KLH®

MADE FOR BUILDING
BUILT FOR LIVING

STRUCTURAL PRE-ANALYSIS TABLES

IMPRINT

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STRUCTURAL PRE-ANALYSIS TABLES

The calculation model for KLH® solid wood panels must consider the influence of the layup (thickness, material, orientation), the internal stress distributions and local stress concentrations. Due to the shear flexible transverse layers, shear deformation may no longer be disregarded and the layup of the panel has to be taken into account.

Dimensioning and structural design follow Eurocode 5 (EN 1995-1-1 and EN 1995-1-2), taking into account the national standards set forth in ÖNORM B 1995-1-1 and ÖNORM B 1995-1-2. It should be pointed out that the national standards in various European countries differ from each other in some detailed aspects (e.g. different partial factors γ_M for "cross laminated timber" material). The material properties of KLH® solid wood panels required for structural design can be taken from the European Technical Assessment (ETA-06/0138).

The structural design of KLH® solid wood panels has to be carried out project-based and locally applicable standards and regulations have to be taken into account.

Due care is also advised when comparing panel thicknesses of KLH® elements with products from other manufacturers: due to different production processes, the cross laminated timber products may well have different properties, e.g. with respect to bending stiffness or shear strength. Please mind the relevant properties in the respective product approvals and take into account the differences in a comparative analysis.

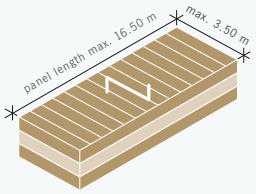
For the structural analysis of cross laminated timber, different models have been developed in the past. The structural analysis of KLH® solid wood panels is based on the shear-elastic beam theory (according to Timoshenko) or the shear-elastic orthotropic plate (according to Reissner-MinTLin). The properties of the composite cross section are thereby described appropriately. To receive correct results (internal forces and moments as well as deformations) is the use of suitable software for the purpose of structural analysis. The software provided by KLH Massivholz GmbH (www.klhdesigner.at) is based on the above mentioned theory and thus a good choice.

01 KLH®-CLT | STANDARD PANEL TYPES AND STRUCTURES

FOR THE WALL

Covering layer in the transverse panel direction TT

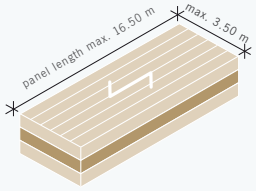
Nominal thickness		Layers	Type	Lamella structure in [mm]						
				T	L	T	L	T	L	T
KLH	60 mm	3s	TT	20	20	20				
KLH	70 mm	3s	TT	20	30	20				
KLH	80 mm	3s	TT	30	20	30				
KLH	90 mm	3s	TT	30	30	30				
KLH	100 mm	3s	TT	30	40	30				
KLH	110 mm	3s	TT	40	30	40				
KLH	120 mm	3s	TT	40	40	40				
KLH	100 mm	5s	TT	20	20	20	20	20		
KLH	110 mm	5s	TT	20	20	30	20	20		
KLH	120 mm	5s	TT	30	20	20	20	30		
KLH	130 mm	5s	TT	30	20	30	20	30		
KLH	140 mm	5s	TT	30	20	40	20	30		
KLH	150 mm	5s	TT	30	30	30	30	30		
KLH	160 mm	5s	TT	40	20	40	20	40		

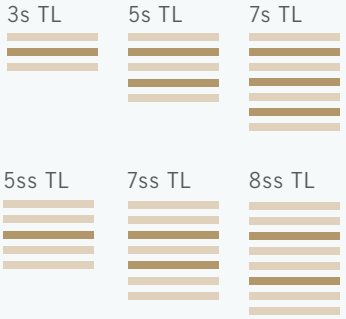


FOR FLOOR AND ROOF

Covering layer in the longitudinal panel direction TL

				L	T	L	T	L	T	L
KLH	60 mm	3s	TL	20	20	20				
KLH	70 mm	3s	TL	20	30	20				
KLH	80 mm	3s	TL	30	20	30				
KLH	90 mm	3s	TL	30	30	30				
KLH	100 mm	3s	TL	40	20	40				
KLH	110 mm	3s	TL	40	30	40				
KLH	120 mm	3s	TL	40	40	40				
KLH	100 mm	5s	TL	20	20	20	20	20		
KLH	110 mm	5s	TL	20	20	30	20	20		
KLH	120 mm	5s	TL	30	20	20	20	30		
KLH	130 mm	5s	TL	30	20	30	20	30		
KLH	140 mm	5s	TL	40	20	20	20	40		
KLH	150 mm	5s	TL	40	20	30	20	40		
KLH	160 mm	5s	TL	40	20	40	20	40		
KLH	170 mm	5s	TL	40	30	30	30	40		
KLH	180 mm	5s	TL	40	30	40	30	40		
KLH	190 mm	5s	TL	40	40	30	40	40		
KLH	200 mm	5s	TL	40	40	40	40	40		
KLH	160 mm	5ss	TL	30+30	40	30+30				
KLH	180 mm	7s	TL	20	40	20	20	20	40	20
KLH	200 mm	7s	TL	20	40	20	40	20	40	20
KLH	220 mm	7s	TL	30	40	30	20	30	40	30
KLH	240 mm	7s	TL	30	40	30	40	30	40	30
KLH	180 mm	7ss	TL	30+30	20	20	20	30+30		
KLH	200 mm	7ss	TL	30+30	20	40	20	30+30		
KLH	220 mm	7ss	TL	40+40	20	20	20	40+40		
KLH	240 mm	7ss	TL	40+40	20	40	20	40+40		
KLH	260 mm	7ss	TL	40+40	30	40	30	40+40		
KLH	280 mm	7ss	TL	40+40	40	40	40	40+40		
KLH	300 mm	8ss	TL	40+40	30	40+40	30	40+40		
KLH	320 mm	8ss	TL	40+40	40	40+40	40	40+40		





Special panel layups are available on request. By using double layers, for example the longitudinal or transverse stiffness 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.

Invoicing widths
2.45 | 2.50 | 2.73 | 2.95 |
3.10 | 3.20 | 3.30 | 3.40 | 3.50 [m]

Maximum length 16.50 [m]
Maximum thickness 0.5 [m]

02 GENERAL REMARKS

Dimensioning according to
ETA-06/0138 together with
ÖNORM EN 1995-1-1:2019 and ÖNORM B 1995-1-1:2019 or
ÖNORM EN 1995-1-2:2011 and ÖNORM B 1995-1-2:2011
per m wall length resp. per m² floor area

Impacts

Service class 1 (k_{def} = 0,6)
Self-weight of KLH® - CLT G_1 and the build-up G_2: k_{mod} = 0,6
Imposed load category A and B (ψ_0 = 0,7 and ψ_2 = 0,3): k_{mod} = 0,8
Imposed load category C (ψ_0 = 0,7 and ψ_2 = 0,6): k_{mod} = 0,9
Imposed load category H (ψ_0 = 0,0 and ψ_2 = 0,0): k_{mod} = 0,9
Snow load at an altitude ≤ 1000 m S_2 (ψ_0 = 0,5 and ψ_2 = 0,0): k_{mod} = 0,9
Wind load W (ψ_0 = 0,6 and ψ_2 = 0,0): k_{mod} = 1,0

Verification of Ultimate Limit States (ULS)

Verification of column stability, bending and shear resistance
Verification in case of fire (with charring rates according to ETA-06/0138 for minimum panel widths of 30 cm)

Verification in the Servicability Limit States (SLS)

Limitation of deflection
Verification of vibration

Verification criteria in detail

ULS tensions: limitation of the utilisation to 90 %
Fire case: limitation of the utilisation to 100 % and deformation limit to ℓ/80
SLS deformation: limitation of the utilisation to 90 %
- characteristic design situation: $w_{inst} \leq \ell/300$
- quasi-permanent structural design situation: $w_{net,fin} \leq \ell/250$

SLS vibration:
- floor class I (e.g. separating floor slabs for apartments or offices); 6 cm wet screed floating on heavy filler or dry screed floating on heavy filler (at least 60 kg/m²)
- floor class II (e.g. detached house); 6 cm floating wet screed (even without filler) or dry screed , floating on heavy filler (at least 60 kg/m²)
- modal damping ratio ζ = 4,0 %
- ratio floor slab width to span width $b/\ell \geq 1,2$

Cladding

For the cladding directly to the KLH® surface, screw-fastened fire rated gypsum plasterboards type F (GtF according to ÖNORM EN 520 and ÖNORM B 3410 or DIN 18180) or equivalent panels respectively free-standing studworks are required.
The fastening needs to comply with the state of the art and the current KLH® installation guidelines.

2.2 SYMBOL EXPLANATION

Service class 1 (deformation factor k_{def} = 0,6)

KLH® - CLT as **wall**

KLH® - CLT as **floor**

Single-sided fire exposed **wall**

Double-sided fire exposed **wall**

Single-sided fire exposed **ceiling**

Self-weight of the **KLH® - CLT panel**: k_{mod} = 0,6

Self-weight of the **build-up**: k_{mod} = 0,6

Imposed load **category A** (ψ_0 = 0,7 and ψ_2 = 0,3): k_{mod} = 0,8

Imposed load **category B** (ψ_0 = 0,7 and ψ_2 = 0,3): k_{mod} = 0,8

Imposed load **category C** (ψ_0 = 0,7 and ψ_2 = 0,6): k_{mod} = 0,9

Imposed load **category H** (ψ_0 = 0,0 and ψ_2 = 0,0): k_{mod} = 0,9

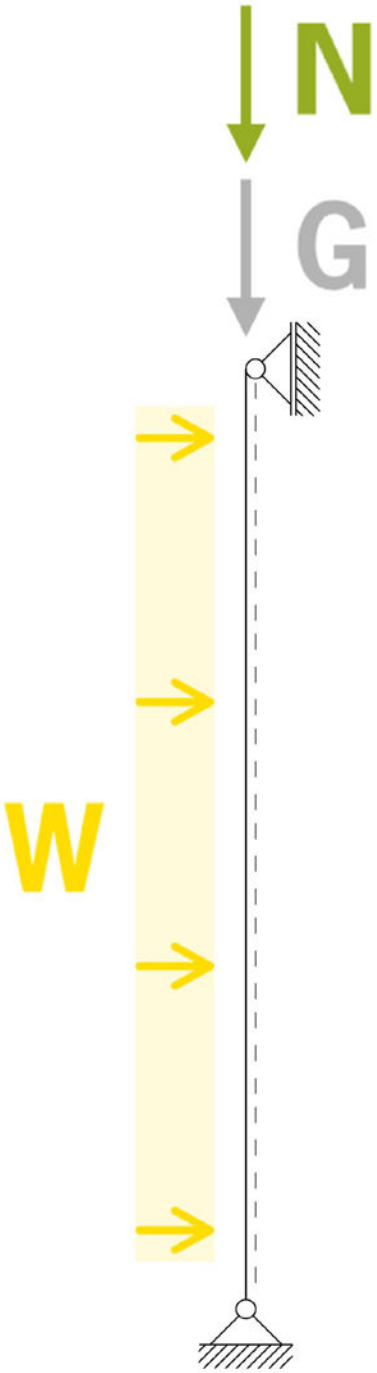
Snow load at an **altitude ≤ 1000 m** S_2 (ψ_0 = 0,5 and ψ_2 = 0,0): k_{mod} = 0,9

Wind load W (ψ_0 = 0,6 and ψ_2 = 0,0): k_{mod} = 1,0

Floor class I (e.g. separating floor slabs for apartments or offices)

Floor class II (e.g. detached house)

03 KLH® AS WALL



Range for loads

Permanent load: $G_{2,k}$ = 20 - 100 kN/m
Imposed load category A: $N_{A,k}$ = 20 - 100 kN/m
Wind load: W_k = 1.0 kN/m²

Wall height (buckling length)

2.95 m
3.50 m

Surfaces

Wood; KLH® - CLT visible
1 x 12.5 mm Gt-F
1 x 15 mm Gt-F
2 x 12.5 mm Gt-F
Studwork; free-standing (build-up: 15 mm Gt-F + 50 mm metal studwall/rock wool + 5 mm air gap)

Verification criteria in case of fire

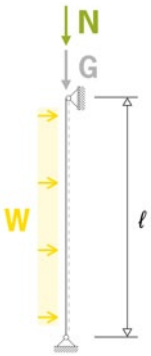
Single-sided fire exposure

Remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 10 mm (calculated with global charring)

Double-sided fire exposure

30/60 minutes: remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 3 mm (calculated with local charring)
90/120 minutes: remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 7 mm (calculated with global charring)

3.1 SINGLE-SIDED FIRE EXPOSURE (FOR EXTERIOR WALLS)

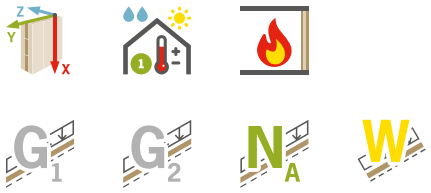


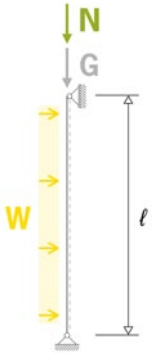
Minimum panel thicknesses for various fire resistances (R 0 to R 120), wall height 2.95 m

Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq$ 2,95 m)				
side 1	[kN/m]	[kN/m]	[kN/m]	REI 0	REI 30	REI 60	REI 90	REI 120
Wood	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT	5s 140 TT
	40 | 40	114	52	3s 70 TT			5s 130 TT	5s 160 TT
	60 | 60	171	78	3s 80 TT	3s 90 TT			
	80 | 80	228	104		3s 110 TT	5s 110 TT		
	100 | 100	285	130	3s 90 TT			5s 140 TT	
1 x 12.5 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
	40 | 40	114	52	3s 70 TT	3s 70 TT			
	60 | 60	171	78	3s 80 TT	3s 80 TT			5s 130 TT
	80 | 80	228	104			3s 100 TT	5s 110 TT	
	100 | 100	285	130	3s 90 TT	3s 90 TT	3s 110 TT		5s 140 TT
1 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 110 TT
	40 | 40	114	52	3s 70 TT	3s 70 TT			5s 120 TT
	60 | 60	171	78	3s 80 TT	3s 80 TT			
	80 | 80	228	104					5s 130 TT
	100 | 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	5s 110 TT	
2 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
	40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 70 TT	3s 80 TT
	60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT	
	80 | 80	228	104					
	100 | 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
Studwork	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT
	40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT		
	60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 90 TT	5s 110 TT
	80 | 80	228	104				3s 110 TT	
	100 | 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT		

Wind pressure: W_k = 1.0 kN/m²

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.





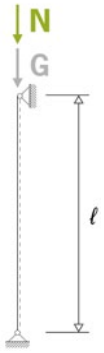
Minimum panel thicknesses for various fire resistances (R 0 to R 120), wall height 3.50 m

Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 3{,}50$ m)				
side 1	[kN/m]	[kN/m]	[kN/m]	REI 0	REI 30	REI 60	REI 90	REI 120
Wood	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT	5s 140 TT
	40 | 40	114	52	3s 80 TT			5s 130 TT	5s 160 TT
	60 | 60	171	78		3s 100 TT	5s 110 TT		
	80 | 80	228	104	3s 90 TT	3s 110 TT		5s 140 TT	
	100 | 100	285	130	3s 100 TT		5s 120 TT		5s 170 TT
1 x 12.5 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
	40 | 40	114	52	3s 80 TT	3s 80 TT			5s 130 TT
	60 | 60	171	78			3s 90 TT	5s 110 TT	
	80 | 80	228	104	3s 90 TT	3s 90 TT	3s 100 TT		5s 140 TT
	100 | 100	285	130	3s 100 TT	3s 100 TT		5s 120 TT	
1 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 110 TT
	40 | 40	114	52	3s 80 TT	3s 80 TT			5s 120 TT
	60 | 60	171	78					
	80 | 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	5s 110 TT	5s 130 TT
	100 | 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT		
2 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT
	40 | 40	114	52	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT	
	60 | 60	171	78					
	80 | 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
	100 | 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	3s 100 TT	3s 100 TT
Studwork	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT
	40 | 40	114	52	3s 80 TT	3s 80 TT	3s 80 TT	3s 90 TT	
	60 | 60	171	78				3s 100 TT	5s 110 TT
	80 | 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT		
	100 | 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	3s 110 TT	5s 120 TT

Wind pressure: $W_k = 1.0$ kN/m²

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

3.2 DOUBLE-SIDED FIRE EXPOSURE (FOR INTERIOR WALLS)



Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 2.95 m

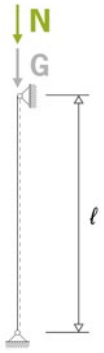
Surface	Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	**Wall height (buckling length $\ell_k \leq 2{,}95$ m)**			
side 1	side 2	[kN/m]	[kN/m]	[kN/m]	**R 0**	**R 30**	**R 60**	**R 90**
Wood	**Wood**	20 | 20	57	26	3s 60 TT	3s 90 TT	5s 140 TT	5s 180 TT
		40 | 40	114	52	3s 70 TT	3s 100 TT		
		60 | 60	171	78	3s 80 TT	3s 110 TT	7s 180 TT	7s 180 TT
		80 | 80	228	104				7s 200 TT
		100 | 100	285	130	3s 90 TT			
Wood	**1 x 12.5 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 | 40	114	52	3s 70 TT			
		60 | 60	171	78	3s 80 TT	3s 90 TT	5s 130 TT	5s 180 TT
		80 | 80	228	104		3s 110 TT	5s 140 TT	7s 200 TT
		100 | 100	285	130	3s 90 TT			
Wood	**1 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 160 TT
		40 | 40	114	52	3s 70 TT		5s 120 TT	
		60 | 60	171	78	3s 80 TT	3s 90 TT		
		80 | 80	228	104			5s 130 TT	5s 180 TT
		100 | 100	285	130	3s 90 TT	3s 110 TT	5s 140 TT	5s 200 TT
Wood	**2 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
		40 | 40	114	52	3s 70 TT			5s 130 TT
		60 | 60	171	78	3s 80 TT		5s 110 TT	5s 140 TT
		80 | 80	228	104		3s 90 TT		
		100 | 100	285	130	3s 90 TT	3s 110 TT	5s 120 TT	5s 150 TT
Wood	**Studwork**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 130 TT
		40 | 40	114	52	3s 70 TT		5s 110 TT	5s 150 TT
		60 | 60	171	78	3s 80 TT			5s 160 TT
		80 | 80	228	104		3s 90 TT	5s 120 TT	
		100 | 100	285	130	3s 90 TT	3s 110 TT		

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 2.95 m

Surface	Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	**Wall height (buckling length $\ell_k \leq 2{,}95$ m)**			
side 1	side 2	[kN/m]	[kN/m]	[kN/m]	**R 0**	**R 30**	**R 60**	**R 90**
1 x 12.5 mm Gt-F	**1 x 12.5 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 140 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 90 TT	
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 100 TT	5s 160 TT
		80 | 80	228	104			3s 110 TT	
		100 | 100	285	130	3s 90 TT	3s 90 TT		
1 x 15 mm Gt-F	**1 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 110 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT		3s 120 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	5s 160 TT
		80 | 80	228	104			3s 100 TT	
		100 | 100	285	130	3s 90 TT	3s 90 TT		
1 x 15 mm Gt-F	**Studwork**	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 70 TT	3s 110 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 80 TT	
		60 | 60	171	78	3s 80 TT	3s 80 TT		3s 120 TT
		80 | 80	228	104			3s 90 TT	5s 140 TT
		100 | 100	285	130	3s 90 TT	3s 90 TT		
2 x 15 mm Gt-F	**2 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 70 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT
		80 | 80	228	104				
		100 | 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
Studwork	**Studwork**	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 90 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 100 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 110 TT
		80 | 80	228	104				
		100 | 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.



Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 3.50 m

Surface	Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	**Wall height (buckling length $\ell_k \leq 3{,}50$ m)**			
side 1	side 2	[kN/m]	[kN/m]	[kN/m]	**R 0**	**R 30**	**R 60**	**R 90**
Wood	**Wood**	20 | 20	57	26	3s 60 TT	3s 90 TT	5s 180 TT	5s 180 TT
		40 | 40	114	52	3s 70 TT	3s 110 TT		7s 180 TT
		60 | 60	171	78	3s 80 TT		7s 180 TT	7s 200 TT
		80 | 80	228	104	3s 90 TT			
		100 | 100	285	130	3s 100 TT	3s 120 TT	7s 200 TT	
Wood	**1 x 12.5 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 | 40	114	52	3s 70 TT	3s 90 TT	5s 130 TT	5s 180 TT
		60 | 60	171	78	3s 80 TT	3s 100 TT	5s 140 TT	7s 200 TT
		80 | 80	228	104	3s 90 TT	3s 110 TT		
		100 | 100	285	130	3s 100 TT		5s 150 TT	
Wood	**1 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 | 40	114	52	3s 70 TT			
		60 | 60	171	78	3s 80 TT	3s 90 TT	5s 130 TT	
		80 | 80	228	104	3s 90 TT	3s 100 TT	5s 140 TT	5s 200 TT
		100 | 100	285	130	3s 100 TT	3s 110 TT		7s 200 TT
Wood	**2 x 15 mm Gt-F**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 130 TT
		40 | 40	114	52	3s 70 TT			
		60 | 60	171	78	3s 80 TT	3s 90 TT		5s 140 TT
		80 | 80	228	104	3s 90 TT	3s 100 TT	5s 120 TT	
		100 | 100	285	130	3s 100 TT	3s 110 TT		5s 150 TT
Wood	**Studwork**	20 | 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 140 TT
		40 | 40	114	52	3s 70 TT			
		60 | 60	171	78	3s 80 TT	3s 90 TT	5s 120 TT	5s 150 TT
		80 | 80	228	104	3s 90 TT	3s 100 TT		5s 160 TT
		100 | 100	285	130	3s 100 TT	3s 110 TT	5s 130 TT	

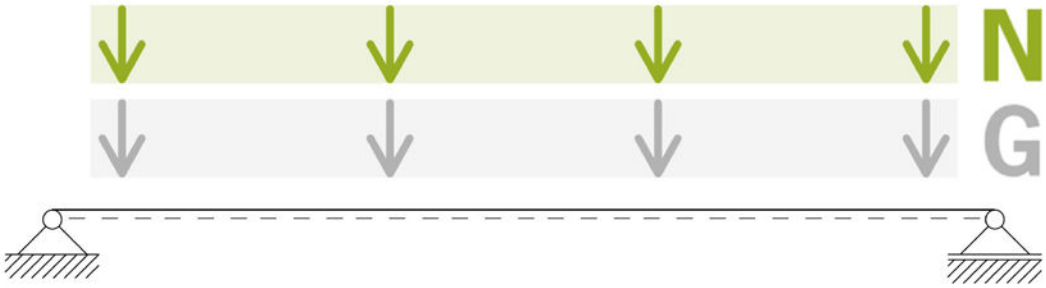
The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 3.50 m

Surface	Surface	$G_{2,k}$ | $N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 3{,}50$ m)			
side 1	side 2	[kN/m]	[kN/m]	[kN/m]	R 0	R 30	R 60	R 90
1 x 12.5 mm Gt-F	1 x 12.5 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 90 TT	5s 160 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 100 TT	
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 110 TT	5s 180 TT
		80 | 80	228	104	3s 90 TT	3s 90 TT		
		100 | 100	285	130	3s 100 TT	3s 100 TT		
1 x 15 mm Gt-F	1 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 120 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 90 TT	5s 140 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 100 TT	
		80 | 80	228	104	3s 90 TT	3s 90 TT	3s 110 TT	5s 160 TT
		100 | 100	285	130	3s 100 TT	3s 100 TT		
1 x 15 mm Gt-F	Studwork	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 110 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT		3s 120 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	5s 140 TT
		80 | 80	228	104	3s 90 TT	3s 90 TT	3s 100 TT	
		100 | 100	285	130	3s 100 TT	3s 100 TT		5s 150 TT
2 x 15 mm Gt-F	2 x 15 mm Gt-F	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 80 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	
		80 | 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
		100 | 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	3s 100 TT
Studwork	Studwork	20 | 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 100 TT
		40 | 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 110 TT
		60 | 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	
		80 | 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	
		100 | 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	3s 120 TT

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

04 KLH® AS FLOOR



Range for loads

Permanent load: $G_{2,k}$ = 1.0 - 3.5 kN/m²
Imposed load category A: $N_{A,k}$ = 2.8 kN/m²
Imposed load category B: $N_{B,k}$ = 3.8 kN/m²
Imposed load category C: $N_{C,k}$ = 4.0 - 5.0 kN/m²

Spans

3.00 m to 7.00 m - in 0.50 m steps

Surface

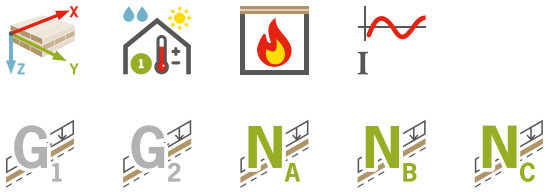
Wood; KLH® - CLT visible

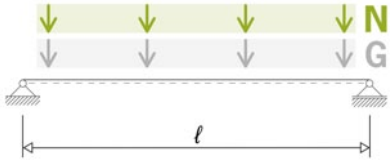
Verification criteria in case of fire

Single-sided fire exposure

Remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 10 mm (calculated with global charring)

4.1 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (WET SCREED)





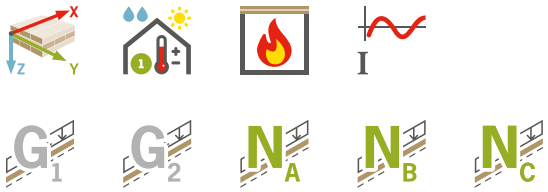
Minimum panel thickness for a specific load-span-combination

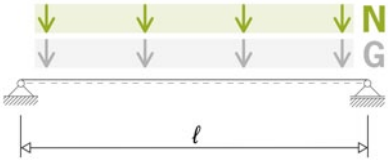
Permanent load	Imposed load		Span of single-span beam ℓ								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
1,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 200 TL	7ss 220 TL	7ss 260 TL	7ss 280 TL
	B	3,80		5s 120 TL	5s 130 TL						
	C	4,00				5s 150 TL	5s 170 TL	5s 200 TL			
		5,00	5s 110 TL		5s 140 TL		5s 180 TL				
2,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80		5s 120 TL	5s 130 TL						
	C	4,00	5s 110 TL		5s 140 TL	5s 150 TL		5s 200 TL			
		5,00		5s 130 TL		5s 160 TL		7ss 200 TL			
2,50	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 160 TL	5s 190 TL	7ss 220 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80	5s 110 TL		5s 140 TL						
	C	4,00	5s 110 TL	5s 130 TL		5s 160 TL					
		5,00	5s 120 TL		5s 150 TL						
3,00	A	2,80	5s 100 TL	5s 120 TL	5s 140 TL	5s 170 TL	5s 190 TL	7ss 240 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80	5s 110 TL								
	C	4,00	5s 120 TL	5s 130 TL							
		5,00			5s 150 TL		5s 200 TL				
3,50	A	2,80	5s 110 TL	5s 120 TL	5s 140 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 260 TL	7ss 260 TL	7ss 280 TL
	B	3,80									
	C	4,00	5s 120 TL	5s 130 TL	5s 150 TL		5s 200 TL				
		5,00		5s 140 TL							

R 0 | R 30 | R 60 | R 90 | R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

4.2 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (DRY SCREED)





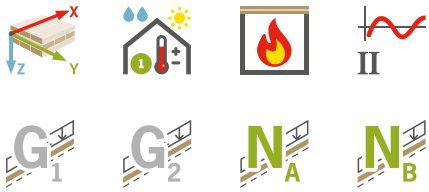
Minimum panel thickness for a specific load-span-combination

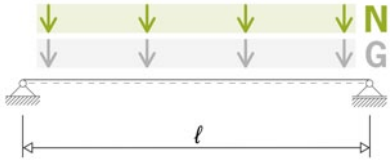
Permanent load	Imposed load		Span of single-span beam ℓ								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
1,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 180 TL	7ss 200 TL	7ss 240 TL	7ss 280 TL
	B	3,80									
	C	4,00									
		5,00			5s 150 TL			5s 190 TL			
1,50	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 200 TL	7ss 220 TL	7ss 260 TL	7ss 280 TL
	B	3,80									
	C	4,00			5s 150 TL			5s 200 TL			
		5,00					5s 180 TL				
2,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 190 TL	7ss 220 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80									
	C	4,00			5s 150 TL						
		5,00				5s 160 TL					
2,50	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 200 TL	7ss 220 TL	7ss 260 TL	7ss 280 TL	7ss 280 TL
	B	3,80									
	C	4,00			5s 150 TL						
		5,00					5s 200 TL				
3,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL	7ss 280 TL
	B	3,80									
	C	4,00					5s 200 TL				
		5,00									

R 0 | R 30 | R 60 | R 90 | R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

4.3 VERIFICATION OF VIBRATION WITH LOW REQUIREMENTS





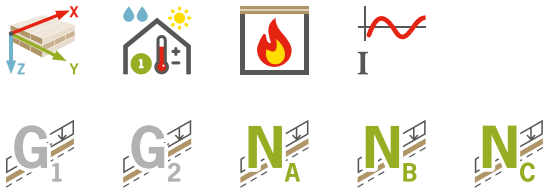
Minimum panel thickness for a specific load-span-combination

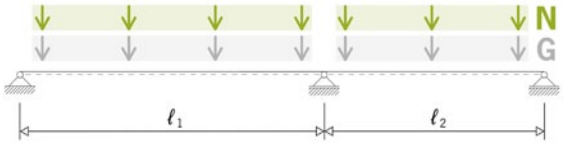
Permanent load	Imposed load		Span of single-span beam ℓ								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
1,00	A	2,80	5s 100 TL	5s 100 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL
	B	3,80		5s 110 TL		5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL	5s 200 TL	
	C	4,00		5s 120 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL
		5,00				5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	7ss 240 TL
1,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 220 TL
	B	3,80		5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL
	C	4,00				5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	7ss 240 TL
		5,00	5s 110 TL		5s 140 TL		5s 180 TL	5s 200 TL			
2,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL	7ss 240 TL
	B	3,80		5s 120 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL		
	C	4,00	5s 110 TL		5s 140 TL	5s 150 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL	
		5,00		5s 130 TL		5s 160 TL		7ss 200 TL	7ss 220 TL	7ss 240 TL	7ss 240 TL
2,50	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 240 TL
	B	3,80	5s 110 TL		5s 140 TL	5s 150 TL		5s 190 TL	7ss 200 TL		
	C	4,00	5s 110 TL	5s 130 TL		5s 160 TL	5s 180 TL	7ss 200 TL	7ss 220 TL		7ss 240 TL
		5,00	5s 120 TL		5s 150 TL		5s 190 TL				7ss 260 TL
3,00	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL	7ss 240 TL	7ss 240 TL
	B	3,80	5s 110 TL		5s 140 TL						
	C	4,00	5s 120 TL	5s 130 TL		5s 160 TL	5s 190 TL	7ss 200 TL	7ss 220 TL		7ss 260 TL
		5,00			5s 150 TL	5s 170 TL	5s 200 TL				

R 0 | R 30 | R 60 | R 90 | R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

4.4 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (WET SCREED)





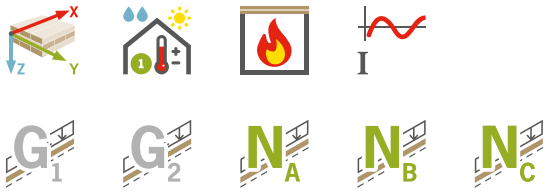
Minimum panel thickness for a specific load-span-combination

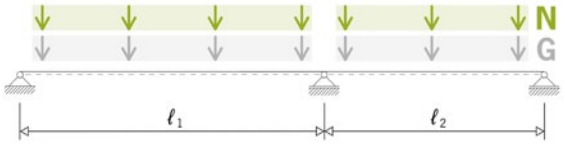
Permanent load	Imposed load		Span of double-span beam ℓ_1 ℓ_2 = 0,8*ℓ_1 to 1,0*ℓ_1								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
1,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL	7ss 240 TL
	B	3,80							5s 190 TL		
	C	4,00									
		5,00					5s 150 TL				
2,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 240 TL
	B	3,80									
	C	4,00					5s 150 TL				
		5,00									
2,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 240 TL	7ss 260 TL
	B	3,80									
	C	4,00									
		5,00									
3,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 150 TL	5s 170 TL	5s 190 TL	5s 200 TL	7ss 240 TL	7ss 260 TL
	B	3,80									
	C	4,00				5s 150 TL					
		5,00		5s 120 TL	5s 130 TL						
3,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL	7ss 240 TL	7ss 260 TL
	B	3,80									
	C	4,00		5s 120 TL	5s 130 TL	5s 150 TL					
		5,00									

R 0 | R 30 | R 60 | R 90 | R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

4.5 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (DRY SCREED)





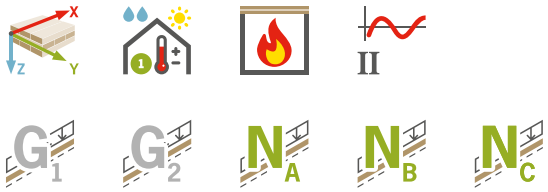
Minimum panel thickness for a specific load-span-combination

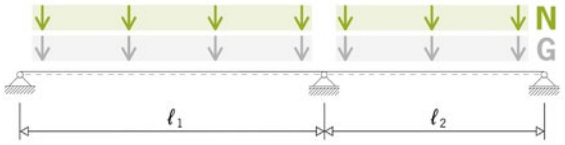
Permanent load	Imposed load		Span of double-span beam ℓ_1 ℓ_2 = 0,8*ℓ_1 to 1,0*ℓ_1								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
1,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL	7ss 240 TL	7ss 260 TL
	B	3,80									
	C	4,00							5s 190 TL		
		5,00									
1,50	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 200 TL	7ss 260 TL	7ss 260 TL
	B	3,80									
	C	4,00									
		5,00									
2,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 190 TL	7ss 240 TL	7ss 260 TL	7ss 260 TL
	B	3,80									
	C	4,00						5s 190 TL			
		5,00									
2,50	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 260 TL	7ss 260 TL	7ss 260 TL
	B	3,80									
	C	4,00									
		5,00									
3,00	A	2,80	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 260 TL	7ss 260 TL	7ss 260 TL
	B	3,80									
	C	4,00									
		5,00									

R 0 | R 30 | R 60 | R 90 | R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

4.6 VERIFICATION OF VIBRATION WITH LOW REQUIREMENTS



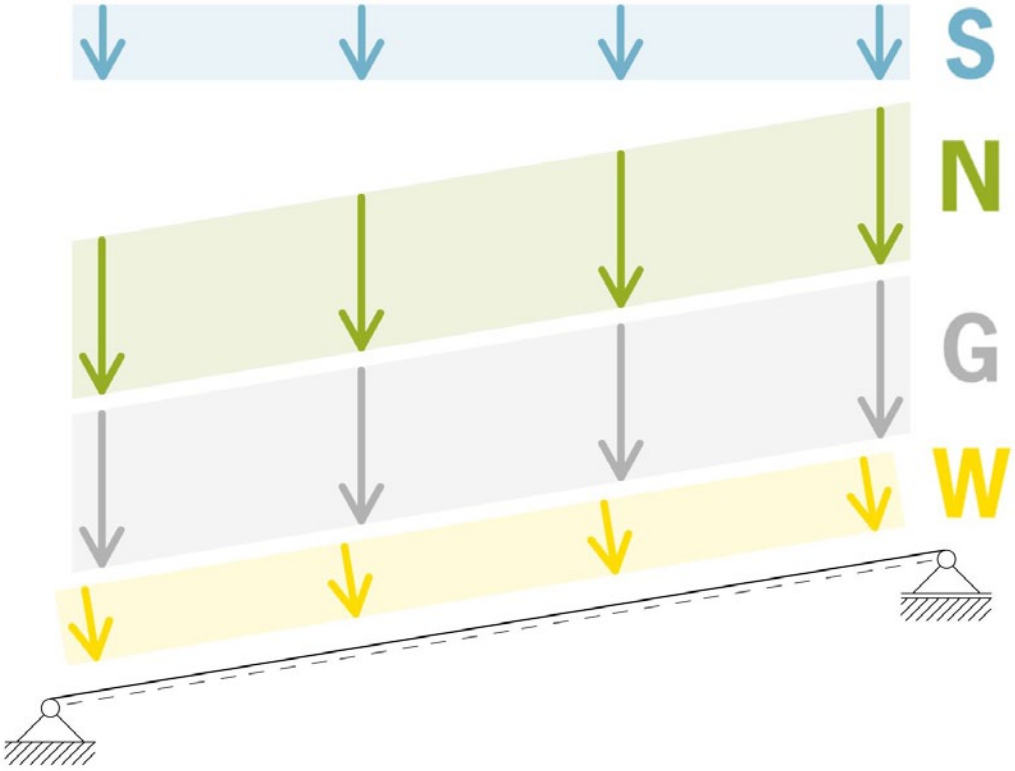


Minimum panel thickness for a specific load-span-combination

Permanent load	Imposed load		Span of double-span beam ℓ_1 ℓ_2 = 0,8*ℓ_1 to 1,0*ℓ_1								
$G_{2,k}$	N_k		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	CAT	[kN/m²]									
0,50	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL	5s 150 TL	5s 170 TL	5s 190 TL
	B	3,80									5s 190 TL
	C	4,00	5s 100 TL						5s 150 TL		
		5,00			5s 120 TL		5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL
1,00	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 180 TL	5s 190 TL
	B	3,80	5s 100 TL								
	C	4,00					5s 140 TL	5s 150 TL			5s 200 TL
		5,00			5s 120 TL			5s 160 TL		5s 190 TL	7ss 200 TL
1,50	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL
	B	3,80									
	C	4,00			5s 120 TL					5s 190 TL	7ss 220 TL
		5,00		5s 110 TL					5s 180 TL	5s 200 TL	
2,00	A	2,80	5s 100 TL	5s 100 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 180 TL	5s 180 TL	5s 190 TL
	B	3,80									5s 200 TL
	C	4,00		5s 110 TL			5s 150 TL			5s 200 TL	7ss 240 TL
		5,00				5s 140 TL			5s 190 TL	7ss 200 TL	
2,50	A	2,80	5s 100 TL	5s 100 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL	5s 190 TL
	B	3,80									5s 200 TL
	C	4,00		5s 110 TL						5s 200 TL	7ss 240 TL
		5,00							5s 190 TL	7ss 200 TL	
3,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL	5s 200 TL
	B	3,80									7ss 240 TL
	C	4,00							5s 190 TL	7ss 200 TL	
		5,00		5s 120 TL	5s 130 TL			5s 180 TL	5s 200 TL		
			R 0		R 30		R 60		R 90		R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

05 KLH® AS ROOF



Range for loads

Permanent load:	$G_{2,k}$ = 0.5 - 2.5 kN/m²
Imposed load category H:	$N_{H,k}$ = 1.0 kN/m²
Snow load at an altitude ≤ 1000 m:	S_k = 0.5 - 5.0 kN/m²
Wind load:	W_k = 0.4 kN/m²

Spans

3.00 m to 7.00 m - in 0.50 m steps

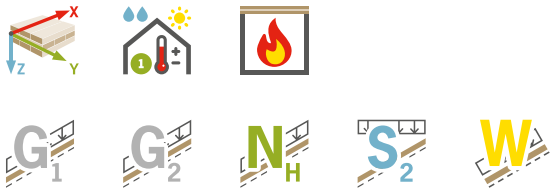
Surfaces

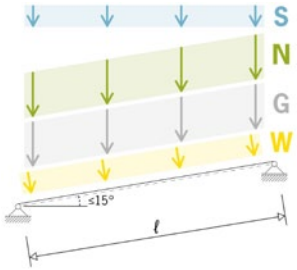
Wood; KLH® - CLT visible

Roof inclination

Maximum roof inclination of 15°

5.1 SINGLE-SPAN BEAM





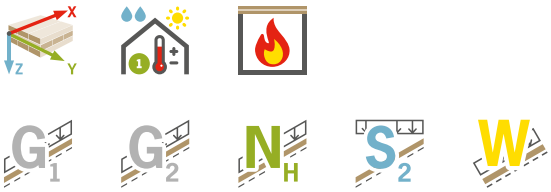
Minimum panel thickness for a specific load-span-combination

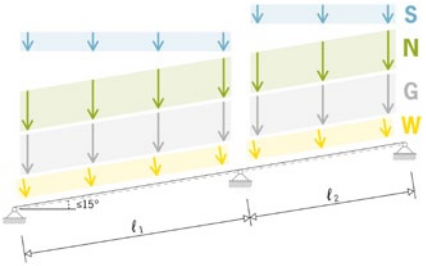
Permanent load	Snow load on roof	Span of single-span beam ℓ								
$G_{2,k}$	$S_2 = \mu^* S_{2,k}$	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	[kN/m²]									
0,50	0,5	3s 60 TL	3s 70 TL	3s 80 TL	3s 80 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL
	1,0				3s 90 TL					
	1,5	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL		5s 160 TL
	2,0			3s 100 TL	3s 110 TL	3s 120 TL	5s 130 TL		5s 160 TL	5s 170 TL
	3,0	3s 80 TL	3s 90 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 190 TL
	4,0	3s 90 TL	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
	5,0	3s 100 TL	3s 110 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL
1,00	0,5	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL
	1,0									
	1,5			3s 100 TL	3s 110 TL	3s 120 TL			5s 160 TL	
	2,0	3s 80 TL	3s 90 TL			5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL
	3,0		3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL
	4,0	3s 90 TL		3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL
	5,0	3s 100 TL	3s 110 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 220 TL	
1,50	0,5	3s 70 TL	3s 80 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL
	1,0									
	1,5	3s 80 TL	3s 90 TL			5s 130 TL				
	2,0			3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	
	3,0	3s 90 TL	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
	4,0	3s 100 TL	3s 110 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL
	5,0		3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	
2,00	0,5	3s 80 TL	3s 90 TL	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL
	1,0									
	1,5			3s 110 TL						
	2,0		3s 100 TL		5s 130 TL					
	3,0	3s 90 TL		3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL
	4,0	3s 100 TL	3s 110 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 220 TL	
	5,0		3s 120 TL	5s 140 TL		5s 170 TL	5s 200 TL	7ss 200 TL		7ss 240 TL
2,50	0,5	3s 80 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
	1,0									
	1,5									
	2,0	3s 90 TL		3s 120 TL	5s 140 TL	5s 150 TL				
	3,0	3s 100 TL	3s 110 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL
	4,0		3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	
	5,0				5s 160 TL	5s 180 TL	5s 200 TL			7ss 240 TL

R 0 R 30 R 60 R 90 R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

5.2 DOUBLE-SPAN BEAM





Minimum panel thickness for a specific load-span-combination

Permanent load	Snow load on roof	Span of double-span beam ℓ_1 ℓ_2 = 0,8*ℓ_1 to 1,0*ℓ_1								
$G_{2,k}$	$S_2 = \mu^*S_{2,k}$	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
[kN/m²]	[kN/m²]									
0,50	0,5	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 100 TL	3s 110 TL	5s 130 TL
	1,0		3s 70 TL	3s 80 TL		3s 100 TL		3s 110 TL	5s 130 TL	5s 140 TL
	1,5				3s 90 TL		3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL
	2,0	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL		5s 160 TL
	3,0			3s 100 TL		3s 120 TL	5s 140 TL		5s 160 TL	5s 180 TL
	4,0	3s 80 TL	3s 90 TL		3s 110 TL	5s 130 TL		5s 160 TL	5s 170 TL	5s 190 TL
	5,0		3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL
1,00	0,5	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 130 TL	5s 140 TL
	1,0							5s 130 TL	5s 140 TL	5s 150 TL
	1,5	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL
	2,0						5s 130 TL			5s 170 TL
	3,0	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL
	4,0				3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL
	5,0		3s 100 TL	3s 110 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
1,50	0,5	3s 60 TL	3s 80 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 120 TL	5s 130 TL	5s 140 TL	5s 150 TL
	1,0	3s 70 TL		3s 90 TL	3s 100 TL	3s 110 TL		5s 140 TL	5s 150 TL	5s 160 TL
	1,5					3s 120 TL	5s 130 TL		5s 160 TL	5s 170 TL
	2,0			3s 100 TL	3s 110 TL		5s 140 TL	5s 150 TL		5s 180 TL
	3,0	3s 80 TL	3s 90 TL		3s 120 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL
	4,0		3s 100 TL	3s 110 TL		5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL
	5,0	3s 90 TL		3s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	
2,00	0,5	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL
	1,0					3s 120 TL	5s 130 TL		5s 160 TL	5s 170 TL
	1,5	3s 80 TL		3s 100 TL	3s 110 TL		5s 140 TL	5s 150 TL		5s 180 TL
	2,0		3s 90 TL			5s 130 TL		5s 160 TL	5s 170 TL	5s 190 TL
	3,0		3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL	5s 200 TL
	4,0	3s 90 TL			5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
	5,0			3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL
2,50	0,5	3s 70 TL	3s 80 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL
	1,0	3s 80 TL	3s 90 TL			5s 130 TL		5s 160 TL	5s 170 TL	5s 190 TL
	1,5				3s 120 TL	5s 140 TL	5s 150 TL		5s 180 TL	5s 200 TL
	2,0		3s 100 TL	3s 110 TL	5s 130 TL		5s 160 TL	5s 170 TL	5s 190 TL	7ss 200 TL
	3,0			3s 120 TL	5s 140 TL	5s 150 TL		5s 180 TL	5s 200 TL	7ss 220 TL
	4,0	3s 90 TL	3s 110 TL				5s 170 TL	5s 190 TL	7ss 200 TL	
	5,0						5s 180 TL	5s 200 TL	7ss 200 TL	

R 0 R 30 R 60 R 90 R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

NOTES

NOTES

NOTES

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