KLH®

MADE FOR BUILDING
BUILT FOR LIVING

CROSS-LAMINATED TIMBER

IMPRINT

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KLH®

CONTENT

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Cross-laminated timber (German abbreviation: KLH) is produced from layers of spruce wood that are arranged crosswise on top of each other and glued to each other with a pressing power of 6 N/mm² to form large-sized solid wood elements. The crosswise arrangement of the longitudinal and transverse layers reduces the swelling and shrinkage of the wood in the plane of the panel to an insignificant minimum and considerably increases the static load-carrying capacity and dimensional stability.

In order to rule out any damage caused by pests, fungi or insects, in compliance with the European Technical Approval, technically dried wood with a wood moisture of 12% (+/-2%) is used to produce KLH solid wood panels. To achieve our high material characteristics, all timber lamellae undergo internal sorting before being used (in addition to customary quality control).

GLUING

Gluing takes place using solvent-free and formaldehyde-free PUR adhesive which has been tested in accordance with DIN 68141 and other strict criteria of MPA Stuttgart, and approved for the production of load-bearing and non-load-bearing timber components and special constructions in accordance with DIN 1052 and EN 301.

The glue is applied automatically over the entire surface with an optimised amount of adhesive. A high-quality level of adhesion is achieved as a result of the high pressing power.

MAXIMUM SIZE

Maximum length	16.50 m
Maximum width	2.95 m
Maximum thickness	0.50 m
Minimum production lengths	8 m, respectively in 10 cm increments up to the maximum length
Produced widths	2.40 / 2.50 / 2.72 / 2.95 m On request 2.25 m

SURFACES

KLH solid wood panels are offered as standard in non-visible quality, industrial visible quality and domestic visible quality. Special surfaces can be provided on request. For further information, as well as quality details about the respective surfaces, see the following pages and www.klh.at.

CNC CUTTING

Factory cutting or beaming takes place using state-of-the-art CNC technology, the basis for which are the production and cutting plans released by the client or the executing company, respectively.
The cutting accuracy is within the range of tolerances in building construction – according to DIN 18203/Part 3 for wall, floor, ceiling and roof panels made of timber materials. On request and with the appropriate equipment, the panels can also be cut by the relevant construction company.
Please also pay attention to the cutting tolerances indicated by us at www.klh.at.

ASSEMBLY

The cut-to-size KLH solid wood elements are delivered to the construction site just before they are needed, and there they are assembled by expert timber construction companies or construction firms using a building crane in the shortest possible construction period.
The links created between tradition, well-founded craftsmanship and state-of-the-art timber construction technology enable individual construction with lasting value and a particular focus on the environment and energy consumption.

PRODUCT ADVANTAGES

- Ecologically sustainable building material
- Recommended in terms of building biology
- Positive ecobalance
- Healthy, comfortable room climate
- Solid wood construction with lasting value
- Freedom in architectural implementation
- Flexible design without a grid pattern
- Compatible with steel, glass and other materials
- Excellent static properties
- Increasing space thanks to slender construction elements
- Technically approved and CE certified building product
- Quality controlled production
- Prefabricated elements with high dimensional accuracy
- CNC controlled cutting of the elements
- Delivery directly to the construction site
- Easy to install
- Short construction period
- Dry construction method
- Buildings are ready for occupancy in a short time

AREAS OF APPLICATION

KLH solid wood panels are used both as load-bearing, reinforcing elements and non-load-bearing elements.

- Detached houses and apartment buildings
- Multi-storey residential buildings
- Public buildings
- Hotels and restaurants
- Old people's homes
- Schools and kindergartens
- Office and administrative buildings
- Event halls
- Industrial and commercial buildings
- Reconstructions and extensions
- Bridges
- …

KLH

TECHNICAL APPROVALS AND CERTIFICATES

EUROPEAN TECHNICAL APPROVAL	ETA - 06/0138
GENERAL BUILDING APPROVAL FOR GERMANY	Z-9.1-482
TECHNICAL APPROVAL FOR FRANCE	AT-3/06-477
TECHNICAL APPROVAL FOR SPAIN	AITIM 31-01
QUALITY MANAGEMENT	In accordance with ISO EN 9001:2008
ENVIRONMENTAL MANAGEMENT	In accordance with ISO EN 14001:2004
ENVIRONMENTAL PRODUCT DECLARATION (EPD)	In accordance with ISO 14025
PEFC CERTIFICATION	

EN ISO 9001
Zertifikat Nr. 20 100 102005046
www.tuv.at

EN ISO 14001
Zertifikat Nr. 20 104 102005188
www.tuv.at

Institut Bauen und Umwelt e.V.

DOWNLOAD OF CERTIFICATES

All approvals and certificates are available for download at www.klh.at.
By request, we would be pleased to send them to you in printed form.

TECHNICAL DETAILS

PRODUCT	Large-sized solid wood panel with crosswise glued lamellae
PRODUCT NAME/BRAND	KLH
OTHER PRODUCT NAMES	Cross-laminated timber (CLT), plywood boards (PBs), X-Lam
USE	Structural elements for walls, ceilings and roofs
DURABILITY	Service classes 1 and 2 according to EN 1995-1-1
WOOD TYPES	Spruce (pine, fir, stone pine and other wood types on request)
PANEL STRUCTURE	3, 5, 7 or more layers depending on static requirements
LAMELLAE	Thickness 10 to 40 mm, technically dried, quality-sorted and finger-jointed (with additional internal sorting to ensure compliance with our high material specifications)
STRENGTH CLASS	C 24 according to EN 338, maximum 10% C 16 permitted (compare ETA-06/0138)
GLUING	Formaldehyde-free PUR adhesive, approved for load-bearing and non-load-bearing components indoors and outdoors according to EN 301
LAMINATING PRESSURE	At least 0.6 N/mm²
WOOD MOISTURE	12% (+/- 2%) on delivery
MAXIMUM DIMENSIONS	Length 16.50 m / width 2.95 m / thickness 0.50 m
PRODUCED WIDTHS	2.40 / 2.50 / 2.72 / 2.95 m
SURFACES/QUALITY CATEGORIES	Non-visible quality (NVQ) / industrial visible quality (IVQ) / domestic visible quality (DVQ)
WEIGHT	5.0 kN/m³ according to EN 1991-1-1:2002 for structural analysis 471 kg/m³ for determination of transport weight
DEFORMATION RATE	In panel plane ~0.01% per % change in wood moisture content Perpendicular to panel plane (panel thickness direction) ~0.20% per % change in wood moisture content
THERMAL CONDUCTIVITY	λ = 0.13 W/(m*K) according to EN 12524
HEAT CAPACITY	c_p = 1600 J/(kg*K) according to EN 12524
DIFFUSION RESISTANCE	μ = 25 to 50 according to EN 12524
AIR TIGHTNESS	Panels with 3 layers in IVQ or DVQ or panels with 5 or more layers can be used as airtight layers. Connections to other components, butt joints, penetrations, etc. must be sealed appropriately.
REACTION TO FIRE	Euro class D-s2, d0
CHARRING RATE	According to ETA - 06/0138

KLH STANDARD PANEL TYPES AND STRUCTURES

COVERING LAYER IN THE TRANSVERSE PANEL DIRECTION TT (WALL)

Nominal thickness in mm	in layers	Lamella structure [mm]					Standard panel widths [m]	Maximum panel lengths [m]
		T	L	T	L	T		
57	3 l	19	19	19			2.40 / 2.50 / 2.72 / 2.95	16.50
72	3 l	19	34	19			2.40 / 2.50 / 2.72 / 2.95	16.50
94	3 l	30	34	30			2.40 / 2.50 / 2.72 / 2.95	16.50
120	3 l	40	40	40			2.40 / 2.50 / 2.72 / 2.95	16.50
95	5 l	19	19	19	19	19	2.40 / 2.50 / 2.72 / 2.95	16.50
128	5 l	30	19	30	19	30	2.40 / 2.50 / 2.72 / 2.95	16.50
158	5 l	30	34	30	34	30	2.40 / 2.50 / 2.72 / 2.95	16.50

COVERING LAYER IN THE LONGITUDINAL PANEL DIRECTION TL (CEILING/ROOF)

Nominal thickness in mm	in layers	Lamella structure [mm]							Standard panel widths [m]	Maximum panel lengths [m]
		L	T	L	T	L	T	L		
60	3 l	19	22	19					2.40 / 2.50 / 2.72 / 2.95	16.50
78	3 l	19	40	19					2.40 / 2.50 / 2.72 / 2.95	16.50
90	3 l	34	22	34					2.40 / 2.50 / 2.72 / 2.95	16.50
95	3 l	34	27	34					2.40 / 2.50 / 2.72 / 2.95	16.50
108	3 l	34	40	34					2.40 / 2.50 / 2.72 / 2.95	16.50
120	3 l	40	40	40					2.40 / 2.50 / 2.72 / 2.95	16.50
95	5 l	19	19	19	19	19			2.40 / 2.50 / 2.72 / 2.95	16.50
117	5 l	19	30	19	30	19			2.40 / 2.50 / 2.72 / 2.95	16.50
125	5 l	19	34	19	34	19			2.40 / 2.50 / 2.72 / 2.95	16.50
140	5 l	34	19	34	19	34			2.40 / 2.50 / 2.72 / 2.95	16.50
145	5 l	34	21.5	34	21.5	34			2.40 / 2.50 / 2.72 / 2.95	16.50
162	5 l	34	30	34	30	34			2.40 / 2.50 / 2.72 / 2.95	16.50
182	5 l	34	40	34	40	34			2.40 / 2.50 / 2.72 / 2.95	16.50
200	5 l	40	40	40	40	40			2.40 / 2.50 / 2.72 / 2.95	16.50
201	7 l	34	21.5	34	22	34	21.5	34	2.40 / 2.50 / 2.72 / 2.95	16.50
226	7 l	34	30	34	30	34	30	34	2.40 / 2.50 / 2.72 / 2.95	16.50
208	7 II	68	19	34	19	68			2.40 / 2.50 / 2.72 / 2.95	16.50
230	7 II	68	30	34	30	68			2.40 / 2.50 / 2.72 / 2.95	16.50
248	7 II	74	30	40	30	74			2.40 / 2.50 / 2.72 / 2.95	16.50
* 260	7 II	80	30	40	30	80			2.40 / 2.50 / 2.72 / 2.95	16.50
* 280	7 II	80	40	40	40	80			2.40 / 2.50 / 2.72 / 2.95	16.50
247	8 II	68	21.5	68	21.5	68			2.40 / 2.50 / 2.72 / 2.95	16.50
* 300	8 II	80	30	80	30	80			2.40 / 2.50 / 2.72 / 2.95	16.50
* 320	8 II	80	40	80	40	80			2.40 / 2.50 / 2.72 / 2.95	16.50

* Special panel types

Special panel structures are available on request. By using double layers, for example the longitudinal or transverse rigidity of the panel can be further enhanced. The fire resistance of the KLH solid wood panel can also be influenced by modifying the structures and can eventually be improved in relation to specific project requirements.

NON-VISIBLE QUALITY (NVQ)

Non-visible quality is only recommended for non-visible construction components, planked from both sides. The lamellae are sorted according to strength classes. Most of them are rated as C 24 strength class timber, use according to approval. The longitudinal layers are finger-jointed.

INDUSTRIAL VISIBLE QUALITY (IVQ)

As a standard, industrial visible quality is executed in a one-sided manner. A double-sided version of this surface is available on request. Industrial visible quality is suitable for industrial surfaces, but not for visible surfaces in living areas.
For industrial visible surfaces, one-sidedly sorted spruce lamellae of B quality are used and are finger-jointed in some cases.

DOMESTIC VISIBLE QUALITY (DVQ)

Domestic visible quality panels are either glued, laminated block-boards at customary widths of approx. 1.20 m or glued, finger-jointed lamellae of AB quality. As a standard, the face side of the panel is of domestic visible quality – panels of domestic visible quality on both sides can be produced on request.

SPECIAL SURFACES (S)

Pine, stone pine, fir and other conifers are available on request but depend on the availability of raw materials.

Please note the relevant information on the following pages

- Grade classes A, B, C – extract from the EN 13017-1, table 1
- Quality definitions for KLH solid wood panels
- Instructions for use of KLH solid wood panels in visible quality

This information, as well as quality definitions, is also available for down-loading at www.klh.at

Planning/interior design: Karl Dreer GmbH
Architect/design: Bembé Felix & Sebastian Dellinger
Dirk Wilhelmy

SURFACE QUALITY ACCORDING TO EN 13017-1

FEATURES	GRADES		
	A	B	C
Gluing	No open glue joints	Open joints: ≤ 100 mm/1 m glue joint permitted	
Wood type mixture	Not permitted	Not permitted; in case of spruce, 10% fir permitted	Permitted
Appearance and colour	Well-balanced colour and texture	Largely balanced colour and texture	No specifications
Knots	Healthy, intergrown knots in spruce up to 40 mm diameter permitted; individual black knots permitted	Healthy, intergrown knots and individual black knots permitted	Permitted
Plugs	Natural knot plugs permitted	Permitted	Permitted
Resin pockets	Occasional, up to 3 mm x 40 mm permitted	Occasional, up to 5 mm x 50 mm permitted	Permitted
Repaired resin pockets	Permitted	Permitted	Permitted
Bark pockets	Not permitted	Occasional pockets permitted	Permitted
Cracks	Occasional surface cracks permitted	Occasional surface cracks and end cracks up to a length of 50 mm permitted	Permitted
Pith	Occasional piths up to a length of 400 mm permitted	Permitted	Permitted
Compression wood	Occasional occurrences permitted	Permitted	Permitted
Insect infestation	Not permitted	Not permitted	Occasional small holes of non-active larvae permitted
Discolouration	Not permitted	Slight discolouration permitted	Permitted
Decay	Not permitted	Not permitted	Not permitted
Sapwood	Permitted in pine; in larch, narrow strips up to 20% of lamella width permitted	Permitted	Permitted
Quality of surface finish	Occasional small faults permitted	Occasional faults permitted	No specifications
Quality of narrow sides and face ends	Occasional small faults permitted	Occasional faults permitted	No specifications
Width of individual lamella	At least 60 mm (not applicable to edge lamellae)	No specifications	No specifications
Cut of lamellae	Cut parallel	Cut parallel	Cut parallel or tapered

NON-VISIBLE QUALITY (NVQ) IN SPRUCE

Spruce lamellae of strength class C 24 and in low proportions C 16 according to approval are used for the production of panels in non-visible quality.

KLH solid wood panels in non-visible quality are suitable for use as load-bearing, non-visible components.

INDUSTRIAL VISIBLE QUALITY (IVQ) IN SPRUCE

For products of industrial visible quality, the wood quality of the covering layer is equivalent to classification B according to EN 13017-1 (table 1).
Depending on the orientation of the covering layer (TL / TT), the lamellae are sometimes finger-jointed.
The surface is planed and slightly smoothed – traces of planing may be visible.
Irregularities in the joint structure, slight glue penetrations as well as slightly rough patches due to subsequent surface treatment are possible.
KLH Massivholz GmbH recommends using industrial visible quality in cases where a visible wooden structure is wanted, but where demands on the surface quality are lower. We would like to expressly point out that this surface is not suitable for use as a visible surface in residential buildings due to the usually high quality requirements of building owners.

With a wood moisture content of 12% (+/- 2%) the maximum joint width is 4 mm. The width of the individual lamella remains at the discretion of the manufacturer.

IMPORTANT NOTES REGARDING THE INDUSTRIAL VISIBLE QUALITY (IVQ)

- A low cost component for any rework on the surface should be taken into account in the assembly price
- Generally, panels are produced with industrial visible quality on one side only
- Quality-related information should be disclosed to the architect/planner and to the building owner already at the tendering stage
- We would like to expressly advice against using products with industrial visible surfaces instead of domestic visible surfaces for cost reasons

DOMESTIC VISIBLE QUALITY (DVQ) IN SPRUCE

Regarding the domestic visible quality, there is a difference in the appearance depending on whether TL or TT panels are used. With TT panels, the covering layer lies transverse to the panel length; TT panels are mainly used as wall panels. With TL panels, the covering layer lies lengthwise to the panel length; TL panels are mainly used as ceiling and roof panels.

For products with domestic visible quality, the wood quality of the covering layer is equivalent to classification AB according to EN 13017-1 (table 1).
A maximum joint width of 2 mm is possible with a wood moisture content of 12% (+/- 2%).
During the cut, all transitions for breadthways panel joints are bevelled.

Architect: Hiendl Schineis Architektenpartnerschaft
Eckhart Matthäus Fotografie

DIFFERENCES IN THE APPEARANCE OF TT AND TL PANELS

Glued, laminated one-layer panels made of spruce are used for TT panels of domestic visible quality (for standard panel types, see price list). The surface is planed and smoothed.

Breadthways glued, finger-jointed lamellae made of spruce are used for TL panels of domestic visible quality (for standard panel types, see price list). The surface is planed (Rotoles) and smoothed.
Slightly rough patches are possible.

IMPORTANT NOTES REGARDING THE DOMESTIC VISIBLE QUALITY (DVQ)

- A low cost component for any rework on the surface should be taken into account in the assembly price
- In standard form, only one side of the panel is of domestic visible quality; panels of domestic visible quality on both sides can be produced on request

GENERAL INFORMATION ON WOOD AS A CONSTRUCTION MATERIAL

Wood as a construction material can look back on an ancient tradition and is highly valued because of its properties and the room climate it brings about. Comfort, well-being, a feeling of security and harmony with nature in addition to its positive effects on the environment are important arguments both for private and public building owners.

WOOD IS ALWAYS UNIQUE

Among other things, wood has hygroscopic properties and is not homogenous in its structure and visual appearance – every wood lamella is therefore unique. Thanks to technical progress and the most diverse production technologies, there are now many different possibilities to use wood – be it as a 50-year old, directly weathered shingle on a roof, as a statically effective supporting structure of an 8-storey building or as the finest veneer with a thickness of 0.8 mm for the furniture industry.
Independent of the manner, wood is processed and manufactured – its properties always remain the same.

IMPACTS OF THE HYGROSCOPIC PROPERTIES

The hygroscopic property is, on the one hand, an essential factor for a comfortable room climate, but on the other hand, it is also responsible for wood changing its volume when absorbing or releasing humidity. This is called swelling and shrinking of wood.

CHANGE OF WOOD MOISTURE AND IMPACTS ON THE VISIBLE SURFACE

In the production of KLH solid wood panels, the process of swelling and shrinking is reduced to a virtually negligible extent through the crosswise gluing of technically dried wood lamellae with a wood moisture of 12% (+/- 2%). During assembly or in the building shell construction phase, KLH solid wood panels are subject to seasonal and construction-site-specific climate fluctuations. Depending on the duration of this phase, the wood moisture of KLH solid wood panels may therefore vary.
As soon as a building is used, the wood moisture of the KLH solid wood panels will adjust to an average of about 8 – 11%, depending on the air humidity prevailing in the building.
This process, which can take up to 3 years, has no influence on the load-bearing capacity of the elements. It can, however, result in a visual change in the appearance of the surface due to the properties of wood as a natural construction material. Cracks and/or gaps may appear.

INTERACTION BETWEEN PANEL STRUCTURE, LOAD-BEARING CAPACITY AND THICKNESS OF THE COVER LAMELLA

KLH solid wood panels are used as structural construction elements for walls, ceilings and roofs.
As such they meet the essential static and structural-physical requirements.
The visible surface is a possible additional aesthetic aspect.

The thicker the edge or cover lamella, the higher the load-bearing capacity of the KLH component. This is the reason why cover lamellae of 19 – 34 mm are used for surfaces of domestic visible quality, depending on the type of panel that is used. What has a positive effect on the load-bearing capacity may have a negative effect on the appearance because of possible formation of cracks or gaps.

Essentially, the same applies as in the furniture industry – the thinner the edge or cover lamella, the more uniform the appearance in the visible surface.
As KLH elements are mainly used as load-bearing construction components, visible surfaces of KLH solid wood panels cannot be compared with visible surfaces from the furniture industry.

FLUCTUATIONS IN THE ROOM CLIMATE

When there are fluctuations in the room climate (e.g. change of air humidity or indoor temperature), wood as a construction material assumes a compensating function – either by absorbing air humidity or by releasing wood moisture.
In case of abrupt fluctuations, it may happen that more moisture is released on the surface than can actually be supplied to the outside from within the core of the panel.
This results in tensions on the surface that can lead to gaps and/or cracks – depending on the thickness of the edge or cover lamella. Especially with surfaces glazed in a light colour (white), there is a more pronounced contrast in the appearance of cracks and/or gaps.

RECOMMENDATIONS FROM KLH MASSIVHOLZ GMBH

- Wood is a natural, non-homogenous construction material – please advise building owners accordingly
- The greatest possible care is required when handling and assembling such elements, especially KLH elements with visible surfaces
- Instruct all subsequent trades during the construction phase accordingly
- High fluctuations in the room climate are to be avoided as much as possible, both during the construction phase and at the start of building utilisation
- Keep air humidity in the building at 40 – 60% to preserve the 12% (+/- 2%) wood moisture in the KLH solid wood panels (e.g. by using humidifiers, indoor fountains, plants …)
- The formation of cracks and/or gaps cannot be excluded even if the greatest of care is applied in handling KLH solid wood panels; particularly with light and/or white glazed surfaces, there may be an undesired contrast due to crack/gap formation

NOTE

These instructions for use are intended for architects/planners as well as building contractors. Please pass on relevant information to builders or refer them to our website www.klh.at

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For love of nature.