assembly, using a water repellent spray (such as PTFE or silicon based spray) or rust inhibitor. This is also useful when the coating layer has been compromised. Take care not to spray onto bare wood surface as these products may influence coating adhesion and/or maintenance of metal hardware. Preferably pre-drill for screws and other larger diameter fasteners. When installing smaller pieces of Accoya®, the use of staples, such as those made of 18 gauge A2 stainless steel, is recommended to reduce split risk.

AVOIDING CONDENSATION

Avoiding condensation of moisture on metal components will help reduce potential corrosion issues, for example by effective ventilation around those components, as will avoiding high humidity non-ventilated areas.

PROPER STORAGE & TRANSPORT

Avoid damage to metal hardware during storage and transport. Please refer to section 02 for further details.

FURTHER INFORMATION

Further information may be obtained directly from suppliers of fasteners, hinges and locks. For a list of system suppliers in your region, please visit the download section of accoya.com.

07 CONTACT WITH OTHER PRODUCTS

INTRODUCTION

Accoya® wood has been tested for compatibility with a wide variety of products commonly used in certain applications and regions. The information below is a summary of these findings, partly based on internal research and partly on extensive testing by system supply partners. For a list of system suppliers in your region, please refer to the download section of accoya.com.

SEALANTS, GASKETS & RELATED PARTS

Rare examples are known where the small amount of residual acetic acid in Accoya® wood has influenced the curing process or the long-term performance of sealants.

It is strongly recommended that the sealant supplier performs a compatibility check. This applies to glazing sealants (silicon, polyurethane, MS-polymer) as well as to sealants used in double-pane glass (e.g. polysulphide, silicone and polyvinyl butyral). When installing unfinished Accoya® wood, adhesion can be improved by applying a primer before applying the sealant.

CLEANING AGENTS

Cleaning agents vary tremendously in chemical composition and use. In general, cleaning agents are quite aggressive chemicals that need to be handled carefully.

Firstly, after using a cleaner extensive washing with clean water is strongly recommended. Some of these products include chemicals that can impact the (long term) performance and/or aesthetics of Accoya® wood. Chemicals which degrade wood in general (such as strong acids and bases) can also degrade Accoya®, these chemicals should be avoided. An exposure to products above a pH value of 9 can invalidate* any warranty.

* THIS EXCLUDES THE BRIEF EXPOSURE TO HIGH ALKALI COATINGS UP TO THE POINT THEY CURE.

FIRE RETARDANTS

As with other woods, fire retardant chemicals may have an impact on compatibility and/or performance of coatings, adhesives and other products. For more information on possible fire retardants please refer to section 10.

Please note that fire retardant chemicals should never be used without the prior written approval of Accsys Technologies.

WOOD REPAIR PRODUCTS

For Accoya® wood products that will be finished with an opaque film-forming coating system it is recommended to repair all mechanical damage, checks and unsound knots prior to finishing. This is to prevent the wood from (liquid) water uptake which could reduce the service life of the coating system.

It is important to adhere to the instructions of the supplier and verify any possible interaction of the repair system with other components. It is strongly advised to use a repair system that has been tested on paint adhesion, shrinkage behaviour, practical workability and resistance against moisture, UV light and high temperature. Two-component systems (e.g. epoxy or polyurethane) are strongly preferred. One component systems that tend to be hydrophilic or shrink after drying and create capillaries should be avoided.

END-GRAIN SEALERS

For Accoya® wood products that will be finished with a film-forming coating system it is strongly recommended that all exposed end-grain be sealed. It is advisable to use a product that has been tested for its ability to reduce liquid water uptake by the wood, adhesion and UV resistance.

PRESSURE TREATED WOOD PRODUCTS

Typical pressure treated lumber (used e.g. as sub-frame battens or decking joists) containing metal salts such as CCA, ACQ and MCQ can leach copper.

We have found a small number of cases where the copper in the pressure treated lumber was wicked into the Accoya® and resulted in green staining on the surface of Accoya® wood. To prevent this staining risk, we recommend isolation techniques such as plastic (or stainless steel) spacers and barrier coatings. Design of the structure to allow quick drying of the pressure treated wood also reduces this staining risk.

08 WEATHERING

UNCOATED ACCOYA®

From a technical performance perspective, in respect of attributes such as durability and dimensional stability, there is no need to finish Accoya® wood. However, like any natural wood species, Accoya® wood is susceptible to weathering in outdoor circumstances.

All materials exposed to exterior conditions are degraded by a series of chemical, biological and physical processes. The surface of any wood will be disfigured by a combination of UV, moulds, algae, mildew, yeasts and pollution, Accoya® is no exception.

GREYING

Because Accoya® wood has a very high resistance against rotting, a popular choice is to use it in various applications uncoated. It will be left to weather naturally to a silvery-grey colour, due to physical and biological processes that take place within the top layer:

- UV light partly degrades the surface lignin. As this lignin holds the wood cells together, this degradation will lead to a rougher and more open surface.
- This opened surface structure will both cause a change in colour and also allow surface moulds, yeasts, mosses and algae to penetrate and develop faster.
- These types of growths can use many sources of nutrients, including extractives in the wood, free sugars, starch, and other available organic compounds, but do not degrade the wood structure itself. However, pigment produced by these moulds and yeasts, may discolour the surface.

The rate of weathering will vary according to the amount of UV, elevation on a building, the surroundings and the surface structure. Accoya® wood will generally grey at a similar rate as most other wood species, but partial shading of a surface will lead to uneven greying and some visible mould stains.

Prior to turning grey, uncoated Accoya® wood will go through a phase of bleaching where it turns a lighter shade of its normal colour. Surface growths are particularly apparent in this intervening period and can vary in level from board to board.

This will become less distinguishable after full (even) greying, but in this transition period the Accoya® wood surface may look blotchy.

APPEARANCE

A wet and a dry board may vary in appearance. Due to the installation details, the presence of shaded areas and the natural differences in the wood between boards some may dry quicker than others. Not only does this reflect on the appearance of a surface while drying, it will also have an influence on the development of moulds, algae and so on.

SURFACE GROWTHS

Acetylation of wood as such - a non-toxic process - does not seem to have an influence on the resistance against surface mould and yeast growth. However, in damp areas there is a high risk that surface growths will develop on Accoya® wood, as they would on other (soft-) wood species, but the incidence of blue stain development is rare.

Levels of mould or yeast developing on the surface during weathering of the Accoya® wood will highly depend on (macro) climatic factors such as moisture, temperature and sunlight. Other influences are location specific, such as proximity to vegetation, pollution, dirt accumulation and the naturally occurring differences in the wood.

SURFACE FIBRES

Uncoated Accoya® wood may show a degree of surface fibres after being exposed for some time, due to the natural degradation of lignin in wood surfaces. As this lignin holds the wood cells together, this degradation will lead to a rougher and more open surface. This may be perceived as fine fibres on the surface, which will eventually erode.

However, the main reason for the occurrence of surface fibres has been the misuse of pressure washers. Using such cleaning devices with too high a pressure will lead to the damage of the uppermost surface layer of wood. Accoya® wood being softwood in nature, it is therefore important to limit the pressure used.

OTHER STAINING

Other occurrences of disfiguring stains on (Accoya®) wood have been identified as:

- Resins: in rare cases individual uncoated boards may exhibit a reddish brown staining after installation. This is the result of natural extractives being transported to the surface as moisture in the boards evaporates. These discolorations will tend to fade and wash off over time.
- Cleaning agents can cause discolouration. Aggressive agents may even affect the Accoya® wood itself (section 07)
- Fasteners: staining around fasteners may occur when non-corrosion resistant steel is used (section 06). Also, fasteners may transport water to and from the sub-frame, which can contain natural extractives.
- Sub-frame silhouette: in some projects a distinct pattern reflecting the sub-frame behind Accoya® cladding has been observed. This is caused by heat transferal from the building to the Accoya® boards, which will decrease the average moisture content at the location of the interface. Drier conditions mean less mould growth, which is why the interfaces are clear where the rest of the board surface shows mould.

- Pressure treated wood used as a sub-frame: these products may contain metal salts such as CCA, ACQ and MCQ. Copper leaching from this treatment may result in green staining on the surface of Accoya® wood. To prevent this staining risk, we recommend isolation techniques such as plastic (or stainless steel) spacers and coatings. Design of the structure to allow quick drying of the pressure treated wood also reduces this staining risk.

PREVENTIVE MEASURES

Surface mould development can be reduced or delayed by decreasing the level of moisture the wood is subject to or by application of a solution with an appropriate mouldicidal efficacy (e.g. biocidal clear primer).

CLEANING

Especially exterior horizontal surfaces will form a biofilm that will hold water and reduce the speed of drying of the board, and a large build-up of such a layer should be prevented. Without the use of preventive measures, regular cleaning will be needed to control the build-up of such a biofilm.

In normal situations a wooden deck should be cleaned once a year, preferably in spring. More frequent cleaning may be necessary in case permanently shaded areas can't be avoided, e.g. on the north side of a house or in the immediate vicinity of bushes, big trees or forests. Flowerpots and plant troughs should always be lifted from the ground, for example, by strips, spacers.

Polluted surfaces can be cleaned with a stiff brush and clear water; planed surfaces are easier to clean than sawn surfaces. Pressure washers can be used but only with a suitable control device as a direct high pressure water spray can damage all wood - including Accoya® wood. If using a pressure washer it should be carried out with some experience and due care. Cleaning coated surfaces with a pressure washer should be avoided.

09 COATINGS

GENERAL

Despite Accoya® wood's excellent compatibility, we highly recommend having the coating manufacturer involved in the process as they have in-depth knowledge of their products, suitable application techniques and how to determine the performance of the finished product. The System Partner leaflets, available through the download section of accoya.com, list manufacturers with experience of coating Accoya®.

Please note that coating formulations vary per manufacturer (and possibly by region) and processes vary depending on the application equipment used and the end-product design.

PREPARATION

- Accoya® wood should be clean, dry (below 8% mc) and free of dust and grease.
- Where possible, finish the wooden parts on all sides before mounting or assembling them.
- When using a primer, a high quality product that contains resin-bleed blockers and fungicides is recommended.
- Accoya® can absorb a high amount of water through the end grain - those should be effectively sealed.
- Due to its superior dimensional stability, the integrity of most coatings will last longer when applied to Accoya® compared to other woods. Coatings formulated for outdoor use that include fungicides combined with an appropriate maintenance cycle in accordance with the manufacturers recommendations will also prolong their cosmetic appearance.
- Always follow the dry film thickness recommendations from the coating manufacturer to preserve the coatings efficacy.
- If you wish to coat a fresh sawn surface of Accoya® it should first be cleaned to remove dirt and residue. Using a stiff brush is sufficient.
- For processing guidelines, please consult section 04.

PENETRATING OILS

Oils such as tung, linseed, and walnut oil, whether pure or oil/varnish mixtures, may be used with good results.

Please note that oils can be a food source to fungi and thus oils containing a mouldicide are recommended if appearance is an important consideration. Accoya® wood can absorb a great deal of oil. If you want to minimize absorption, it is recommended that you let the first coat of oil dry before applying additional coats.

NON-FILM-FORMING AND SEMI-FILM FORMING SYSTEMS

Accoya® wood may be finished with semi- and non-film-forming paint systems such as stains and oils. It is recommended for both cases to apply multiple coats and follow maintenance intervals as prescribed by the coating manufacturer. Note that the first layer of some oil based products tend to get absorbed by the Accoya® wood more quickly.

The wetting of Accoya® wood is different due to the hydrophobic nature of the wood surface in its first minutes of exposure. In the long term Accoya® wood absorbs (liquid) water. As a result of this trait, water-based stains may not penetrate as deeply or form as thickly on Accoya®.

OPAQUE & TRANSLUCENT COATINGS (FILM-FORMING)

Before a film-forming coating is applied, it is recommended that all mechanical damage is repaired with a suitable product prior to finishing. Opaque and translucent coating systems should be applied on all sides corresponding to the requirements of the end product and/or paint supplier's instructions. End-grain should be sealed before coating with a suitable product so that the protection of all finished sides against water (liquid) uptake is approximately equal.

The rate of drying and/or curing of a coating might be different with Accoya®, but in general the paint supplier's instructions should be followed. Coating performance on Accoya® in joinery and cladding is improved and maintenance intervals are often prolonged with film forming coatings due to the improvement in dimensional stability.

BEST PRACTICES FOR JOINERY

Accsys Technologies has gained a lot of valuable experience of joinery coating over the years. Although practices may vary from country to country, in line with best joinery practices and coating manufacturers advice, it is important to note the following guidance when coating Accoya® wood.

These guidelines are supplemental to advice from coating manufacturers, please consult your coating supplier at all times:

- A fully factory applied joinery coating is strongly recommended. If site finishing is required, then at least a primer and mid coat should be applied in the factory and the top coat must be applied before the joinery gets wet on site.
- Accoya® wood must be dry, clean and free from dust when coated. This is critical when brush applying top coats on site. Please see Section 03 of the Accoya® Wood Information Guide for moisture testing techniques.
- When using an opaque base coat, preferably an effective and well applied anti stain blocking primer is included.
- Translucent coating systems should contain an effective mouldicidal component to protect the wood from unattractive moulds and mildew. As with other wood types and being a natural material, the porosity of Accoya® may vary. Therefore when applying translucent stains, it is advisable to test a sample area first.
- Sealers must be used on end grain throughout the joinery, with a product that is compatible with the paint system and approved by the coating manufacturer.
- Dip and flow coat application of the first coating layer is widely practiced in the Netherlands and Germany for all wood joinery and is particularly effective in forming an all-encompassing first coat.
- Coating manufacturer's application methods and guidance should be followed with particular focus on avoiding cold coatings (should typically be above 15°C at application), correct film thickness and appropriate drying techniques / conditions.
- Coatings should be thoroughly cured in a moisture and temperature controlled environment and in line with coating manufacturers guidelines. This often involves overnight drying between layers. Control is particularly important in colder months.
- Coated joinery should be stored on site as per coating manufacturers guidelines.
- It is strongly recommended to use corrosion proof hardware with Accoya® joinery. However, applying 3 layers of paint behind hardware that may be prone to corrosion helps create an isolation barrier between it and the wood. It also good joinery practice to spray inside any lock housings and apply end grain sealer. Please see section 06 for more details on contact with metals.

Accoya® wood contains a small amount of acetic acid. This can disturb the factory coating process that have re-circulation of the coating (as in flow coating). By adding a buffer in the coating, potential problems can be prevented. Please consult your coating supplier.

We also refer to the Joinery Coatings Essential guide, available through the download section of accoya.com.

DECK COATINGS

To obtain a “natural appearance” of an Accoya® deck with reduced potential discoloration issues, a translucent non-film-forming coating, an oil-based stain or some other type of hydrophobic agent is an option. Fully weathered, horizontal applications, if coated, deserve special attention to select the best solution.

Note that film-forming systems are not recommended for decking boards because of possible slip risk and a risk of moisture accumulation when the coating is compromised by mechanical damage.

Fully weathered, horizontal applications are subject to higher levels of moisture, UV intensity and temperatures. Combined with the fact that horizontal surfaces - as decks and outdoor furniture - undergo wear and tear in their normal use and need to be cleaned, if coated deserve special attention to select the best solution:

- A fully factory applied coating is strongly recommended. Coating systems should be applied on all surfaces with a minimum dry film thickness that corresponds to the requirements of the end product and/or paint supplier’s instructions.
- As moulds are capable of growing on and also through coating layers, to reduce risk of growth on and beneath the coating, at least the first layer if a stain should contain an effective mouldicidal component to protect the wood from possible disfigurement.
- Please be aware of the fact that greying of the Accoya® surface, as with other wood species, will also occur when a clear or translucent coating system is used, and this process can happen quickly if the clear coating does not contain sufficient UV blockers.
- Pigments added to a clear coating system will camouflage mould / yeast disfigurement. However, it is advisable to test a sample area first with pigmented stains, because as with other wood types and being a natural material, the porosity of Accoya® may vary.
- Using thicker layers will reduce moisture absorption and therefore the risk of mould / yeast growth on and through coatings. This will also lead to a more resilient coating in the sense of wear and tear, and may lead to a longer life expectancy of the coating.

SERVICE LIFE

The service life of a decking coating will depend highly on the quality and thickness of the coating layers, the coating colour, regional differences in UV-intensity, the average moisture level and the use intensity.

Whilst a specific service life of any deck coating system can only be given by the coating manufacturer, generally speaking a maintenance interval of more than one year will be rare - in line with other typical deck wood species. A seasonal maintenance involving a re-coat is most common.

- The machining (including planing and/or sanding) of the Accoya® wood may have an influence on the performance of the coating applied.
- For optimum life expectancy of any specific system, please adhere to the maintenance recommendations of the coating manufacturer.
- Generally speaking, regular localised remedial work in areas with high use intensity will prolong the interval for a complete renovation of the coating.
- Regular cleaning (preferably with a soft brush and clear water) will help reduce the risk of moulds growing through the coating.
- The ease of cleaning of non-film-forming deck coatings generally improves when the coating is weathered.
- Pressure washing should be avoided with coated surfaces as the high pressure water could damage the coating layer and decrease the service life.

10 FIRE BEHAVIOUR

EU - PRODUCT STANDARD

Accoya® wood is part of the scope of EN 14915 'Solid wood panelling and cladding - characteristics, evaluation of conformity and marking'.

This harmonised European standard defines solid wood boards for use in panelling and cladding and specifies the relevant characteristics and the appropriate test methods to determine these characteristics in both internal and external use and it provides for the evaluation of conformity and the requirements for marking these products.

One of the properties this standard deals with is the reaction to fire for cladding applications. This property is one of the entire cladding system: including fasteners, detailing, sub-frame and substrate backing the cavity. This means that it is not possible to classify Accoya® on its own.

To avoid testing all possible cladding systems according to EN 13501-1 (single burning item or SBI test), the standard gives guidelines for certain cladding systems that are classified without the need for further testing (table below), in which Accoya® is classified as Class D, the same class as other softwoods.

If certain local regulations or building codes call for it, Accoya® can meet higher requirements, by giving it a fire retardant treatment. This can be done by impregnating fire retardant chemicals or applying a fire retardant (intumescent) primer over which a normal coating can be applied.

Since the chemical structure of Accoya® is modified, it is possible that the performance of the fire retardant will vary from normal woods. It is therefore important that the fire retardant performance is proven by an independent and accredited body. Please contact your Accsys Technologies Sales Manager for fire retardant treatment options available in your region.

Most fire retardant impregnations significantly reduce the strength of wood due to their moisture absorption properties and the impact of moisture on wood strength. Tests on acetylated wood indicate that its strength is not compromised in a similar manner and therefore dimensions do not have to be reduced in any way.

As with other woods, fire retardant chemicals may have an impact on compatibility and/or performance of coatings, adhesives and other products. These products should be tested first to ensure they will meet end-product performance requirements. Fire retardants should never be used without the prior written approval of Accsys Technologies.

^a Mounted mechanically on a wood batten support frame, with the gap closed or filled with a substrate of at least Class A2-s1, d0 with minimum density of 10 kg/m³ or filled with a substrate of cellulose insulation material of at least Class E and with or without a vapour barrier behind. The wood product shall be designed to be mounted without open joints.

^b Mounted mechanically on a wood batten support frame, with or without an open air gap behind. The wood product shall be designed to be mounted without open joints.

^c An open air gap may include possibility for ventilation behind the product, while a closed air gap will exclude ventilation. The substrate behind the air gap shall be of at least class A2 - s1, d0 with a minimum density of 10 kg/m³. Behind a closed air gap of maximum 20 mm and with vertical wood pieces, the substrate may be of at least D - s2, d0.

PRODUCT	PRODUCT DETAIL	MEAN DENSITY ≥	THICKNESS ≥ TOTAL / MIN.	END-USE CONDITION ^c	CLASS
Panelling / cladding ^a	Wood pieces with or without tongue and groove and with or without profiled surface	390 kg/m ³	9 / 6 mm	Without air gap or with closed air gap	D-s2, d2
		390 kg/m ³	12 / 8 mm	Without air gap or with closed air gap	D-s2, d0
Panelling / cladding ^b	Wood pieces with or without profiled surface	390 kg/m ³	9 / 6 mm	With open air gap ≤ 20 mm behind	D-s2, d0
		390 kg/m ³	18 / 12 mm	Without air gap or with closed air gap	D-s2, d0
Wood ribbon elements	Wood pieces mounted on a support frame	390 kg/m ³	18 mm	Surrounded by open air on all sides	D-s2, d0

USA - FLAME SPREAD TEST

Southwest Research Institute (SwRI) performed Flame Spread Tests and Smoke Developed Tests in accordance with the standard test method for surface burning characteristics of building materials NFPA 255 (ASTM E84, ANSI, UL 723 & UBC 8-1).

The conclusion of the Flame Spread Test results is that Accoya® wood can be classified within the range of standard timber species and achieves Class C in this US rating system.

FLAME SPREAD CLASSIFICATION	FLAME SPREAD RATING OR INDEX
Class I (or A)	0 - 25
Class II (or B)	26 - 75
Class III (or C)	76 - 200

WOOD / SPECIES	FLAME SPREAD INDEX*
Lodgepole Pine	93
Accoya®	95
Oak	100
Sitka spruce	100
Maple	104
Birch	105
Cottonwood	115

WOOD / SPECIES	SMOKE DEVELOPED INDEX*
Yellow Cedar	90
Oak	100
Eastern White Pine	122
Accoya®	155
Lodgepole Pine	210
Western Red Cedar	213

* data source - USDA - United States Dept of Agriculture Wood Handbook. Lower numbers equal a lower flame spread or less smoke.

AUSTRALIA

Bush fire risk based zoning is a consideration in Australian building regulations. They have been adjusted to include requirements on resistance to bush fire for building constructions on a zonal system from low to high categories, described in the standard AS 3959.

Some species of timber are listed in in Appendix E of this standard:

- Bushfire Resistant Timber
- E1: density 750 kg/m³ or greater
- E2: density 650 kg/m³ or greater

With an average density of 512 kg/m³, Accoya® (Radiata Pine) is classified, as other softwoods, outside of these lists.

NEW ZEALAND

New Zealand uses the same fire testing principles as Europe (the so-called room corner test), but has different limits for the classification: the Time To Flashover [s] instead of heat release and fire growth.

Based on indicative cone testing, Accoya® is likely to be a group number 4 material, comparable to other softwoods.

11 SUSTAINABILITY

By significantly enhancing the durability and dimensional stability of abundantly available certified wood species, Accoya® wood provides compelling environmental advantages over scarce slow growing hardwoods, woods treated with toxic chemicals and non-renewable carbon-intensive materials such as plastics, steel and concrete. In comparing Accoya® wood with other materials, it is necessary to take the full life cycle into account, from 'cradle to grave'.

PRODUCTION PHASE

- EUTR compliant: made from legally harvested wood from well managed sustainable sources including FSC®, PEFC™ and other regionally certified woods.
- Only abundantly available, and often fast growing source species such as Radiata Pine, are used to create Accoya®, safeguarding a consistent supply and preventing deforestation of tropical forests.
- The Accoya® wood manufacturing process is non-toxic and adds nothing to the wood that does not already naturally occur in it.
- The Accoya® production facility meets highest requirements with respect to health, safety and the environment as recognized by several ISO 14000-based certifications.

END OF LIFE PHASE

- Accoya® wood is fully re-usable and recyclable. Re-use is recommended but Accoya® may be safely incinerated for bio-energy or composted to close the carbon cycle loop.
- In the Cradle to CradleSM philosophy, for which it holds the prestigious Gold-level certification, Accoya® wood is understood to be non-toxic and 100% biodegradable.
- By-products of the production process are re-used, recycled or sold for re-use by others including the food industry (the Accsys Technologies acetylation plant is even halal and kosher).
- Waste wood from construction projects gets high quality second life as input material for Tricoya® fibre panels, thus even increasing the carbon sink effect of wood.

USE PHASE

- Enhanced durability, facilitating a longer service life, improved carbon sequestration potential and lower lifetime material consumption versus other materials.
- Proven quality: Accoya® wood has acquired several quality certifications (e.g. KOMO®, RAL, FCBA, WDMA) and is warranted against fungal decay for at least 50 years above ground and 25 years in ground contact and fresh water immersion.
- Outstanding dimensional stability and improved hardness results in lower maintenance frequency (lower costs) and therefore less coating use and waste over the product's service life.
- Superior thermal insulation, which provides energy conservation advantages when used in joinery applications.

PROVEN GREEN PERFORMANCE

The environmental performance of Accoya® is thoroughly tested and published following uncompromising leading independent international methodologies such as Life Cycle Analysis (LCA following ISO 14040/44) and Environmental Product Declarations (EPD following ISO 14025).

The results from these studies are available through the download section of accoya.com and underline the benign environmental performance of Accoya® wood. For example, official carbon footprint studies show that Accoya® wood is an environmentally compatible, even carbon negative, substitute for carbon intensive materials such as plastics, metals and concrete, as well as for various wood species.

Furthermore, Accoya® has been recognized as an exemplary product in the field of sustainability by the most respected eco labels and certifications worldwide, of which further details can be found in section 12.

MATERIAL	EMISSIONS
Accoya® Scots Pine	-25
Red meranti - sustainable	-23
Accoya® Radiata Pine	-7,5
PVC / steel	116
Aluminium	132,5
Red meranti - unsustainable	314,4

WOOD SPECIES	CUBIC METRES
Accoya® Radiata Pine	28
Western red cedar	15
Bamboo	11
Teak	6
Oak	5

CRADLE TO GRAVE CARBON FOOTPRINT COMPARISON (WINDOW FRAMES)

In a cradle to grave carbon footprint assessment, greenhouse gas emissions during the life cycle of a product / material can be measured. The results are presented in kg CO₂ equivalent (CO₂ eq).

This includes the end of life scenario (recycling, dump or incineration for energy) and the carbon sequestration effect of wood according to PAS 2050:2011 guidelines over a 100 year time frame.

The annual yield of renewable materials is not included in a carbon footprint assessment. This can be perceived as an additional environmental credential for slow growing, limited available certified tropical hardwood, but even more so for fast growing certified sources, of which Accoya® is produced.

Source: Vogtländer, J.G. (2013): Cradle to Grave Carbon Footprint Assessment for Accoya® Wood and its applications Part 1: Window Frame. Delft University of Technology. Publicly available through the download section of accoya.com.

GREENHOUSE GAS EMISSIONS (cradle to grave)

In kg CO₂ eq per window frame in various material alternatives.

CUBIC METRES OF WOOD PRODUCED

Per hectare per year.

12 CERTIFICATIONS AND APPROVALS

SUSTAINABILITY



CRADLE TO CRADLE GOLD

Accoya® wood (Radiata Pine) is one of the very few building products to have acquired Cradle to Cradle™ Certification on the exclusive Gold level. Cradle to Cradle™ (C2C) provides a means to tangibly and credibly measure achievement in environmentally-intelligent design including the use of environmentally safe and healthy materials and instituting strategies for social responsibility.



EUTR COMPLIANCY

The responsible procurement of wood plays a fundamental role in positioning Accoya® as an environmentally friendly product. All Accoya® wood is produced from well managed sustainable sources including FSC®, PEFC™ and other regionally certified woods as required by the EUTR timber regulation in Europe and the Lacey Act in the USA.



FSC®

Of the various schemes for sustainable forestry available, the Forest Stewardship Council (FSC®) is regarded as the leading and most comprehensive certification program available. This program not only focus on benign environmental performance but also safeguard social interests for all stakeholders involved.



THE FUTURE BUILD

The Future Build is a green building materials portal that helps architects, engineers and contractors confidently select and source environmentally sustainable, third party certified products. Only products that have been assessed and selected according to stringent standards and criteria set by the carbon neutral Masdar City, Abu Dhabi, are listed. Accoya® wood was rated as excellent or "A".



NORDIC ECOLABEL

The Nordic Ecolabel or Nordic Swan is a voluntary eco labelling scheme that evaluates a product's impact on the environment throughout the whole life cycle. It is granted for Accoya® in Norway, Finland, Denmark and Sweden and guarantees that climate requirements are taken into account, and that CO₂ emissions (and other harmful gasses) are limited - where it is most relevant.



TIMBER TRADE FEDERATION

Accsys Technologies is a member of the Timber Trade Federation (TTF), the trade association for the timber industry. All Members need to adhere to the high business and environmental standards contained in the Code of Conduct. The timber industry is proud of its strong environmental credentials and recognizes its responsibility to help protect forests for future generations.



SINGAPORE GREEN LABEL

For the South East Asian market we have attained the highly regarded Green Label of the Singapore Environment Council (SEC), which was set up to promote environmental awareness in this region. The 'Green Label' can only be obtained by compliance with the strict eco standards specified by the SEC's scheme and rigorous testing of the product for possible harmful content.



NL GREEN LABEL

Accoya® has been given "A" rating, which is the highest rating because of its extremely high durability, low maintenance requirements and the excellent recyclability.



DUBOKEUR®

Exterior window frames made of Accoya® comply with the requirements set by the Dutch institute for biology and ecology of constructions, resulting in the DUBOkeur® quality mark.

PERFORMANCE AND APPLICATIONS



FCBA (FRANCE)

Accsys Technologies obtained the FCBA control convention in 2014. The process and product control that is linked to this certificate consists of a twice yearly audit, in which this institute will take samples, tests and assess of existing reports on properties such as:

- Durability against fungi and termites.
- Physical properties (water uptake, dimensional stability, shrinkage).
- Mechanical properties.
- Thermal isolation value.



RAL (GERMANY)

Accoya® wood has been evaluated according to the VFF Merkblatt H0.06-4 for its suitability in RAL certified joinery. Final acceptance of Accoya® wood was given in April, 2010, after a provisional acceptance period, and it has been added to the "approved" wood species list of the VFF (Joinery and Facades Association).



JWPA (JAPAN)

The Japan Wood Protection Association (JWPA) evaluates the performance of wood preservatives and treated wood. This results in a product certification for Accoya®, with no process audits associated. The JWPA tests and assesses the performance of (amongst others):

- Corrosion test.
- Toxicity testing.
- Field tests (resistance against termites and fungi).
- Mechanical properties.
- Durability tests.



ICC (USA)

The international Code Council (ICC) is dedicated to developing standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures. Accsys Technologies has ICC ESR-2825 approval which confirms Accoya® meets US building code for decking and porch boards, inclusive of in ground contact and termite zones.



KOMO (THE NETHERLANDS)

Accsys Technologies' modification process and the end product, Accoya® wood, are inspected several times each year by the notified certification body, SKH (The Netherlands), within the KOMO® guidelines for modified wood, in accordance with the assessment directive BRL 0605. Accsys Technologies' production is evaluated on: the uniformity and replication of the production process and the quality system.

Accoya® wood has been tested in accordance with SKH publication 97-04 in respect to durability, dimensional stability, mechanical properties, workability, glue-ability and finishing, and has been shown to satisfy the requirements demanded of a wood species for use in KOMO® certified joinery and façade cladding.

For use with KOMO® and facade elements must satisfy requirements related to burglary resistance. Assessment by SKH has shown that Accoya® is at least equivalent to Pine, with a screw-holding capacity well above the values for Pine.



WMDA HALLMARK® (NORTH AMERICA)

Accsys Technologies was certified by the Window and Door Manufacturers' Association (WDMA) as an approved material for Hallmark® Certified producers after meeting the requirements of the WDMA I.S.4 "Industry Specification for Preservative Treatment for Millwork" in October, 2009.

This rating certifies the quality of exterior millwork and gives government and private agencies a method of identifying windows and doors that are manufactured in accordance with the WDMA's highest standards.

The WDMA Hallmark® is a mark of excellence among architects, contractors and other specifiers. Products eligible for Hallmark® certification are subjected to a rigorous verification process in order to ensure conformance with requirements.

CE-MARKING

On a European level construction products carry a common mark to show they meet a harmonised European standard and may be easily identified as being 'fit for purpose' across all of its member states. This mark is intended to remove any technical barriers to trade and promote the free movement of products within the EU.

This CE mark (from the French, Conformité Européen) indicates that essential health and safety requirements have been met. It is NOT a statement of quality; it is simply 'a fitness for purpose' mark which allows the enforcing authority to compare the products used in certain applications to the associated requirements stated in national building regulations.

Accoya® wood is part of the scope of EN 14915:2013 'Solid wood panelling and cladding - characteristics, evaluation of conformity and marking'. This harmonised European standard defines solid wood boards for use in panelling and cladding and specifies the relevant characteristics and the appropriate test methods to determine these characteristics in both internal and external use and it provides for the evaluation of conformity and the requirements for marking these products.

The basis of any CE-marking is a Declaration of Performance (DoP), which is the responsibility of and should be constructed by the company responsible for manufacturing the finished - in this case cladding - product to be installed on a building. As Accsys Technologies supplies rough sawn lumber, but no finished cladding product, it is not permitted to issue a CE marking (nor a DoP). However, Accsys is able to provide information which can assist its customers in preparing a DoP.

An example of a Declaration of Performance (DoP) that could be constructed by the end product manufacturer is given opposite. For some of the performance declarations in this DoP existing data for Accoya® may be used. Please contact our sales offices for any assistance in drafting such a DoP and in obtaining supporting official reports.

DECLARATION OF PERFORMANCE (DOP) NR.		
1. Unique identification	<i>To be completed by the cladding manufacturer or vendor</i>	
2. Type, batch or serial number	<i>To be completed by the cladding manufacturer or vendor</i>	
3. Intended use or uses	Exterior wall cladding or siding	
4. Name and contact address of the manufacturer	<i>The company that markets (economic transfer) the end product</i>	
5. Name and contact address of the authorised representative	<i>To be completed by the cladding manufacturer or vendor when applicable</i>	
6. System(s) of assessment and verification of constancy of performance	AVCP system 4	
7. Construction product covered by	EN 14915:2013	
8. European Technical Assessment	N/A	
9. DECLARED PERFORMANCE		
ESSENTIAL CHARACTERISTICS	PERFORMANCE	HARMONIZED TECHNICAL SPECIFICATION
Reaction to fire	D - s2,d0	EN 14915:2013, 5.1
Density, thickness	≥ 390, 18/12	
Release of formaldehyde	E1	EN 14915:2013, 5.2.1
Content of pentachlorophenol	NPD	EN 14915:2013, 5.2.2
Release of other dangerous substances	NPD	EN 14915:2013, 5.3
Water vapour permeability	NPD	EN 14915:2013, 5.4
Sound absorption	NPD	EN 14915:2013, 5.5
Thermal conductivity	0,12 W/(m·K)	EN 12667
Durability against biological attack	Class 1	EN 350-1
10. The performance of the product identified in point 1 and 2 is in conformity with the declared performance in point 9. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.		

NPD: no performance declared

Reaction to fire: the product shall be mounted and fixed in accordance with the conditions described in relevant footnotes of Table 1, EN 14915:2013. For further details please refer to section 10 - EU product standard.

13 STANDARDS AND REGULATIONS

The next pages contain various standards and guidelines that Accoya® has been tested against, with passes or better results against set criteria. For more detailed information on these results, please refer to the download section of accoya.com or contact us directly.

EUROPE

EN 46

Wood preservatives - Determination of the preventive action against recently hatched larvae of *Hylotrupes bajulus* (Linnaeus)

EN 113

Wood preservatives - Test method for determining the protective effectiveness against wood destroying basidiomycetes - Determination of the toxic values.

EN 117

Wood preservatives - Determination of toxic values against European *Reticulitermes* species.

EN 118

Wood preservatives - Determination of preventive action against *Reticulitermes santonensis* de Feytaud.

EN 275

Wood preservatives - Test method for determining the protective effectiveness against marine borers

EN 320

Fibreboards - Determination of resistance to axial withdrawal of screws.

EN 335

Durability of wood and wood-based products - Definition of use classes.

EN 350

Durability of wood and wood-based products - Natural durability of solid wood.

EN 408

Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties.

EN 460

Durability of wood and wood based products - Natural durability of solid wood - Guide to the durability requirements for wood to be used in hazard classes.

EN 717-1

Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method.

ENV 807

Wood preservatives - Determination of the effectiveness against soft rotting micro-fungi and other soil inhabiting micro-organisms.

EN 927

Paints and varnishes - Coating materials and coating systems for exterior wood.
Part 3: Natural weathering.
Part 5: Assessment of liquid water permeability.
Part 6: Exposure of wood coatings to artificial weathering using fluorescent UV lamps and water

EN 1534

Wood and parquet flooring. Determination of resistance to indentation (Brinell).

EN 12667

Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance.

EN 10088

Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 14915

Solid wood panelling and cladding - characteristics, evaluation of conformity and marking.

GENERAL STANDARDS

ISO 16000-6

Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS/FID

ISO 16000-9

Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.

ISO 16000-11

Indoor air - Part 11: Determination of the emission of volatile organic compounds from building products and furnishing - Sampling, storage of samples and preparation of test specimens

GERMANY

DIN 52184

Testing of wood; determination of swelling and shrinkage.

DIN 52185

Testing of wood; compression test parallel to grain.

DIN 52186

Testing of wood; bending test.

DIN 52189

Testing of wood; Impact bending test.

DIN 52192

Testing of wood; compression test perpendicular to grain.

DIN 52617

Determination of the water absorption coefficient of building materials.

AGBB

Health-related Evaluation Procedure for Volatile Organic Compounds Emissions (VOC and SVOC) from Building Products.

IFT RICHTLINIE

DI-01/1

Application of sealants. Part 1 - Testing of products in contact with sealants used in double glass.

IFT RICHTLINIE

FE-08/1

Window corner joints for wooden windows. Requirements, testing and evaluation.

IFT RICHTLINIE

HO-10/1

Solid, finger-jointed and laminated elements for wooden windows. Requirements and testing.

IFT RICHTLINIE 7/86

Compatibility of sealing profiles with wood paintings.

RAL-GZ 695

Windows, doors, façades and patios - quality assurance.

VFF MERKBLATT HO.06-4

Wood species suitable for joinery - part 4: modified wood.

NETHERLANDS

BRL 0605

National Assessment Directive for the KOMO® product certificate modified timber.

BRL 1704-1

Finger-jointed timber for load bearing applications.

BRL 1704-2

Finger-jointed timber for non-load bearing applications.

BRL 2338

Adhesives for load-bearing wooden building constructions.

BRL 2339

Adhesives for non-load bearing applications.

BRL 2902

Optimized timber for non-load bearing applications

SKH PUBLICATION 97-04

Basis of assessment for wood species for use in KOMO certified joinery; requirements and testing methods

WVS_SHR_049

Determination of shrinkage and swelling of solid timber.

FRANCE

FD P20-651
Durability of wood products and works

NF DTU 51.4
Building works – Exterior floor decking – Part 1-1: Contract bill of technical model clauses

NF DTU 21-203-1
Building works - Timber frameworks and stairs - Part 1: Technical specifications

NORTH AMERICA

ASTM B117
Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D143
Standard Test Method for Small Clear Specimens of Timber

ASTM E84
Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM G154
Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Non-metallic Materials

WDMA T.M. 1
Soil Block Test, Test Method to Determine Preservative Effectiveness in Preventing Wood Decay

WDMA T.M. 2
Swellometer Test, Test Method to Determine the Short-Term Anti-Swell Effectiveness of Treating Systems

WDMA I.S. 4
Industry Specification for Preservative Treatment for Millwork

AWPA E1
Standard Method of Laboratory Evaluation to Determining Resistance to Subterranean Termites

AWPA E7
Standard Field Test for Evaluation of Wood Preservatives to be Used in Ground Contact (UC4A, UC4B, UC4C); Stake Test

AWPA E10
Standard Method of Testing Wood Preservatives by Laboratory Soil-Block Culture

AWPA E12
Standard Method of Determining Corrosion of Metal in Contact with Treated Wood

AWPA E18
Standard Field Test for Evaluation of Wood Preservatives Intended for Use Category BB Applications Exposed, Out of Ground Contact, Uncoated Ground Proximity Decay Method

AWPA E20
Standard Method for Determining the Leachability of Wood Preservatives in Ground Contact

AWPA E22
Standard Accelerated Laboratory Method for Testing the Efficacy of Preservatives Against Wood Decay Fungi Using Compression Strength

AWPA E23
Accelerated Method of Evaluating Wood Preservatives in Soil Contact

AWPA E24
Standard Method of Evaluating the Resistance of Wood Product Surfaces to Mold Growth

ABBREVIATIONS

ASTM

ASTM stands for the American Society for Testing and Materials. More information is available at astm.org.

AWPA

The American Wood Protection Association standards are represented by the acronym AWPA. More information is available at awpa.com.

BRL & SKH

SKH is a Dutch notified certification body that is permitted to KOMO® certify timber, timber products, timber constructions and timber related products. The BRL represents the National Assessment Directive. For information about BRL and SKH publications, please contact the certification and attestation body SKH through skh.org.

DTU

A "document technique unifié" (DTU) or Unified Technical Document is a document applicable to building works contracts in France. It is established by the "General Standards Commission Building / DTU" for which the Scientific and Technical Centre for Building (CSTB) provides the secretariat. The CSTB can be reached through cstb.fr.

EN & ENV

EN stands for 'European Standard' and is the abbreviation used in the European classification system. ENV denotes a European pre-standard.

ISO

ISO (International Organization for Standardization) is a network of the national standards institutes of some 162 countries, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. Every full member of ISO has the right to take part in the development of any standard which it judges to be important to its country's economy. ISO standards are voluntary. As a non-governmental organization, ISO does not regulate or legislate. However, countries may decide to adopt ISO standards as regulations or refer to them in legislation. More information can be found on iso.org.

VFF & IFT

The VFF stands for "Verband der Fenster- und Fassadenhersteller" The "Gütegemeinschaft Fenster und Haustüren" is the beholder of the RAL certification (window.de). IFT Rosenheim is a test and certification body in Germany (ift-rosenheim.de).

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Accoya® wood should always be installed and used in accordance with the written instructions and guidelines of Accsys Technologies and/or its agents (available upon request). Accsys Technologies accepts no liability for any defect, damage or loss that may occur where such written instructions and guidelines are not adhered to.

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