accoya®

ACCOYA®

Wood Information Guide V3.9

CONTENTS

1 INTRODUCTION

About this guide

Welcome to the Accoya Wood Information Guide. This document has been written for professionals wishing to use Accoya wood to create beautiful, reliable and highly durable end products and has been compiled to offer best practices and recommendations for the handling and use of Accoya wood.

The guide is composed from current good practice, without aiming to be exhaustive and is produced as part of the supporting information portfolio to the “Accoya wood – Certificate of Warranty”.

In addition, Accsys runs an approved Manufacturer Training Programme and we would encourage all manufacturers planning to use Accoya to participate in this training programme.

Should you require any further information or guidance, please contact your local sales representative or send an email to: **sales@accsysplc.com**

This is version 3.9 of the Accoya Wood Information Guide. To confirm this is the most up to date version and check for other potentially useful information please check our website: **www.accoya.com**

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2 ACCOYA WOOD PROPERTIES

Accoya wood has been produced commercially since 2007, initially in small volumes, then growing as manufacturers and architects gained an appreciation for its characteristics. Adoption has accelerated to the extent that almost 350,000m^3 has been used around the world for a range of exterior applications. Accoya represents a major development in wood technology that has made the consistent supply of durable, dimensionally stable and reliable wood from a sustainable source possible.

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

Accoya performance testing is reviewed in detail in the Performance Testing Summary Brochure.

KEY PROPERTIES & BENEFITS

- HIGHLY STABLE
- HIGHLY DURABLE
- IDEAL FOR COATING
- EXCELLENT MACHINABILITY
- NON TOXIC
- BAREFOOT FRIENDLY
- STRUCTURALLY CERTIFIED
- SUSTAINABLY SOURCED
- LOW CO_2 EMISSIONS
- INSECT RESISTANT
- 100% RECYCLABLE
- LOW ENVIRONMENTAL IMPACT

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.1 Appearance

Accoya wood is supplied as rough sawn and finger jointed in various sizes and grades.

Detailed information on available dimensions is available at: **www.accoya.com**

Details of end product manufacturers and Accoya stocking distributors can be found at: **www.accoya.com/where-to-buy**

2.2 Material properties

This table shows the average properties of Accoya wood made from radiata pine and has been compiled using data from official test reports from independent institutes in Europe, USA, Australia and New Zealand. For further information on a wider range of testing information please see the Accoya Performance Testing Summary brochure, available at: **www.accoya.com**

Property	Test method	Value
Durability	EN 113 (EN84), ENV 807 and EN 252 AS5604	Class 1* Class 1
Density	65% RH, 20°C (70°F)	515 ± 80 kg/m³ 32 lb /ft³ ± 5 lb /ft³
Shrinkage (avg)	ISO 4469	
Wet to 65% RH, 20°C	Radial Tangential	0.4% 0.8%
Wet to Oven Dry	Radial Tangential	0.7% 1.5%
Equilibrium moisture content	65% RH, 20°C (70°F)	3 – 5%
Thermal conductivity	EN 12667 ASTM C-177	0.12 W/m K 0.10 W/m K
Janka hardness	ASTM D143	Side 4,100 N End 6,600 N
Brinell hardness	EN 1534	2.4 kgf/mm² 24.0 N/mm²

***What is Class 1 Durability?** Wood resistance to rot and decay is measured on a scale of 1 to 5 with 1 being the most durable. Provisional durability class can be determined in a 16 week petri dish test (EN113). Official durability class can only be determined from long term, real life durability testing (EN252). Results show many wood types can under perform in EN252. Accoya achieves durability class 1 in both EN113 and EN252. As there is no durability class system in the USA, Accoya has been tested alongside other durable woods including FEQ Burmese teak, sapele mahogany and western red cedar. This five year ground contact test in accordance with AWPA E9 standards was run by an independent lab at their Gainesville Florida test site. Accoya outperformed all tested durable woods. Please see the Accoya Performance Testing Summary brochure available at www.accoya.com for more details.

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.3 Mechanical properties

The Accoya acetylation process improves hardness and compression strength significantly. Accoya is approved for a general building use by the German Institute for Building Technology (DIBt) for load bearing structural applications. This DIBt approval qualifies the strength class of A1 and A2 solid Accoya timber, based on the European strength class system of C classes (EN338).

Accoya A1 quality is classified as C22 strength grade and Accoya A2 quality is classified as C16 (see adjacent table). The approval applies to Accoya wood in the widths 100mm to 250mm with a thickness of 25mm to 100mm, and can be used both flat and upright. C22 and C16 strength classes are common for structural timbers produced from spruce and pine in the UK and Mainland Europe.

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Property strength [N/mm2]		Characteristic values for strength class: C16 (A2 Grade)	C22 (A1 grade)
Bending	$f_{m,k}$	16	22
Tension			
Parallel to grain	$f_{t,0,k}$	10	13
Perpendicular	$f_{t,90,k}$	0,5	0,5
Compression			
Parallel to grain	$f_{c,0,k}$	17	20
Perpendicular	$f_{c,90,k}$	2,2	2,4
Shear	$f_{v,k}$	1,8	2,4
Stiffness [kN/mm²]			
Mean MOE parallel	$E_{0,mean}$	8	10
5% MOE parallel	$E_{0,05}$	5,4	6,7
Mean MOE perpendicular	$E_{90,mean}$	0,27	0,33
Mean shear modulus	G_{mean}	0,5	0,63
Density [kg/m³]			
Density	0_k	310	340
Mean density	P_{mean}	370	410

NB: Characteristic values are used in structural grade classification and stated as the average result minus two standard deviation.

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

The standard wood design safety factors (k_{def}, k_{mod}) as given in EN 1995-1 were determined in the DIBt test programme to be appropriate and may be used. Accoya wood may be fastened to a timber sub-frame with nails, clamps, wood screws, dowels and bolts. For non pre-drilled holes, the minimum spacing distance and edge/end clearance (EN 1995-1-1, table 8.2) should be in line with wood with a density between 420 and 500kg/m³.

2.4 Property characteristic values for strength class

The strength class determining properties of timber are strength, stiffness and density. The values mentioned in EN 338 are so-called characteristic values of the material properties. For safety reasons, these are threshold values that at least 95% of the pieces of timber will meet. Hence these characteristic values are lower than the average mechanical property values commonly reported for timber species. Average mechanical property values should not be used for structural calculations.

To achieve design values, the characteristic values are divided by a material factor and multiplied by climate, load duration and beam height modification factors (EN 1995-1-1).

Accoya wood in B grade is not strength graded in any way and is not included in the scope of the DIBt work programme or certification.

2.5 Residual acid

Many durable wood species naturally contain a quantity of acid. Accoya wood contains a small amount of residual acetic acid from the acetylation process. Since acids can create compatibility issues with coatings, glues and fixtures, the acetic acid 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 ≤ 1.0% (mass/mass oven dry wood)
- Maximum residual acetyl compounds content of individual samples ≤ 1.8%

Although levels are controlled, freshly cut or planed Accoya wood may have a slight vinegar-like odour. Some of the residual acetic acid will dissolve in water absorbed by Accoya wood. In wet circumstances, the Accoya wood will therefore have a pH in the range of 4 – 5.5. At these levels a wide range of coatings, glues, fixings and other products can be used with Accoya. Please see the applicable sections for each in this guide.

QUALITY CONTROL SAMPLING

Note: Accoya carries out destructive testing on the core of the wood from every batch.

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.6 Acetylation and Durability

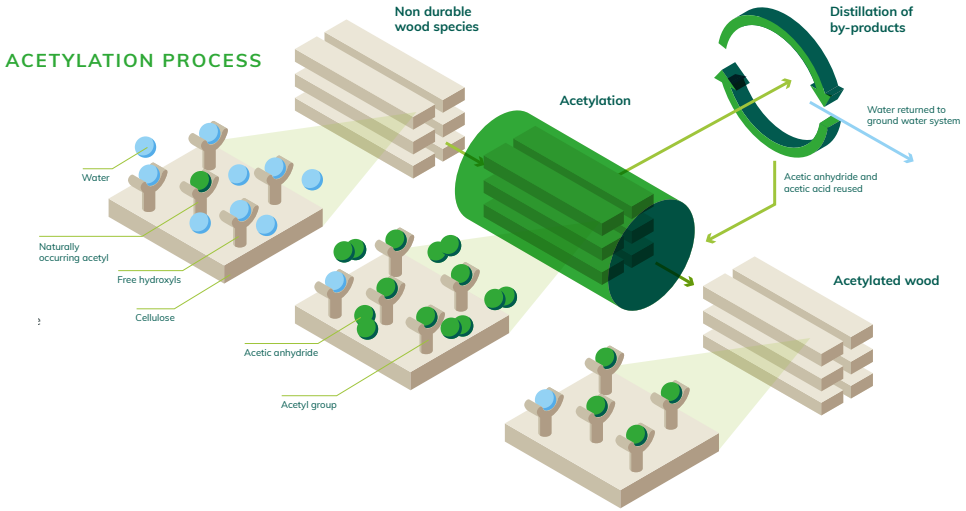
Accoya wood is modified uniformly through the cross section, not just at the surface. The entire cell wall structure is altered to the effect that it repels moisture, greatly reducing the capacity for bound water and therefore swelling and shrinkage. This bulking up of the structure in turn gives it excellent protection and sustained strength even when wet.

The wood structure is modified through the process to give it its unique stable, durable and inert properties with high thermal insulation that all helps to deliver long term performance. Accoya wood performs in the harshest of environments and even lends itself to being coated black.

Modification quality of each batch produced is validated to the core of the wood by a range of sophisticated and proven tests that take place in Accsys' laboratories. This quality control approach is independently audited on a regular basis by organisations 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. See 2.8 for more information.

Accoya wood has evidenced improved performance in multiple tests and in numerous regions against various fungal, termite and other insect species in many locations around the world.



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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.7 Classification of natural wood durability to wood-destroying fungi

Accoya wood is resistant to salt and can be used around saltwater (for instance as marina decking and boardwalks). Accoya is used in permanent salt water immersion but is not warranted for resistance against attack from marine organisms. However, Accoya wood has been tested in the waters of Northern Europe for more than a decade without attack and a 10 year service life position has been established for that region. Testing on the US Pacific coast is ongoing with no attack after 4 years.

Accoya wood is warranted for 50 years above ground, 25 years in ground contact and freshwater immersion. A copy of the warranty is available in the warranties section on **www.accoya.com**

Durability class	Description
1	Very Durable
2	Durable
3	Moderately Durable
4	Slightly Durable
5	Not Durable

2.8 Durability use classes

The EN 335 gives general definitions of use classes for different service situations and is relevant to solid timber and wood-based products. Accoya wood is suitable for use classes 1-4 defined in this standard.

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Use class	Conditions of use	Wetting	Wood moisture content
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 wood MC >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 in contact with fresh water	Permanent exposure to water with wood MC >20%
5	In contact with salt or salt water splash zones[1]	Permanently exposed to brackish water	Permanent exposure >20% to salt water

[1] The Accoya warranty covers use in salt water splash zones, for instance Marina decking. Accoya is suitable in full salt water immersion though the warranty does not cover attack by marine organisms.

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

The AWPA standard U-1 describes use category designations and typical applications. Accoya wood is suitable for Use Classes UC1 – UC4A in this standard.

Use category	Service conditions	Use environment	Typical application
UC1 Interior, Dry	Interior construction Above Ground, Dry	Continuously protected from weather or other sources of moisture	Interior construction and furnishings
UC2 Interior, Damp	Interior construction Above Ground, Damp	Protected from weather, but may be subject to sources of moisture	Interior construction, sill plates
UC3A Above Ground, Protected	Exterior construction Above Ground, Coated & rapid water runoff	Exposed to all weather cycles, including intermittent wetting	Coated millwork, siding, trim
UC3B Above Ground, Exposed	Exterior construction Above Ground, Uncoated or poor water run-off. Excludes above ground applications with ground contact type hazards.	Exposed to all weather cycles including intermittent wetting but with suffcient air circulation so wood can readily dry	Decking, railings, joists and beams for decks and freshwater docks, fence pickets, uncoated millwork
UC4A Ground Contact, General use	Ground Contact or Fresh Water Non-critical components (Includes above ground applications with ground contact type hazards or that are critical or hard to replace)	Exposed to all weather cycles, including prolonged wetting	Sawn fence, deck and guardrail posts, joists and beams for decks and freshwater docks

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.9 Dimensional stability comparison

Accoya wood exhibits superior dimensional stability compared to other naturally durable species, in both radial as well as tangential direction (table adjacent).

This provides short and long term benefit. In the short term, Accoya remains stable during processing. In the medium term, joinery remains stable and resists movement when environmental conditions fluctuate after installation.

Further on in service, deck boards remain flat, stable around fixings and with practically no splinters. Cladding boards and louvres retain their flush and smooth lines and coated products benefit from the board stability placing less stress on the coating and leading to requiring earlier maintenance.

MOVEMENT LEVELS FROM GREEN TO OVEN DRY CONDITION

Species	Typical characteristic values Radial	Tangential	Warranty Maximum[5]
Accoya (Acetylated radiata pine)[4]	0.8%	1.6%	2.5%
Douglas fir[1]	4.8%	7.6%	-
Ipe[1]	6.6%	8.0%	-
Kebony[3]	1.4%	2.5%	-
Meranti[1]	3.0%	6.6%	-
Merbau[1]	2.7%	4.6%	-
Radiata pine[4]	3.4%	7.9%	-
Sapele[1]	4.6%	7.4%	-
Siberian larch[2]	4.0%	9.0%	-
Teak (Burmese FEQ)[1]	2.5%	5.8%	-
Thermally modified ash[3]	2.3%	4.0%	-
Western red cedar[1]	2.4%	5.0%	-

[1] Wood Handbook, USDA Forest Products Laboratory. Green to Oven Dry measurements
[2] Rosenfeld Kidson – Species Fact Sheet Larix sibirica
[3] Internal testing Accsys
[4] Dimensional stability of Accoya wood under different moisture conditions, SHR Report 6.322
[5] Accoya wood - Certificate of Warranty

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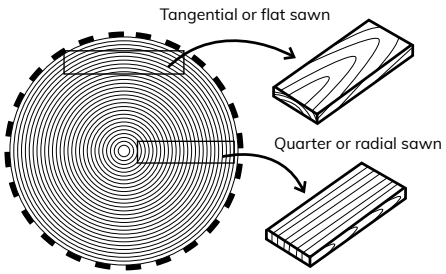
2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.10 Expansion and Contraction

The adjacent table shows average movement from green (soaked) to oven dry boards of 5 ¾" or 145mm width. Accoya wood's enhanced dimensional stability often allows for:

- Greater widths on cladding without excessive cupping
- Narrower gaps between deck boards
- Gaps between deck boards not closing up when soaked in winter months.

It is however still necessary to take into account the expected expansion in installing Accoya products.



Species	Characteristic values Radial sawn (inch/mm)	Tangential sawn (inch/mm)	Warranty Maximum (inch/mm)
Accoya (Acetylated radiata pine)	0.04 / 1.0	0.09 / 2.2	0.14 / 3.6
Douglas fir	0.27 / 7.0	0.43 / 11.0	-
Ipe	0.38 / 9.6	0.46 / 11.6	-
Kebony	0.08 / 2.0	0.14 / 3.6	-
Meranti	0.17 / 4.4	0.38 / 9.6	-
Merbau	0.15 / 3.9	0.26 / 6.7	-
Radiata pine	0.19 / 4.9	0.45 / 11.5	-
Sapele	0.25 / 6.4	0.42 / 10.7	-
Siberian larch	0.23 / 5.8	0.51 / 13.1	-
Teak (Burmese FEQ)	0.14 / 3.6	0.33 / 8.4	-
Thermally modified ash	0.13 / 3.3	0.23 / 5.8	-
Western red cedar	0.14 / 3.5	0.29 / 7.3	-

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2 ACCOYA WOOD PROPERTIES TECHNICAL DATA

2.11 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 the movement tolerances in **section 2.10** should be allowed. Installation guides that cover dimensional stability considerations for common wood products should be more than sufficient for Accoya wood.

The Accoya Lumber Grade Guide lists the maximum allowable shape tolerance for delivered sawn Accoya planks. Accoya's dimensional stability does ensure it can resist distortion in all but the most severe applications. Traditional approaches such as engineered component development may not be required but will improve performance in particularly severe applications such as oversize doors coated black. For more specific information on dimensional stability values and distortion risk, please contact your local Accsys sales representative.

2.12 Slip resistance

The slip resistance of all wooden (decking) boards and many other materials depends on factors such as degree of weathering, surface profiling, coating, wetness of the boards and maintenance – i.e. the presence of a biofilm of bacteria, fungi and algae. Test methods vary greatly across the world (even throughout Europe) and only a few countries have official requirements covering the slip resistance of flooring surfaces.

The most common slip resistance measures express results on new boards in wet and dry condition:

- Most dry timber decking boards can be considered as sufficiently slip resistant.
- When wet, the slip resistance of decking boards is decreased by approximately 35% in comparison with dry circumstances and are therefore considered more slippery. Designing for easy water run-off and ventilation beneath the boards are therefore important. A shaded location will also affect the time for the boards to dry out.
- If decking boards are coated, stains are more suitable in terms of slip resistance than oils, although that is heavily dependent on the particular coating system and the cleaning maintenance.
- Smooth surfaces have a higher coefficient of sliding friction compared to grooved surfaces, and are therefore less slippery.

Generally speaking, the results for Accoya wood when tested by these methods are comparable to unmodified wood species with the same surface specifics (including dimensions, profile details, surface finish and the presence of a lubricant and/or biofilm).

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3 TRANSPORT AND STORAGE

3.1 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 supplies Accoya wood in rough sawn dimensions in dry condition and ready for use (wood moisture content <4% on average).

The recipient at the delivery address must ensure that Accoya wood packages are unloaded carefully and any damage is recorded at point of unloading.

3.2 Transport

In order to prevent damage, products made of Accoya should be carefully transported. Protection of joints, frame corners, projecting profiles (cills) and hardware is especially important. To prevent water uptake during transport, storage and at the building site, it is strongly recommended that Accoya and Accoya products are stored under cover or covered in suitable, breathable and weatherproof material.

3.1 PACKAGING

3.4 ACCOYA BUNDLE LABEL INCLUDING DIMENSION, GRADE, LENGTH, QUANTITY AND BATCH NUMBER

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3 TRANSPORT AND STORAGE

3.3 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 4** for more details on determining whether Accoya wood has absorbed excess water and for drying considerations.

Accoya wood can be manufactured into parts, even with long intervals before assembly. Unlike many wood species, changes in size, straightness 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.

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

When storing bundles of (rough) Accoya please note bearers need to be at least every 1.2m and in line with stickers in the bundle. Any bundles stored on top of each other should have the bearers and stickers aligned to ensure the transfer of pressure does not cause undue stress on the boards. Storing bundles of processed products (e.g. cladding boards) should be horizontally on bearers at least every 800mm, with a minimum of 3. Again, bundles on top of each other should have the bearers aligned.

3.4 Traceability

Accoya wood is primarily identified by its packaging labels, which feature the Accoya logos. Additionally the batch number and grade (A1 and A2) associated with each board is printed at one end of the board's sawn surface.

Batch number should be recorded as part of a manufacturer's production record-keeping per job. In case of doubt, Accsys will verify the product's authenticity. In addition, Accoya wood can generally be traced through the supply channel by its packaging number. It is therefore imperative to retain all relevant documents. This tracking is also needed if you intend to offer products with sustainable wood certification such as FSC. The packaging number is to be quoted in the case of any queries, complaints or warranty claims.

3.5 Information transfer

It is important to inform the owner and third parties performing installation that Accoya has been used in the manufacture of the (end) product. Sections 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.

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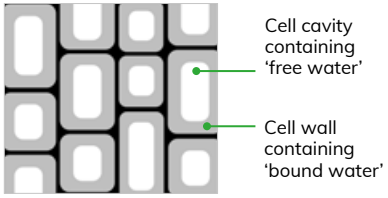
4 WOOD MOISTURE CONTENT

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 condition will have minimal bound water, which is what accounts for many of its superior properties, it can still contain free water (for example as a result of not using effective end grain sealer in window manufacture or in horizontal application). Final product quality can be harmed by free water during manufacture; it is therefore essential that the moisture content of the wood is determined prior to further processing such as gluing and coating if there is a suspicion that the boards have become wet prior to the manufacturing step.



FREE WATER ILLUSTRATION

It is therefore also important that buildings that introduce high levels of water via the building materials require careful management to maintain a suitable climatic environment and equilibrium.

4.1 Definition

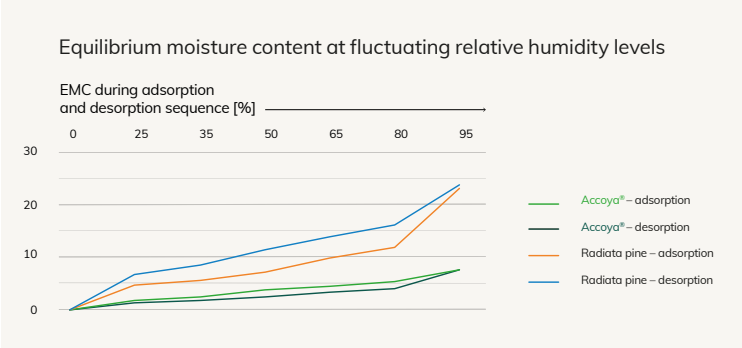
In line with normal convention, wood moisture content, as expressed in this guide, is the mass of the water contained in wood, expressed as a percentage of the mass of absolutely dry wood.

4.2 Wood moisture content

Accsys dispatches Accoya wood in dry condition (wood moisture content <4% on average). This allows Accoya wood to be processed into products for application directly after being delivered.

Accoya wood moisture content increases to between 7 and 9% in a sustained climate of 95% relative humidity/20°C (70°F). As such, overseas shipping and regional/seasonal climate fluctuations can have an influence on moisture content.

Typically, moisture gain or loss due to fluctuating humidity occurs in the cell walls and is bound. More excessive moisture gain through soaking quickly fills the cell wall absorption limit and is deposited in the cell wall cavity (fibre lumen) as free water.



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4 WOOD MOISTURE CONTENT

4.3 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/m^3 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 further processing, gluing or coating.

4.4 Water absorption properties

End grain water absorption of Accoya is particularly high due to the cell structure. Liquid water absorption can be deep and Accoya takes longer to dry out than many species. If there has been a risk of sustained wetting prior to product manufacture, 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 9** on coatings.

Good design and fit for purpose practices should be adopted in Accoya use and application. The potential for water ingress should be considered and addressed by employing good design and assembly practices appropriate to the location of the installation, such as should be employed when working with any timber. For example, avoid water traps such as horizontal surfaces, allow plenty of ventilation for cladding and decking and use a protective coating for external windows and doors.

PIN METER

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5 PROCESSING

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 to a uniform level and these properties are not leachable.

Accoya is easy to process and can be compared, in general, to a harder softwood species such as yellow poplar (tulip wood). Accoya typically runs better through machines than softwoods such as Douglas fir, cedar and larch and much better than most durable tropical hardwoods.

Special tools are not required for standard operations such as cross cutting, ripping, planing, routing or drilling. Depending on the required coating, 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-like odour 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 (for example oak and WRC), 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 4**). A moisture content reading below 8% indicates suitability for processing. Also note that the tracking number printed on the Accoya sawn boards (see **section 3.4**) should be recorded against the job sheet prior to processing.

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5 PROCESSING

5.1 Visual grades

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, which are not visible on the sawn boards' surfaces as graded. The boards are sold on the basis of defects visible on the sawn boards. Defects arising after processing might include internal cracks, internal resin pockets and movement. For more information on grade names and definitions for Accoya radiata pine, please see the Lumber Grading Specifications, available on **www.accoya.com**.

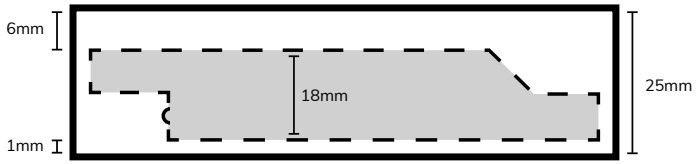
5.2 Discolouration

Accoya boards have a discoloured zone around the perimeter. Wood resins move from the core of the wood to outer zone during kiln drying. These resins are then solubilised and darkened during the acetylation process which causes discolouration in this outer zone. The level and depth of discolouration depends on factors such as the amount of resin in particular logs and boards. Individual boards are spaced with small battens, typically leaving a lighter mark where they meet the board – known as sticker marks.

The acetylation process can result in discoloration generally up to 6mm in depth with sticker marks up to a similar depth, and due to natural wood variation, occasionally deeper. Removal of this surface discolouration is not required when using opaque coatings or for parts that will not be visible. Discolouration and sticker marks visible on surfaced, non coated product applications or translucent stain coated applications will fade over the course of days and months proportionate to the level of UV exposure. Discolouration can be more apparent once the wood is wet or translucent coated.

As an example the drawing to the right shows a 18mm thick cladding board produced from 25mm Accoya by setting the bottom knife to remove 1mm from the back side and 6mm (plus any over thickness) from the top side.

DISCOLOURATION: ROUGH BOARD, AFTER SURFACING 3MM AND AFTER SURFACING 6MM FROM ROUGH



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5 PROCESSING

5.3 Changed properties

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

- The Janka and Brinell hardness increases from the original wood used to produce Accoya (refer to **section 2** for ratings). As a guide, Accoya wood is more comparable in machining to species like yellow poplar/tulip wood.
- Since the moisture content of Accoya is generally below 5%, this can make some of the material a little more brittle than unacetylated wood.
- Density has increased (avg. 515 kg/m³) as compared to unacetylated radiata pine.
- Internal stress within the wood is reduced by the process. This eases the process of 'working' the timber compared to untreated radiata pine and many other wood types used for exterior use.
- Accoya wood has an outer zone of discolouration which should be considered in profiling. Please see **section 5.2**.
- Please reference **section 5.2** on discolouration when setting up for profiling to achieve the best result.

For further guidance and detailed information please contact your local Accsys sales representative and consider arranging an Accoya Manufacturer Training Programme session at your workshop.

5.4 Sawing, planing and profiling

Accoya wood 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 wood 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 contaminate the surface, such as oil, lubricant or rust, particularly if the wood is to be coated or glued, as this can affect appearance and compatibility.

Accoya wood 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/extraction system, using antifriction lubricants or otherwise reducing static energy at the rotary blades.

Despite Accoya wood's improved properties, boards may harbour tension and flaws internally, similar to other comparable wood species.

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5 PROCESSING

These typical wood guidelines also apply to Accoya wood:

- Similar to other wood species, re-sawing, ripping or heavily planing Accoya boards can reveal stresses created during drying and processing. Ripping to create thinner boards is not recommended with boards having an original thicknesses of more than 38mm and should be approached cautiously in all instances. Please consult your Accsys sales manager for guidance on specific situations or variations.
- Checks and resin pockets can appear, especially after heavy planing or re-sawing.
- Although the Accoya wood 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 and for deep milling, wood pieces with pronounced slope of grain, irregular growth rings and similar issues should be avoided or used in more tolerant areas.

- When planing Accoya wood ensure that knives are aligned correctly and are sharp. If working with multiple species and knives that are rapidly dulled, it is advised to machine Accoya wood first before the other species.
- Due to the smooth Accoya surface after planing all cutter marks may be more defined and show through the coating. Special care is needed and feed speeds should be adjusted accordingly. A feed speed comparable to durable hardwoods is common while experience is developed.
- To attain the highest surface finish quality on Accoya wood, it is best you contact your machine and tooling provider for optimum feed and cutter speed settings advice. When machining Accoya wood for the first time it is best to produce some test runs to establish the appropriate parameters for a particular machine and set up.
- The in-feed rollers can be aluminium but the out feed rollers of equipment should preferably be rubber to prevent surface damage.

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5 PROCESSING

5.5 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 wood. For dowel connections it is important that the diameter of the drill is no smaller than the diameter of the plug to prevent splitting.

Best practice for wedges for door construction is to make sure the dimensions of rebate and wedge are sufficiently large, the wedge is flattened rather than pointed and care should be taken in installing: a series of taps will avoid splitting. See **section 6.3** for additional details.

5.6 Sanding

Sanding Accoya wood presents no challenges. Experience from Accsys manufacturing customers over the years has shown that it is often not necessary to sand Accoya wood between coats of water based coatings since fibres scarcely 'bloom' or roughen the surface after moisture absorbance. Nevertheless, advice should be taken from your coatings partner on good process detail, as poor practice may result in reduced surface aesthetics.

When sanding of the wood surface is required, a belt sander with a 120 grit pad will give good coating quality results. Orbital palm sanders may create a "washboard" effect as the soft pad will sink in and erode the softer summerwood, leaving the denser winterwood high. Avoid this type of machinery or make sure the sander has a hard and rigid base (no Velcro type fixing of the pad).

DOOR WEDGES

CONTENTS

5 PROCESSING

5.7 Fasteners

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 options, please refer to **section 7**.

5.8 Waste wood and 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, the adoption of the "preferential sequence for waste management" is recommended. This model largely follows the guidelines of the popular Cradle to Cradle™ (C2C) philosophy 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**

Since Accoya wood has a long service life, it is often the proper selection and maintenance of other components that now become the critical success factors. It is therefore recommended integrating Accoya wood's performance into the overall design strategy of a product, and apply an appropriate maintenance interval for coatings and other finished product components to achieve optimal product service life. Further it is recommended to design in such a manner that product or material re-use is facilitated, as the service life of Accoya wood might be exceeding the (economical) service life of the product.

If this is not possible, it is recommended that Accoya wood is used for energy production through incineration. The German wood research institute Wilhelm-Klauditz-Institut (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 biological degradation.

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6 GLUING

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 wood can be glued using most commonly used wood adhesive systems. Particularly good results are obtained with polyurethane (PU), emulsion poly isocyanate (EPI), epoxy and phenol resorcinol formaldehyde (PRF) adhesives. The results of gluing with polyvinyl acetate (PVAc) improve with longer clamp times but it should not be solely relied on for strong joints. Melamine urea formaldehyde (MUF) should be avoided.

When gluing Accoya wood 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. Use should always be in line with best practice, design and performance specific demands. Gluing Accoya and products offered by adhesive system partners is part of the Accoya Approved Manufacturer training programme.

CONTENTS

6 GLUING

6.1 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 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 4**.

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.

6.2 Optimising 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.
- With water based adhesives, possibly increase the clamp time or press time to allow the water to be absorbed and the adhesive to produce adequate green strength to bond the Accoya wood pieces.
- The applied pressure during gluing should be adapted to the strength of Accoya wood, as should the temperature if heat is applied. Accoya wood should be treated as moderately hard softwood in this context.
- The curing time and the best curing conditions.
- The properties of glued and finished product should be fit for purpose.

CONTENTS

6 GLUING

6.3 Joints

It is strongly advised that any end-grain that will be exposed be sufficiently sealed using a suitable product as recommended by the supplier. This is particularly critical for joinery. For a long lasting result, the importance of a proper frame corner joint is emphasized. 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 performance problems and other damage.

Dowels, biscuits and similar devices, if not made from Accoya wood, may swell (much) more than Accoya wood. Plastic dowels graded to the application may be used as an alternative to wooden dowels. 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.

6.4 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 and dimensional stability of the Accoya fingers (reducing the self clamping benefit after adhesive application), 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.

6.5 Laminating

Good results can be achieved with PU (both 1 and 2 component types), PRF and EPI. The best results are obtained with structural PU and PRF adhesives and only these types should be used in uncoated use or applications which will be subject to regular wetting. It is important to work on a flat surface and not apply excessive

pressure because Accoya wood is smoother and may expel adhesives from the gluing surface. Take advice from your adhesive supplier on best practice for surface preparation (roughening) before laminating. Adhesive may also require more time to penetrate the surface of the Accoya wood.

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6 GLUING

Due to the high dimensional stability of Accoya wood, the annual ring orientation and the amount of balancing of layers is of less importance.

6.6 Best practice in design of structural laminate

The physical and chemical changes associated with acetylation, can affect the curing process of the glue line. In particular adhesives which require moisture for hardening can be affected by the particularly low moisture content of Accoya.

Testing has so far been undertaken on Accoya wood by Dynea and Henkel, in accordance with EN301 and EN 302-1 (PRF adhesives) or EN 15425 (PU adhesives), to confirm that their adhesives are suitable for structural bonding of Accoya. It may be possible to use other adhesives, but these would need to be confirmed by the relevant manufacturers.

Whilst EN14080:2013 suggests that the durability of glued laminated products shall be taken as the natural durability according to EN 350-2 of the timber from which they are made, and therefore DC1 with Accoya, professional bodies such as the Structural Timber Association (STA) in the UK consider the use of well-maintained water-repellent stain finishes together with rain screening and other protection measures as essential when used in Glulam applications, and therefore the Accoya Warranty will only apply to Glulam applications where this guidance and moisture exclusion is achieved and maintained.

Please contact your Accsys sales manager for best practice guidelines related to structural laminate design and maintenance.

6.7 Best practice in designing for moisture management in glulam beams includes:

- Protecting end grain
- Orienting lamella to achieve vertical grain on surfaces to mimimise checking and water ingress points
- A robust adhesive to prevent delamination and moisture ingress
- Regular inspection for identification and repair of splits or delamination
- A maintained, film forming coating
- Drainage, particularly on horizontal surfaces and ventilation.

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7 CONTACT WITH OTHER MATERIALS

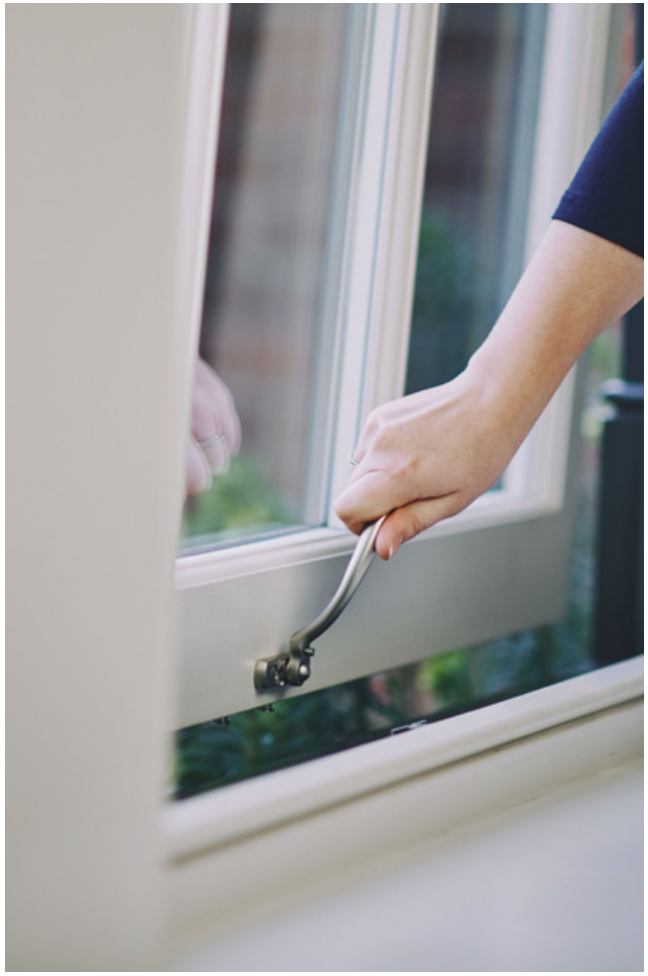
METALS

All wood contains organic acids, although the quantity varies by species. In moist conditions, 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. In wet circumstances, the Accoya wood will have a pH in the range of 4 – 5.5. For a list of system suppliers in your region, please visit the More about Accoya / System Suppliers section of our website **www.accoya.com**

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. Similar good practices that are commonly used in the industry for reference species such as oak and western red cedar should be adopted.

Indirect contact issues can occur in non-ventilated high humidity areas with a high risk of condensation (for example lock rebates, swimming pool enclosures, 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.



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7 CONTACT WITH OTHER MATERIALS METALS

7.1 Stainless steel

The use of corrosion-resistant stainless steel fasteners and fixtures that conform to EN 10088-1 is recommended, such as widely used 1.4301 (A2) or 1.4401 (A4) quality stainless steel. The A4 quality should be used in particularly challenging environments, such as in coastal regions or near highly polluted industrial zones. An international comparison of grade specifications is shown in the table below.

These comparisons are approximate only since exact properties vary by standard. 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.

7.2 Naval brass and aluminium

Corrosion testing on naval brass (brass containing tin) 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 performed well in internal testing: 3003, 6005, 6060 and 6063. Accsys 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.

7.3 Coated hardware

When stainless steel fixtures or other corrosion resistant metals are not available, coated fixtures (such as with epoxy, lacquer, polyurethane or powder coating) 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 during installation should be prevented to reduce risk of corrosion. For example, by predrilling for fasteners.

It should be noted that the performance of coated fixtures varies, and no particular standard that can be cited.

STAINLESS STEEL GRADE SPECIFICATIONS

USA	UNS No	Old British BS	EN	Euronorm No	Name	ISO 3506	French AFNOR	Swedish SS	Japanese JIS
304	S30400	304S31	58E	1.4301	X5CrNi 18-10	A2	Z 6 CN 18 09	2332	SUS 304
304L	S30403	304S11	-	1.4306	X2CrNi 19-11	-	Z 2 CN 18 10	2352	SUS 304L
3016	S31600	316S31	58H, 58J	1.4401	X5CrNiMo 17-12-2	A4	Z 6 CND 17.11	2347	SUS 316
316L	S31603	316S11	-	1.4404	X2CrNiMo 17-13-2	-	Z 2 CND 18.13	2348	SUS 316L

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7 CONTACT WITH OTHER MATERIALS METALS

7.4 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 oxidise. 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 damaged this product will be susceptible to local accelerated corrosion.

7.5 Coated steel 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.

7.6 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.
- The concentration of acetic acid in confined spaces, such as door lock houses, can rise and increase the risk of accelerated corrosion. Metals in these areas should also be sealed (for example with a vapour-proof epoxy or end grain sealer) even if there is no direct contact between metal and Accoya wood.
- 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.
- Avoiding moisture build up, specifically in engineered wood such as large size laminated sections through good design and with effective coatings. Cracks and fissures should be repaired. Regular inspections and proper maintenance is recommended to avoid problems occurring.
- Avoid damage to metal hardware during storage and transport (**section 3**).

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.

Further information may be obtained directly from suppliers of fasteners, hinges and locks.

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7 CONTACT WITH OTHER MATERIALS NON-METAL PRODUCTS

Accoya wood has been tested for compatibility with a wide variety of products commonly used in a wide range of applciations and regions. The information below is a summary of these findings, partly based on internal research and partly on extensive testing by system suppliers experienced with Accoya.

7.7 Sealants, gaskets and 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.

If not already tested and approved, 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.

7.8 Cleaning agents on uncoated wood

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 contain 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.***

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7 CONTACT WITH OTHER MATERIALS NON-METAL PRODUCTS

7.9 Fire retardants

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

Please note that certain fire retardant chemicals products might invalidate the Accoya warranty. Please contact your local Accoya sales manager to discuss compatibility of fire retardant chemicals with Accoya in respect to the Accoya warranty.

7.10 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 water ingress 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 for 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 (creating capillaries) should be avoided.

7.11 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 effectively 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.

Coating manufacturers often produce their own end grain sealers. In all cases, the end grain sealer should be approved as compatible by the coating manufacturer.

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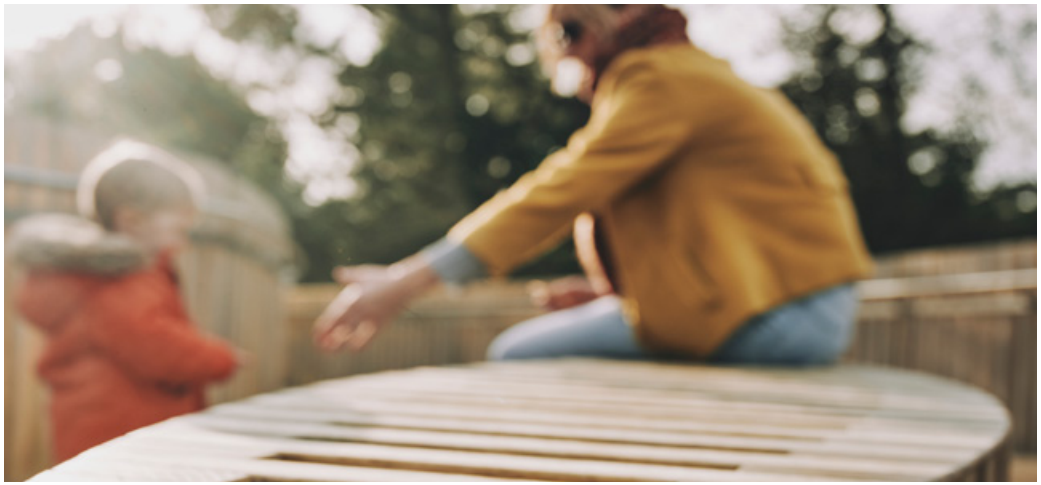
7 CONTACT WITH OTHER MATERIALS NON-METAL PRODUCTS

7.12 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.

It has been reported, particularly with recently treated and damp pressure treated lumber have been presented 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, isolation techniques such as plastic (or stainless steel) strips or spacers and barrier coatings are recommended. Design of the structure to allow quick drying of the pressure treated wood also reduces this staining risk. Alternatively, Accoya can be considered as a higher performing alternative to pressure treated lumber in these applications and will also eliminate green staining showing through.

Further information may be obtained directly from suppliers of barrier products.



WICKING OF PRESSURE TREATED SOFTWOOD FRAMING CHEMICALS THROUGH ACCOYA

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8 WEATHERING UNCOATED ACCOYA WOOD

From a technical performance perspective, in respect of attributes such as durability and dimensional stability, there is no need to finish Accoya wood for cladding and decking applications. Joinery applications are more complex so it is recommended that you seek expert advice before using Accoya for uncoated windows and doors.

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 blemished by a combination of UV, moulds, algae, mildew, yeasts and pollution. Accoya is no exception and the initial light colour of uncoated Accoya may cause early moulds and blemishes to stand out more than on other wood types, prior to it weathering further to grey.

8.1 Greying

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

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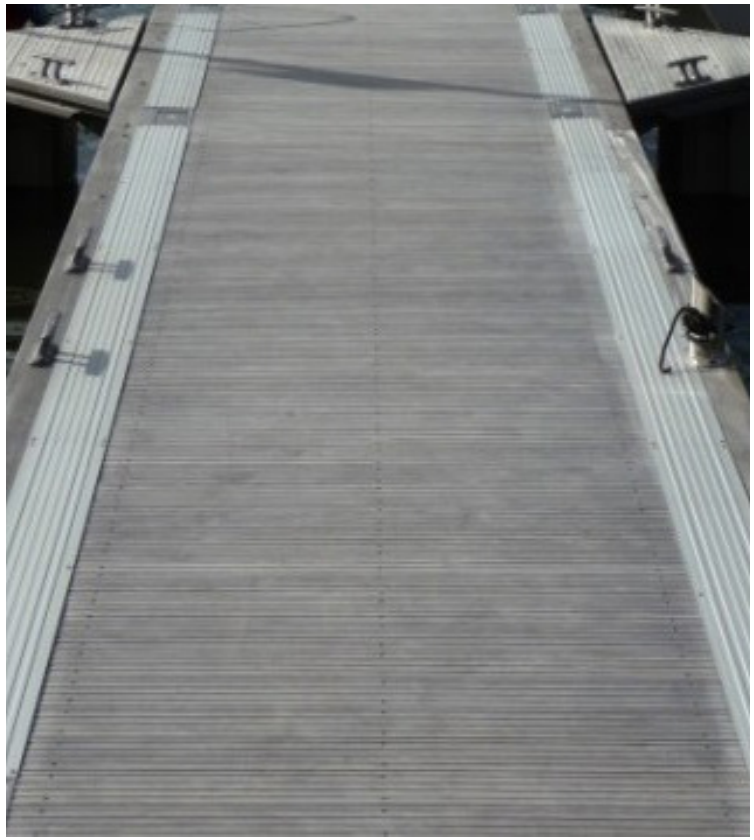

WEATHERED UNCOATED ACCOYA

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8 WEATHERING UNCOATED ACCOYA WOOD

- 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, dirt, pollution and other available organic compounds, but do not degrade the Accoya structure itself. However, pigment produced by these moulds and yeasts may discolour the surface.

The rate of weathering, eventual colour and level of surface growth will vary according to the amount of UV, elevation on a building, the surroundings, the installation details (particularly those related to ventilation) and the surface texture of the boards. 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, particularly as the initial Accoya colour is relatively light and does not camouflage these occurrences in early stages of weathering. See examples right.

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WEATHERED UNCOATED ACCOYA

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8 WEATHERING UNCOATED ACCOYA WOOD

However, 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.

8.2 Appearance

A wet and a dry board may vary in appearance, generally darker and less attractive when wet and brighter in dry weather. Due to the installation details, the presence of a shaded area and the natural differences in the wood between boards, as for instance density variation or grain orientation, 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 other surface growths.

CLADDING PROJECT, NORTH AMERICA

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8 WEATHERING UNCOATED ACCOYA WOOD

8.3 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. Independent review by BM Trada finds that Accoya is similar or less prone to mould and yeast growth than un-modified pine. However, in damp and/or shaded areas there is a high risk that surface growths will develop on Accoya wood, as they would on other (soft) wood species.

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.

8.4 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 by UV light. As this lignin holds the wood cells together, this degradation will lead to a rougher and more open surface. This may be evident as fine fibres on the surface, which will eventually erode.

The higher the amount or intensity of UV the surface is subject to, the faster this process will develop. It should be noted that these fibres are formed on all exposed wood species, including Accoya wood, particularly on flat surfaces like decking. A ribbed deck profile will tend to cause an accumulation of these fibres, making it all the more noticeable.

In rare cases, certain harsh climatic conditions may lead to a special form of surface fibres unrelated to UV-degradation. Typically, this involves an apparently extreme amount of surface fibres in spring, usually after a prolonged snow cover. A lengthy moisture load combined with a repeated freeze-thaw cycle during winter may lead to a mechanical disintegration of the (uppermost) wood surface.

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Rough sawn surfaces are more conducive to build-up

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8 WEATHERING UNCOATED ACCOYA WOOD

The Holzforschung institute of Austria has indicated that Robinia and thermally modified woods are particularly badly affected, but also larch, teak and sapele are prone to such behaviour. In all of these cases the durability of the Accoya wood is not compromised in any way. It is recommendable to periodically wash any loose fibres off, as they may flock together and become a spot for organisms to settle, which may lead to disfigurements.

Inappropriate use of pressure washers can increase occurrence of surface fibres. 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.

8.4 Naturally occurring surface fibres on decking

8.4 Fibres may get trapped in ribbed surface profiling

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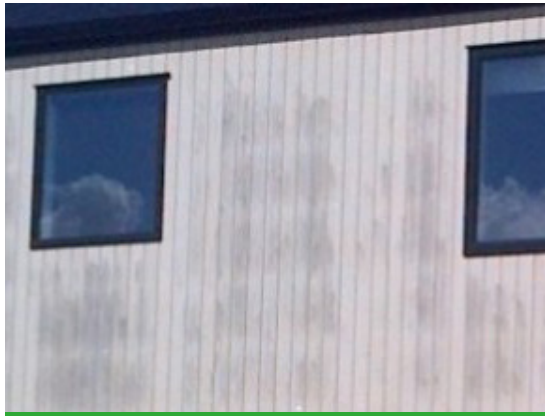
8 WEATHERING UNCOATED ACCOYA WOOD

8.5 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 or condensing around (even corrosion resistant) metal fixings as moisture in the boards evaporates. These discolourations will tend to fade and wash out over time.
- Aggressive cleaning agents can cause discolouration and may even affect the Accoya wood itself (**section 7**) if left to soak.
- Fasteners; staining around fasteners may occur when non-corrosion resistant steel is used (**section 7**). Also, fasteners may transport water to and from the subframe, which can contain natural extractives.
- Sub-frame silhouette; in some projects a distinct pattern reflecting the sub-frame behind Accoya and other types of wood cladding such as western red cedar, has been observed. This is caused by heat transfer from the building to the Accoya boards, which will decrease the average moisture content at the location of the interface. Dryer conditions mean less mould growth, which is why the interfaces are clear whereas the rest of the board surface shows mould. Adversely, inadequate ventilation of the cavity increases the potential for prolonged wetting of the battens and cladding. This may encourage the growth of surface mould on the Accoya cladding in line with the battens, visible as a darker discolouration band.
- 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 (see **section 7.12**). To prevent this staining risk, isolation techniques such as plastic (or stainless steel) strips or spacers and coatings are recommended. Design of the structure to promote quick drying of the pressure treated wood also reduces this staining risk.



8.5 A New Zealand housing project with a very distinct batten (sub-frame) silhouette showing in the cladding surface

8.5 Reddish brown staining

CONTENTS

8 WEATHERING UNCOATED ACCOYA WOOD

8.6 Preventive measures

Good design and maintenance is critical in minimising the incidence of surface moulds. Surface mould development can be reduced by decreasing the level of moisture the wood is subject to, for example by creating effective ventilation, avoiding water traps and shedding water naturally.

8.7 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.

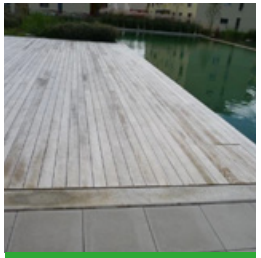
In normal situations a wooden deck should be cleaned once a year, preferably in spring. More frequent cleaning may be necessary in case permanently shaded areas can't be avoided, e.g. on the north side of a house or in the immediate vicinity of bush or tree cover. Flowerpots and plant troughs should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

Polluted surfaces can be cleaned with a nylon brush and clean water (refresh the water regularly until it stays clear); 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. 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.

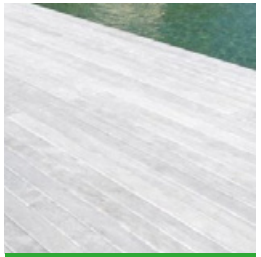
Persistent stains may be taken care of by using deck cleaners, which may also cause the surface of the wood to bleach to some extent. It is important to adhere to the instructions of the supplier. Make sure to wet the boards thoroughly before using such cleaning products, and after cleaning to rinse with plenty of clean water.

POOL DECKING IN OESINGEN, SWITZERLAND

Newly installed

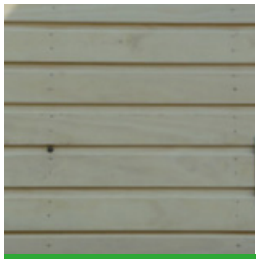


10 months of weathering

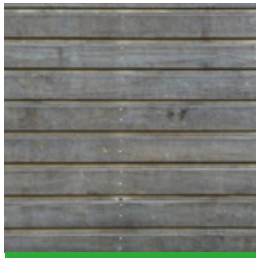


30 months of weathering

OFFICE CLADDING, VROOMSHOOP, THE NETHERLANDS



2 months of weathering



2 years of weathering

4 years of weathering

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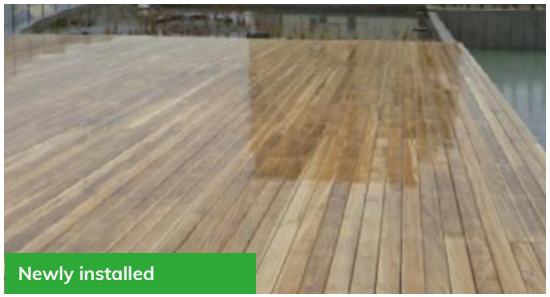
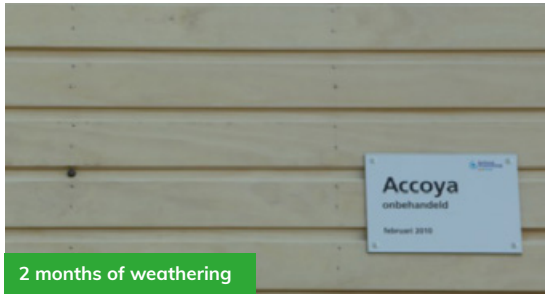
8 WEATHERING UNCOATED ACCOYA WOOD

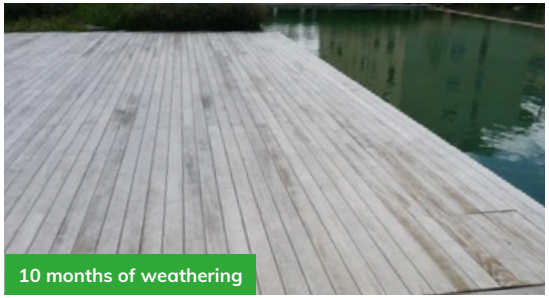

May 2019


Newly installed



2 months of weathering

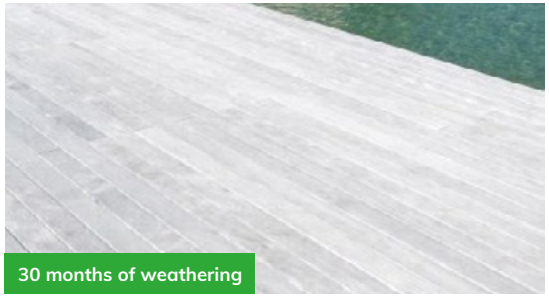

Jan 2020


10 months of weathering

2 years of weathering


April 2020

CLADDING PROJECT, NORTH AMERICA


30 months of weathering

POOL DECKING IN OESINGEN, SWITZERLAND

4 years of weathering

OFFICE CLADDING, VROOMSHOOP, THE NETHERLANDS

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9 COATINGS

Despite Accoya wood's excellent compatibility with a wide range of coating types, it is highly recommended having the coating manufacturer involved in the process, as they have in-depth knowledge of their products, suitable application techniques and how to assess the performance of the finished product.

Several leading coating companies have more than 10 years experience in testing and industrial application of their coatings on Accoya. In any case, the manufacturers recommendations should be followed to attain best application performance.

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.

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9 COATINGS

9.1 Preparation

- Accoya wood should be clean, dry (below 8% mc) and free of dust, grease and other pollution.
- 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. Resin blocking primers are essential for white paint finishes. Resin blocking primers are typically used on hardwood species and western red cedar.
- Accoya wood can absorb a high amount of water through the end grain – those should be effectively sealed (**section 4**).
- Due to its superior dimensional stability, the integrity of most film or semi film forming coatings will last considerably longer when applied to Accoya wood 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 overall and cosmetic appearance.
- Always follow the wet/dry film thickness recommendations from the coating manufacturer to optimize and preserve the coatings efficacy.
- In certain circumstances (more so with translucent coating systems), suitable and appropriate pre-coating surface preparation can help to achieve a more consistent, clean, uniform finish and improve the surface film application, appearance and performance. Planed surfaces that are left for a period of time before coating benefit from surface preparation (sanding / fladding or textured brushing) to remove any surface contamination.
- Accoya wood in contact with water will have a pH in the range of 4 to 5.5.

For processing guidelines, please consult **section 5**.

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9 COATINGS

9.2 Penetrating oils

Oils such as tung, linseed, and walnut oil, whether pure or oil/varnish mixtures, may be used with pleasing aesthetic results. Longevity of such non-film forming finishes on Accoya is typically no longer than on traditional wood types.

Please note that oils can be a food source to fungi and thus oils containing a mouldicide are recommended. 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.

9.3 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 tends 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. As a result of this trait, water-based stains may not penetrate as deeply or form as thickly on Accoya wood.

Non-film forming coatings typically last no longer on Accoya than on other wood types. Testing of a wide range of semi film forming coating brands on Accoya typically shows longer maintenance intervals on Accoya.

Clear or very light pigmented non or semi-film forming coatings are not recommended. See **section 9.5**.

9.4 Opaque and translucent coating (film forming)

Before a film forming coating is applied, it is recommended that all mechanical damage or wood defects are repaired with a suitable product. 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 each individual coating layer might be different with Accoya wood. Coating company guidelines for coating Accoya should be obtained and followed to achieve the required performance levels.

Coating performance on Accoya wood in joinery and cladding is improved and maintenance intervals are often prolonged. Film forming coatings further extend the maintenance intervals due to their high film builds, illustrated by leading international coating companies through numerous case study projects. Do not over apply the coating wet film thicknesses as this extends the drying process without adding to or enhancing performance.

Clear or very light pigmented non or semi-film forming coatings are not recommended. See **section 9.5**.

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9 COATINGS

9.5 Best practices for joinery

Accsys, working with leading coating companies, has gained 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 4** for moisture testing techniques.
- Opaque coatings with an excess of calcium carbonate (chalk) fillers can cause coating blistering on Accoya and must be avoided. Please consult your coatings provider.
- When using an opaque base coat, preferably an effective and well applied anti-stain blocking primer is included and this is critical for white coatings.
- 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.
- Clear or very lightly pigmented coatings are best avoided. They break down more rapidly in UV exposure and are particularly susceptible to disfiguring stains on or behind the coating. As an alternative to retain the original Accoya look, a translucent stain with a pigment level similar to the original Accoya wood should be considered.

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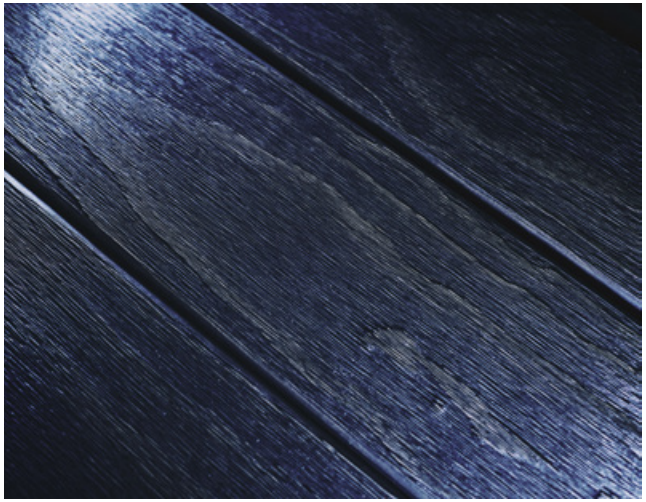

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9 COATINGS

- Sealers must be effectively used on all end grain throughout the joinery, with a product that is compatible with the paint system and approved by the coating manufacturer.
- Dip, flood and flow coat application of the first coating layer is widely practiced for all wood joinery and is particularly effective in forming an all-encompassing first coat. Monitor and control the level of wetting of Accoya wood during the flow coat, dipping and deluge application process. Accoya wood tends to be more porous than hardwood and some softwoods. Excessive wetting should be avoided as this can significantly extend drying times.
- Coating manufacturer's application methods and guidance should be followed with particular focus on avoiding aeration in the coating film when spraying, avoiding cold coatings (should typically be above 15°C (60°F) at application), correct film thickness and appropriate drying techniques/conditions.
- Coatings should be thoroughly cured in a humidity 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 three layers of paint behind hardware that may be prone to corrosion helps create an isolation barrier between it and the wood. It is also good joinery practice to spray inside any lock housings and apply end grain sealer. Please see **section 7** for more details on contact with metals.

Accoya wood contains a small amount of acetic acid. In some circumstances this can disturb the factory coating processes 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.

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9 COATINGS

9.6 Deck coatings

To obtain a "natural appearance" of an Accoya wood deck with reduced potential discolouration issues, a translucent non film-forming coating, an oil-based stain or some other type of hydrophobic agent is an option. Darker or more highly pigmented coatings typically have longer maintenance intervals.

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.

- A fully factory applied coating system is strongly recommended. Coating 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 to prevent risks of water absorption prior to coating and other in field complications.
- 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 of a stain should contain an effective mouldicidal component to help protect the wood from possible disfigurement. Generally, the darker the pigment, the greater the maintenance interval.
- Clear or lightly pigmented coatings are not recommended for Accoya decks. They will generally provide little protection to weathering and greying and can make cleaning of the surface more difficult if disfigurement occurs beneath them.
- Pigmented coating systems 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 wood may vary.
- Using somewhat thicker and/or multiple coating layers will help reduce moisture absorption and therefore the risk of mould and/or 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.
- If so required, slip resistant coatings or applied strips can be used on Accoya wood in the same way as on other timber decking.

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9 COATINGS

9.7 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 cleaning and re-coat is most common and good practice.

- 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. This includes applying the optimum coating film thickness as coating system performance can be affected where films are too low or high.
- 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.

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10 FIRE BEHAVIOUR

10.1 EU – Product standard

Accoya wood is part of the scope of EN14915:2013 + A2:2020 '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 as well as 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 that covers the entire cladding system; including fasteners, detailing, sub-frame and substrate backing the cavity. This means that it is not possible to classify Accoya wood on its own.

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EN 14915 excerpt Product	Product detail	Mean density ≥	Board thickness ≥ max/min	End-use condition	Class
Panelling / cladding	Wood pieces with or without tongue and groove & with or without profiled surface	390 kg/m³	9 / 6mm	Without air gap or with closed air gap	D-s2, d2
		390 kg/m³	12 / 8mm	Without air gap or with closed air gap	D-s2, d0
Panelling / cladding	Wood pieces with or without tongue & groove and with or without profiled surface	390 kg/m³	9 / 6mm	With open air gap ≤ 20mm behind	D-s2, d0
		390 kg/m³	18 / 12mm	Without air gap or with closed air gap	D-s2, d0
Wood ribbon elements	Wood pieces mounted on a support frame	390 kg/m³	18mm	Surrounded by open air on all sides	D-s2, d0

NB: The above table is based on table 1 of EN14915:2013 + A2:2020. For further details please refer to this standard.

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10 FIRE BEHAVIOUR

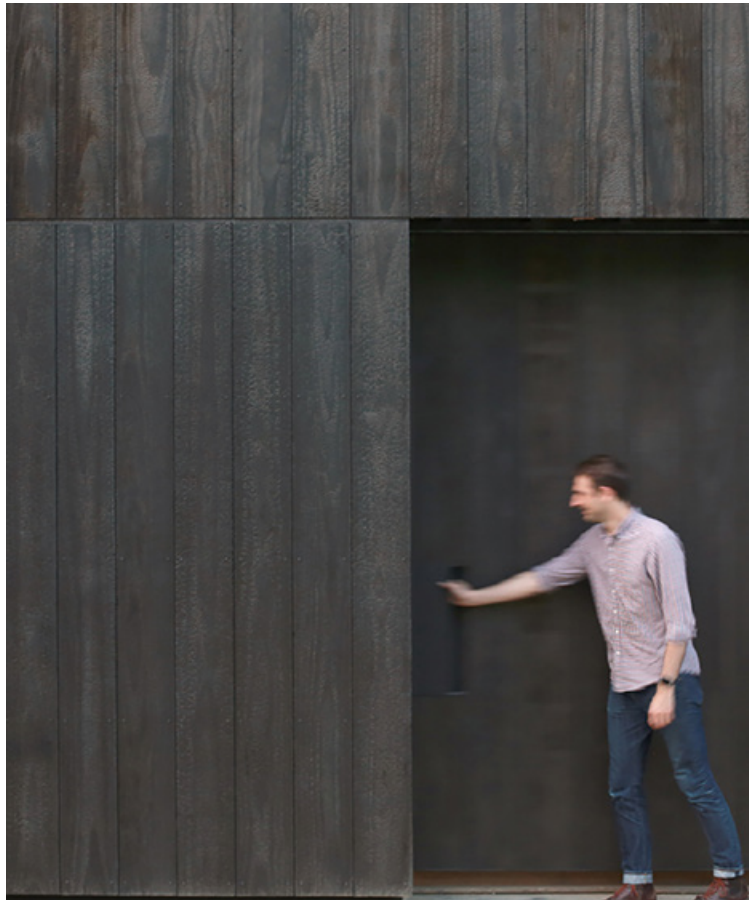
To avoid testing all possible cladding systems according to EN 13501-1 (single burning item or SBI test), the EN 14915 standard gives guidelines for certain cladding systems that are classified without the need for further testing (table on previous page), in which untreated chemically modified wood is classified as Class D, the same class as other softwoods.

If certain local regulations or building codes call for it, Accoya cladding can meet higher requirements, up to Class B, by giving it a fire retardant treatment. This can be done by impregnating fire retardant chemicals. The Wood Protection Association provides guidance on selection and use of fire retardant treatments.

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. The Wood Protection Association provides a guidance document on the test requirements. Please contact your Accsys sales representative for fire retardant treatment options available in your region.

As with other woods, fire retardant chemicals used with Accoya generally 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 can affect the Accoya decay and dimensional stability warranty position and Accsys should be contacted to check queries pertaining to this.

For more information please visit **www.thewpa.org.uk/flame-retardants**



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10 FIRE BEHAVIOUR

10.2 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.

ASTM E84 CLASSIFICATION TABLES

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

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

** Note that the classifications presented on this page are valid for untreated Accoya wood. Higher ratings can be achieved when using fire retardants.

10.3 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 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 515 kg/m³, Accoya wood (radiata pine) is classified, as other softwoods, outside of these lists.

10.4 New Zealand

New Zealand uses the same fire testing principles as Europe (the so-called room corner test or SBI), 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 wood is likely to be a group number 4 material, comparable to other softwoods.

Wood / species	Flame spread index*	Smoke developed index*
Accoya**	95	155
Douglas fir	70	80
Eastern white pine	85	122
Lodgepole pine	93	210
Oak	100	100
Sitka spruce	74	74
Southern pines	103-195	n/a
Western red cedar	70	213

CONTENTS

11 CONTACT

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