

**Timbers for window joinery – Part 4:  
Modified Timbers**

**Supplement 1: ACCOYA®**

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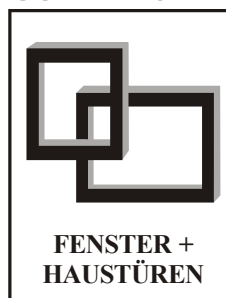
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## 1 Introduction

This supplement complements the VFF Guidance Sheet HO.06-4 “Timbers for window joinery -Part 4: Modified timbers” with proven product-specific data. This guidance sheet describes the established modification processes and specifies the property requirements for the production of dimensionally stable exterior joinery as well as suitable test methods for these properties. The properties listed hereinafter are explained by the guidance sheet which also comprises general advice. The guidance sheet also comprises a bibliography.

## 2 Scope

This supplement contains the product description of the modified timber product “ACCOYA® Wood“ as well as the description of a quick test method (cf. Clause 3), by the aid of which the adherence to the warranted characteristics can be checked (cf. Table B1, Clause 4, fourth line). **This supplement may only be applied in conjunction with a valid version of VFF Guidance Sheet HO.06-4 “Timbers for window joinery – Part 4 modified timbers.”**

This supplement is valid at maximum until the date stated on the cover. If the suitability has not changed, the term of validity will be prolonged correspondingly upon query at the manufacturer of “ACCOYA® Wood“. If the manufacturer effects any changes to a modified timber product described in a supplement to this guidance sheet, which influence the properties of the product, or should he have gathered new findings respective to individual characteristics listed in the technical description – even within the term of validity of three years – he shall submit these to the Gütegemeinschaft without delay, including the appropriate proofs (test reports). Taking account of the proofs furnished by the manufacturer, the supplement will be revised accordingly and the published with a new term of validity. This also applies if the modified timber product “ACCOYA® Wood“ is no longer produced and this supplement has to be withdrawn.

## 3 Product description

ACCOYA® wood is a modified wood product made from Radiata pine (*Pinus radiata*) which is acetylated according to the process of ACCSYS Technologies London, United Kingdom which is patented worldwide.

The assured properties of acetylated Radiata pine (ACCOYA® wood) are listed in Table B1. The property performances quoted in Table B1 below are based on pertinent test reports, where products and components customarily used in window production were tested. **Where it is intended to use deviating constructions and/or components, their suitability and/or compatibility shall be proven by corresponding additional tests.**

### GENERAL NOTE:

Special care has to be taken when machining, processing and finishing acetylated Radiata pine (ACCOYA® wood). The specifications furnished by the suppliers for adhesives, coating systems, fittings, sealants, gaskets, and insulating glass shall be strictly observed. Different results may be obtained depending on the product used. **Therefore, only products authorized by the supplier may be used.** Due to the reduced wettability, drying and curing periods may need to be extended

Where available, the characteristics of untreated Radiata pine as well as Scots pine (*Pinus sylvestris*) are quoted with the properties of ACCOYA® wood.

According to the indices<sup>(x)</sup> the numerical values given in Table B1 are of the following types:

<sup>1</sup> Mean value, Minimum ... Maximum

<sup>2</sup> Mean value/Maximum

<sup>3</sup> Mean value/characteristic value

<sup>4</sup> Mean value/Minimum

**Table B1: Properties of acetylated Radiata pine (ACCOYA® wood)**

Property		ACCOYA® wood		Application advice
<b>1. General characteristics</b>				
Timber specie(s)		<i>Pinus radiata</i> (PNRD: Radiata pine) from plantations		
Timber quality		EN 942: J10. The Accoya A1 grading quality corresponds to this appearance class. The Accoya grading quality A2 corresponds to appearance class J20.		
<b>2. Manufacturing process</b>				
Modification process		Acetylation in a closed autoclave Proofs of quality assurance: - KOMO-Certificate 33058/21 "Modified timber" - FCBA-Certificate No. 517-22-2068-gb - ICC-ES Evaluation Report ESR 2825		The timber is acetylated to a defined degree to ensure that the timber achieves durability class 1 (throughout the cross section). This is documented by continuous factory production control and third party supervision.
Structure and colour changes caused by modification		During acetylation, the resins are partly dissolved and accumulate on the surface of the timber. This leads to an olive-brown surface discolouration similar to oak. Acetylation does not cause micro cracks and cell collapse.		The discolouration caused by the process (slight darkening of the surface) has no negative effects on machining and finishing.
Simple procedure for testing guaranteed properties		Immersion of a cross section in cold water ( $20 \pm 2$ °C) between 30 and 50 mm (storage on timber battens). Measurement of cross-sectional dimensions prior to and after 24 h water immersion.		Maximum increase of cross-sectional dimensions: + 2,5 % for oven-dried wood + 1,5 % for conditioned wood (room temperature), cf. also 4.2
<b>3. Material properties</b>				
<b>3.1 Physical properties</b>				
Resistance against wood destroying fungi		ACCOYA®	Radiata	
		Class 1	Class 4-5	
Resistance against blue stain		Not resistant		Protection against blue stain required
Density <sup>1</sup> (at 20 °C/65 % r.h.)	g/cm <sup>3</sup>	ACCOYA®	Radiata	Checking of density required during receiving inspection and testing
		0,53 0,45 ... 0,61	0,47 0,42 ... 0,55	
Equilibrium wood moisture at 20 °C/ 65 % r.h.	%	ACCOYA®	Radiata	Commercially available timber moisture meters using the electrical resistance or the capacitance methods will only yield approximate estimates. Most of these meters will not measure below 6% mc. When using the capacitance method, density shall be set to 510 kg/m <sup>3</sup>
		4,5	9,8	
		Fibre saturation point of ACCOYA® is about 10 % ... 12 %		
Swelling and shrinkage properties <sup>2</sup>		ACCOYA®	Radiata	
Radial	%	0,7 / 1,0	3,4 / 4,0	
Tangential	%	1,5 / 2,3	7,9 / 9,6	
Axial	%	0,13/0,36	not specified	
Capillary water uptake <sup>2</sup>		ACCOYA®	Radiata	
Radial	kg/m <sup>2</sup> .h <sup>-0,5</sup>	0,41/0,50	0,64/0,78	
Tangential	kg/m <sup>2</sup> .h <sup>-0,5</sup>	0,30/0,42	0,27/0,50	
Axial	kg/m <sup>2</sup> .h <sup>-0,5</sup>	1,6/2,3	2,0/2,5	
Resistance to fire		D acc. EN 13501-1, B2 acc. DIN 4102		
Thermal conductivity ( $\lambda_D$ -value)	W/mK	0,12		Declared lambda value based on tests according to EN 12664 in connection with EN 10456

Property		ACCOYA® wood			Application advice	
<b>3.2 Mechanical properties</b>						
Bending strength <sup>3</sup>	N/mm <sup>2</sup>	ACCOYA® A1	Radiata		Strength classes acc. EN 338 (Structural Timber – Strength Classes) Accoya grading quality A1: C 22 Accoya grading quality A2: C 16	
		45,3/22,7	43,0/25,8			
Modulus of elasticity in bending <sup>3</sup>	N/mm <sup>2</sup>	ACCOYA®	Radiata			
		9920/5290	9060/5200			
Compression strength parallel and perpendicular to grain <sup>3</sup>	N/mm <sup>2</sup>	ACCOYA®	Radiata			
		Axial	58,5/40,2	42,5/31,5		
		Radial	5,8/4,8	5,0/4,5		
		Tangential	4,4/3,6	3,3/2,4		
Impact bending <sup>3</sup>	kJ/m <sup>2</sup>	ACCOYA®	Radiata			
		50,0/22,0	48,0/20,0			
Resistance to axial withdrawal of screws <sup>4</sup>	kN		ACCOYA®	Radiata	Tested as manufactured with countersunk, recessed SPAX-screws Z, 3,5 x 35 mm and ASSY 3.0 piano hinge screws 3,5 x 35 mm	
		radial	2,4 / 2,0	2,0 / 1,7		1,7 / 1,5
		tang.	2,0 / 1,7	1,7 / 1,2		1,7 / 1,5
		axial	1,9 / 1,4	1,4 / 1,0		1,5 / 1,1
Surface hardness <sup>4</sup> (Janka)	kN		ACCOYA®	Radiata		
		radial	4,0 / 2,9	2,8 / 1,8		
		tangential	4,2 / 3,2	2,7 / 1,6		
		axial	6,6 / 5,4	3,6 / 2,8		
Surface hardness (Brinell)	N/mm <sup>2</sup>	not specified	23,4	13-19		
<b>3.3 Chemical properties</b>						
Registration, evaluation and accreditation of chemicals (REACH)	Not applicable. During acetylation, only non-hazardous substances are used resp. produced					
<b>4. Suitability for window construction</b>						
<b>4.1 Suitability as a component for windows</b>						
Suitability for laminated and/or finger-jointed constructions	The following combinations were tested: - 3 lamellae ACCOYA®, - 1 lamella ACCOYA® + 2 lamellae Scots pine, - 1 lamella ACCOYA® + 2 lamellae Norway spruce			EPI-adhesives can be recommended for lamination and finger-jointing. Use products authorized by the manufacturer only		
Bonding strength of adhesives	in general, no differences with untreated Radiata pine. MUF systems are not recommended.			Use products authorized by the manufacturer only.		
Compatibility with surface coatings	in general, no differences with untreated Radiata pine Where translucent coatings are used, stickermarks of the acetylation process may be visible through the coating. It is therefore recommended to make up a reference sample for the end user.			Sealing of cross-grain recommended. Sanding between coats may not be necessary. Use products authorized by the manufacturer only. Contaminations, e.g. after installation, should be removed within 8 h in order to avoid discolouration.		
Compatibility with fittings and fasteners	Acetic acid content may lead to corrosion (Oxidation, white corrosion, red corrosion) of lesser grade metals.			Preferably, stainless steel (A2/A4 quality) fixtures should be used. When these fixtures or other corrosion resistant metals are not available, coated fixtures should be considered. Use products authorized by the manufacturer only.		

Property	ACCOYA® wood	Application advice
Compatibility with sealants (adhesion)	WG 1: Neutral-silicone: no interference observed WG 2: Alkoxy-silicone: <b>restricted suitability!</b> WG 3: MS sealant no interference observed	Incompatibility of adhesion with acetic-curing silicone sealants. Application of primers required. Use products authorized by the manufacturer only.
Compatibility with gaskets (sealing profiles)	WG 1: Polyethylene, polypropylene: no interference observed WG 2: Silicone-natural rubber: no interference observed WG 3, WG 4: Thermoplastic elastomers: no interference observed WG 5: Soft PVC: no interference observed	Use products authorized by the manufacturer only.
Compatibility in contact with the insulating glass seal	During a short test: insulating glass test P3 acc. ift Guideline DI-01/1 (only case 1) no interferences were observed	Use products authorized by the manufacturer only.
Tips on processing Sawing, moulding, cutting drilling, torque for screwing, etc.	In comparison to untreated wood, the acetylated pine wood (ACCOYA®) machines very easily and has a reduced abrasiveness. Noise emission of tools is reduced as well.	Fibre chip-out during machining. ACCOYA® is reduced, which produces smoother surfaces in comparison with unmodified wood. Application recommendations of the paint manufacturers shall be adhered to.
Development of dust	The amount of dust fines is significantly increased in comparison to non-modified timber.	During comparative measurements of the Timber Employers liability insurance association (Holz-Berufsgenossenschaft) in a manufacturing plant, the maximum workplace concentrations (MAK-values) were not exceeded.
Emissions during woodwork- ing (volatile organic com- pounds for which MAK- values are in force)	During machining of unfinished ACCOYA®, acetic acid may be emitted.	During comparative measurements of the Timber Employers liability insurance association (Holz-Berufsgenossenschaft) in a manufacturing plant, the maximum workplace concentrations (MAK-values) were not exceeded.
Recycling of product residues, ordinance on used wood		Production residues of ACCOYA® shall be classified as used wood category A II
Substances of high concern acc. REACH (“candidate list”) hazardous substances acc. TRGS 900	Not applicable. During acetylation, only non-hazardous substances are used resp. produced	Safety data sheet available.
<b>4.2 Suitability as end product (wood window)</b>		
Glueing and corner strength	Tests were carried out on mortice-and-tenon-joints glued with EPI-adhesives based on DIN 68121. For solid timber blanks and 3-layer laminates made from ACCOYA® (IV 68 and IV 78 respectively) the weight classes (casement weight) 130 kg (IV 68) and 150 kg (IV 78) were achieved.	For other constructions of corner joints (e.g. dowel-, mechanical joints), the respective proofs have to be furnished.
Natural weathering of win- dows (vertical position)	After 4 years of outdoor exposure no changes were seen on Accoya windows; no corrosion of stainless steel screws and coated fixtures, no open joints, and no coating damages occurred.	

Property	ACCOYA® wood	Application advice
<b>5. Final product</b>		
Emission testing (chamber testing)		Residual emissions of acetic acid from surface-coated ACCOYA® will in general not lead to any detectable odour annoyances.

## 4 Testing procedures

The users of acetylated Radiata pine ACCOYA® may apply the following, simple test routines during their receiving inspection and testing in order to verify that the deliveries comply with the properties specified above.

### 4.1 Visual Tests

Check the deliveries for completeness and compliance with the order. Compliance of the delivery with the KOMO product certificate No. 33058/21 shall be declared, furthermore, the delivery shall be marked with the production number (lot number).

### 4.2 Measurements

#### 4.2.1 Testing apparatus

- a) timber moisture meter
- b) sliding calliper
- c) water tank with cold water ( $20 \pm 2$  °C)

#### 4.2.2 Test pieces

For this test, sections of solid or laminated blanks of 300 mm length are used.

#### 4.2.3 Preparation of test pieces

The moisture content of the test pieces is determined. Moisture meters using the electrical resistance method shall be set to “Radiata pine”, “pine” or “softwood”. Moisture meters using the capacitance method shall be set to a density of 510 kg/m<sup>3</sup>. The test pieces shall have a moisture content of 6-7 % max. If this is not the case, the test pieces have to be dried down and the determination of moisture content shall be repeated after drying.

#### 4.2.4 Execution of the test

Length and width are marked at one end of the test pieces and are measured with the sliding calliper (cf. fig. A.3.1). The measured values are recorded. This end of the test pieces is then immersed in water in such a way that between 30 and 50 mm of the test pieces are covered by the water. They are left in the water for  $24 \pm 1$  h.



**Fig. B1:** Measurement of length and width of the test pieces

#### 4.2.5 Determination of results

The test pieces are removed from the water, surplus water is removed. Afterwards, moisture content is determined at the immersed end. It shall now be significantly higher than before immersion (> 20 %). Length and width after immersion are measured and recorded.

Determination of the increase in length and width:

$$\Delta l/\Delta b = \frac{l_2/b_2 - l_1/b_1}{l_1/b_1} \times 100 (\%)$$

Where:

$\Delta l/\Delta b$ : increment of length and width of the test piece  
 $l_1/b_1$ : length/width of test piece before immersion in water  
 $l_2/b_2$ : length/width of test piece after immersion in water

#### 4.2.6 Requirements

Maximum increase of cross sectional dimensions may not exceed:

- + 2,5 % for oven-dried wood and
- + 1,5 % for conditioned wood (room temperature).

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