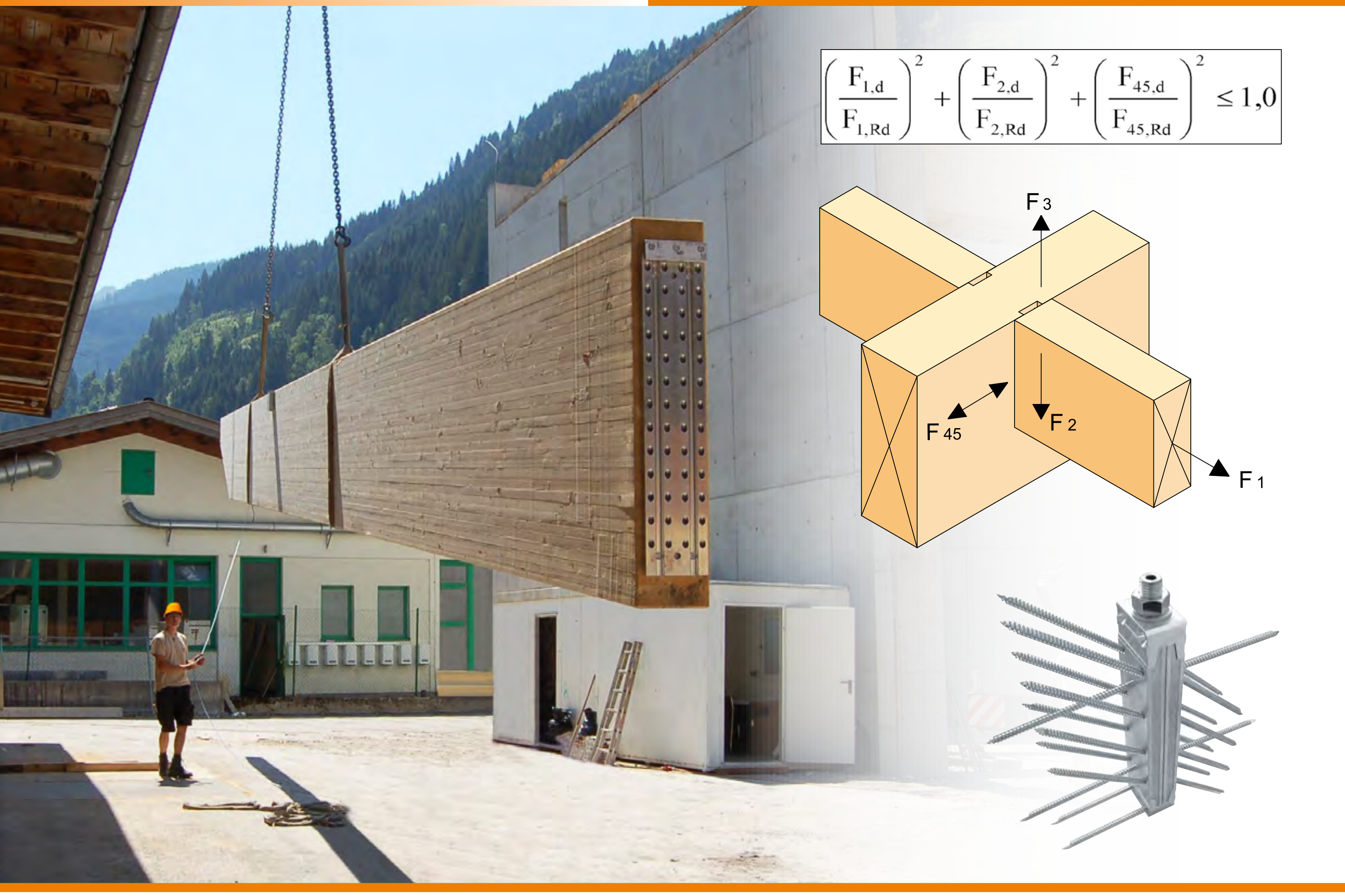
1/2017

Connection Systems

MEGANT® Statics

Certainly a great connection.



$$\left(\frac{F_{1,d}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2,d}}{F_{2,Rd}}\right)^2 + \left(\frac{F_{45,d}}{F_{45,Rd}}\right)^2 \leq 1{,}0$$

CE ETA-15/0667

www.knapp-connectors.com/megant

KNAPP® connectors.com

Content

! The following calculation tables are valid for the connectors. Load carrying capacity of timber beams are not included.

The calculation is carried out in each case, to the customer's responsibility. The specification of the Knapp GmbH is merely a possibility. Knapp GmbH accepts no liability for the calculation and the result.

Our Customer Service

The KNAPP®-Team provides competent advice and excellent service for your projects.

- In Germany and Austria we offer full-coverage service by representatives on-site. You will find the right contact person easily and quickly.

- You can reach our internal consultants in Germany and Austria, Monday – Tuesday 8 a.m. to 5 p.m. and on Friday 8 a.m. to 13 p.m.

- You can reach us on phone +43 (0)7474 / 799 10 and E-Mail: info@knapp-connectors.com

www.knapp-connectors.com/contact

Our Planner Service

▸▸▸ **Planner service**

- You can visit our online-shop 24 hours a day. Here you will receive comprehensive information about products and service. After one-time registration you will be able to use the download area.

www.knapp-connectors.com/downloads

- We offer comprehensive planning and structural-engineering calculations for architects, planners and structural engineers. Contact us for your next project! We'd like to offer you statics pre-dimensioning, recommending the right connector from KNAPP®. Benefit from our know-how, many years of experience and rely on our engineers consulting.

www.knapp-connectors.com/plannerservice

KNAPP® offers the right connection for the areas of:

| Timber construction | Post-beam wood-glass-facade | Prefab walls | Timber construction engineering | Door- and window construction | Furniture and interior design | Glued glass elements for timber and metal construction

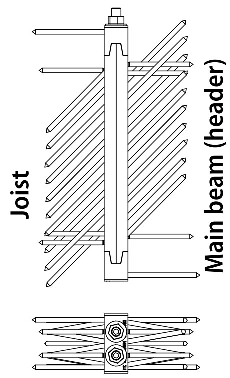
More information
www.knapp-connectors.com/downloads

MEGANT® | The heavy-duty connector for timber construction engineering up to 500 kN

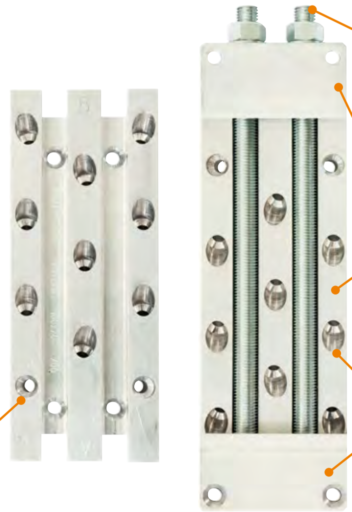
System advantages:

- Load range – standard sizes up to 428 kN, customized solutions up to 500 kN
- Minimum timber width ≤ 100 mm - 190 mm
- Connection options – on wood, steel or concrete
- ETA-assessment for solid and glued laminated timber of soft- and hardwood
- Additional wood materials like LVL, CLT, Parallam (PSL), Intrallam (LSL)
- MEGANT® ETA-assessment with stainless steel screws and threated rods
- Unique – mounting possible from all directions without tilting
- Loadable in all directions
- Fire protection – three sided concealed jointless installation
- Short crane times by a high degree of prefabrication – only 2 cm hooking way
- Dismountable – installed to connect and rebuild

Installation example with MEGANT®:
No reduction of the main beam.



Horizontal screws for removing the tensile forces from the excentric moment.



Joist

Main beam (header)

Threaded rod with washers and hex nuts.

Profiled base plates made of aluminium with fastening holes at 45° and 90°.

Conical clamping aluminium caps for closed joints in the connection area. Additional mounting holes for easy installation and high horizontal loads.

Biaxially inclined screw pattern to avoid splitting wood in header and joint.

No tilting when mounting!

MEGANT® 310x60x40 | MEGANT® 430x60x40 | MEGANT® 530x60x40 | MEGANT® 310x100x40 | MEGANT® 430x100x40 | MEGANT® 550x100x40 | MEGANT® 310x150x50 | MEGANT® 430x150x50 | MEGANT® 550x150x50

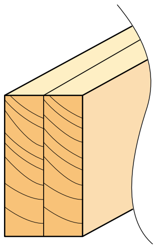
More information:
www.knapp-connectors.com/products

MEGANT® 60, 100, 150 Softwood ETA-15/0667 CE

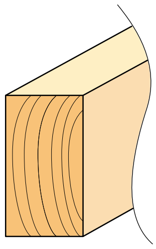
Header/joist-connector

The connectors are intended to be used in load-bearing connections of softwood timber structures as end grain to side grain, end grain to end grain or side grain to side grain connections, e.g. between beams as well as connections between timber and a concrete structure or steel member.

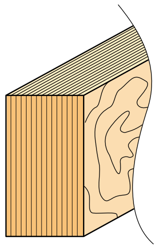
Softwood timber beams



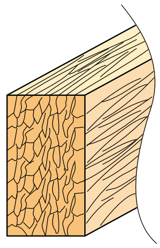
DUO/TRIO
EN 14080



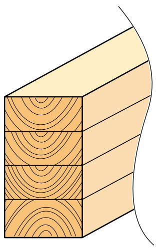
Solid wood (C)
Spruce, pine, larch
EN 338 / EN 14081-1



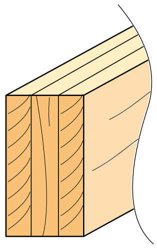
Laminated veneer lumber (LVL), Kerto
ETA approval / EN 14374



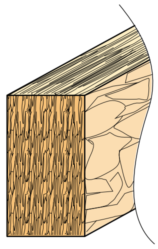
Parallam (PSL)
ETA approval



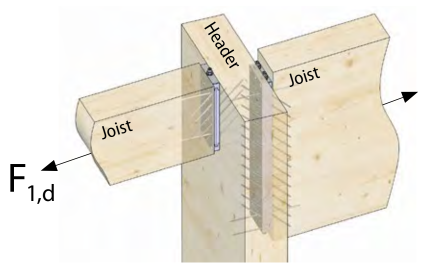
Glued laminated timber (GL)
EN14080



Cross laminated timber (CLT)
ETA approval



Intrallam (LSL)
Laminated strand lumber
ETA approval



F_1 Characteristic and Design values perpendicular to the connector plate

Centric tensile load connected to the middle of the joist for MEGANT® 60, 100, 150 in softwood

Design values with horizontal screws CS 8x160 in the header and joist

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Factor n_{ef}	Charact. values [kN] $F_{1,KCC,Rk}$	Charact. values [kN] $F_{1,J/H,Rk}$	Design values $F_{1,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{1,ser}$ [kN/mm]
MEGANT® 310x60x40 MEGANT® 430x60x40 MEGANT® 550x60x40	Gl 24c	350	100x440 100x520 100x640	3,00	36,6	35,4	16,3	19,0	21,8	24,5	6,3
	GL 24h	380				37,8	17,4	20,3	23,2	26,2	6,8
	GL 28h	410				40,2	18,5	21,6	24,7	27,8	7,2
	GL 32h	430				41,7	19,2	22,5	25,7	28,9	7,5
	CLT	380				37,8	17,4	20,3	23,2	26,2	6,8
MEGANT® 310x100x40 MEGANT® 430x100x40 MEGANT® 550x100x40	Gl 24c	350	140x440 140x520 140x640	4,67	55,3	55,1	25,4	29,6	33,9	38,1	11,6
	GL 24h	380				58,8	27,1	31,7	36,2	40,7	12,4
	GL 28h	410				62,5	28,8	33,6	38,5	43,3	13,2
	GL 32h	430				64,9	30,0	34,9	39,9	44,2	13,7
	CLT	380				58,8	27,1	31,7	36,2	40,7	12,4
MEGANT® 310x150x50 MEGANT® 430x150x50 MEGANT® 550x150x50	Gl 24c	350	190x410 190x520 190x640	6,33	74,3	74,6	34,4	40,2	45,9	51,7	18,5
	GL 24h	380				79,7	36,8	42,9	49,1	55,2	19,8
	GL 28h	410				84,7	39,1	45,6	52,1	58,6	21,0
	GL 32h	430				88,0	40,6	47,4	54,2	59,4	21,8
	CLT	380				79,7	36,8	42,9	49,1	55,2	19,8

Service class: 1-2
GL24c/GL24h/GL28h/GL32h: Glued laminated timber of softwood
CLT: Cross laminated timber of softwood with $\rho_k \geq 380$ kg/m³
γ_M = 1,3 Partial safety factor for timber joints
$\gamma_{M,2}$ = 1,25 Partial safety factor for aluminium tensile strength

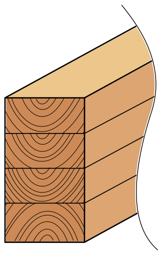
MEGANT® 60, 100, 150 Hardwood

ETA-15/0667 CE

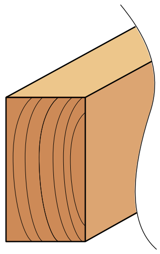
Header/joist-connector

The connectors are intended to be used in load-bearing connections of hardwood timber structures as end grain to side grain, end grain to end grain or side grain to side grain connections, e.g. between beams as well as connections between timber and a concrete structure or steel member.

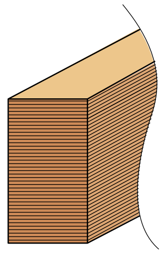
Hardwood timber beams



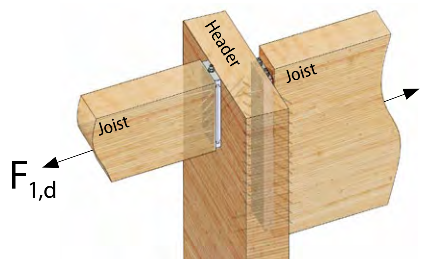
I Glued laminated timber
ETA approval



I Solid wood
Ash, oak and beech
EN 338 / EN 14081-1



I Veneer laminates
Beech (Baubuche), birch
ETA approval / EN 14374



F_1 Characterisitc and Design values perpendicular to the connector plate

Centric tensile load connected to the middle of the joist for MEGANT® 60, 100, 150 of hardwood (D30 – D50)

Design values for hardwood (D30 – D50) with horizontal screws 8x120 in header and joist

					Charact. values [kN]		Design values $F_{1,Rd}$, γ_M=1,3 [kN]				$K_{1,ser}$
KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Factor n_{ef}	$F_{1,KCC,Rk}$	$F_{1,J/H,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x60x40 MEGANT® 430x60x40 MEGANT® 550x60x40	D30 (GL_H)	530	100x440 100x520 100x640	3,00	36,6	40,1	18,5	21,6	24,7	27,8	8,8
	D35 (GL_H)	540				41,4	19,1	22,3	25,4	28,6	9,0
	D40 (GL_H)	550				42,6	19,7	22,9	26,2	29,3	9,1
	D50 (GL_H)	≥ 590				47,6	22,0	25,7	29,3	29,3	9,6
MEGANT® 310x100x40 MEGANT® 430x100x40 MEGANT® 550x100x40	D30 (GL_H)	530	140x440 140x520 140x640	4,67	55,3	62,5	28,8	33,6	38,4	43,2	16,2
	D35 (GL_H)	540				64,4	29,7	34,7	39,6	44,2	16,5
	D40 (GL_H)	550				66,3	30,6	35,7	40,8	44,2	16,7
	D50 (GL_H)	≥ 590				74,2	34,2	39,9	44,2	44,2	17,7
MEGANT® 310x150x50 MEGANT® 430x150x50 MEGANT® 550x150x50	D30 (GL_H)	530	190x410 190x520 190x640	6,33	74,3	84,7	39,1	45,6	52,1	58,6	25,8
	D35 (GL_H)	540				87,2	40,3	47,0	53,7	59,4	26,2
	D40 (GL_H)	550				89,8	41,5	48,4	55,3	59,4	26,6
	D50 (GL_H)	≥ 590				100,5	46,4	54,1	59,4	59,4	28,1

Service class: 1-2
D30/D35/D40/D50 Solid hardwood
GL_H Glued laminated timber and Veneer laminates
γ_M = 1,3 Partial safety factor for timber joints
$\gamma_{M,2}$ = 1,25 Partial safety factor for aluminium tensile strength

MEGANT® 60 Softwood ETA-15/0667 CE

Header/joist-connector

F_2 Characterisitc and design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of softwood

Torsional fixed main beam (header)

Charact. values [kN] | Design values $F_{2,Rd}$, γ_M=1,3 [kN] | $K_{2,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	Gl 24c	350	100x440	1x M20x340 (8.8)	150,4	176,4	88,1	40,6	47,4	54,2	61,0	37,3
	GL 24h	380					94,1	43,4	50,6	57,9	65,1	39,8
	GL 28h	410					100,0	46,1	53,8	61,5	69,2	42,3
	GL 32h	430					103,8	47,9	55,9	63,9	71,9	46,7
	CLT	380					94,1	43,4	50,6	57,9	65,1	39,8
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	Gl 24c	350	100x520	1x M20x460 (8.8)	150,4	176,4	138,4	63,9	74,5	85,2	95,8	37,3
	GL 24h	380					147,8	68,2	79,6	91,0	102,3	39,8
	GL 28h	410					157,1	72,5	84,6	96,7	108,7	42,3
	GL 32h	430					163,2	75,3	87,9	100,4	113,0	46,7
	CLT	380					147,8	68,2	79,6	91,0	102,3	39,8
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	Gl 24c	350	100x640	1x M20x580 (8.8)	150,4	176,4	188,7	87,1	101,6	116,1	130,6	37,3
	GL 24h	380					201,6	93,0	108,5	124,0	136,7	39,8
	GL 28h	410					214,2	98,9	115,3	131,8		42,3
	GL 32h	430					222,5	102,7	119,8	136,7		46,7
	CLT	380					201,6	93,0	108,5	124,0		39,8

Service class: 1-2
$F_{2,KCC,Rk}$ = 150,4 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

Torsional not fixed main beam (header)

Charact. values [kN] | Design values $F_{2,Rd}$, γ_M=1,3 [kN] | $K_{2,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	Gl 24c	350	100x440	1x M20x340 (8.8)	130,1	176,4	88,1	40,6	47,4	54,2	61,0	30,6
	GL 24h	380					94,1	43,4	50,6	57,9	65,1	32,7
	GL 28h	410					100,0	46,1	53,8	61,5	69,2	34,7
	GL 32h	430					103,8	47,9	55,9	63,9	71,9	38,4
	CLT	380					94,1	43,4	50,6	57,9	65,1	32,7
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	Gl 24c	350	100x520	1x M20x460 (8.8)	130,1	176,4	138,4	63,9	74,5	85,2	95,8	30,6
	GL 24h	380					147,8	68,2	79,6	91,0	102,3	32,7
	GL 28h	410					157,1	72,5	84,6	96,7	108,7	34,7
	GL 32h	430					163,2	75,3	87,9	100,4	113,0	38,4
	CLT	380					147,8	68,2	79,6	91,0	102,3	32,7
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	Gl 24c	350	100x640	1x M20x580 (8.8)	130,1	176,4	188,7	87,1	101,6	116,1	118,3	30,6
	GL 24h	380					201,6	93,0	108,5	118,3		32,7
	GL 28h	410					214,2	98,9	115,3			34,7
	GL 32h	430					222,5	102,7	118,3			38,4
	CLT	380					201,6	93,0	108,5			32,7

Service class: 1-2
$F_{2,KCC,Rk}$ = 130,1 kN for torsional not fixed main beam (header)
f_{R2} = 1,00 *(1 main beam width BH ≤ 140 mm (or reduction according to table)
γ_M = 1,30 Partial safety factor for timber joints
$\gamma_{M,1}$ = 1,10 Partial safety factor for aluminium
$\gamma_{M,2}$ = 1,25 Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	140	160	180	200	220	240	260	280	300	320
Eccentricity e =	e ≤ 90	e= 100	e= 110	e= 120	e= 130	e= 140	e= 150	e= 160	e= 170	e= 180
f_{R2} =	1,00	0,94	0,89	0,83	0,78	0,72	0,67	0,61	0,56	0,50

Design values $M_{2,\varphi,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of softwood

$M_{2,\varphi,Rk}$ | Design values $M_{2,\varphi,Rd}$ [kNm] | $K_{2,\varphi,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	[kNm]	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kNm/rad]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	Gl 24c	350	100x440	1x M20x340 (8.8)	2,1	1,0	1,2	1,3	1,5	211
	GL 24h	380			2,3	1,1	1,2	1,4	1,6	225
	GL 28h	410			2,4	1,1	1,3	1,5	1,7	239
	GL 32h	430			2,7	1,2	1,4	1,7	1,9	264
	CLT	380			2,3	1,1	1,2	1,4	1,6	225
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	Gl 24c	350	100x520	1x M20x460 (8.8)	3,2	1,5	1,7	2,0	2,2	462
	GL 24h	380			3,4	1,6	1,8	2,1	2,4	493
	GL 28h	410			3,6	1,7	1,9	2,2	2,5	524
	GL 32h	430			4,0	1,8	2,1	2,5	2,8	578
	CLT	380			3,4	1,6	1,8	2,1	2,4	493
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	Gl 24c	350	100x640	1x M20x580 (8.8)	4,2	1,9	2,3	2,6	2,9	809
	GL 24h	380			4,5	2,1	2,4	2,8	3,1	864
	GL 28h	410			4,8	2,2	2,6	2,9	3,3	918
	GL 32h	430			5,3	2,4	2,8	3,2	3,7	1014
	CLT	380			4,5	2,1	2,4	2,8	3,1	864

MEGANT® 60 Softwood

ETA-15/0667 CE

Header/joist-connector

F_3 Characteristic and design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x60x40 $n_{45,J}=7$; $n_{90,J}=5$ $n_{45,H}=7$; $n_{90,H}=5$	Gl 24c	350	100x440	1x M20x340 (8.8)	29,8	13,8	16,0	18,3	20,6
	GL 24h	380			31,0	14,3	16,7	19,1	21,5
	GL 28h	410			32,2	14,9	17,3	19,8	22,3
	GL 32h	430			33,0	15,2	17,8	20,3	22,8
	CLT	380			31,0	14,3	16,7	19,1	21,5
MEGANT® 430x60x40 $n_{45,J}=11$; $n_{90,J}=5$ $n_{45,H}=11$; $n_{90,H}=5$	Gl 24c	350	100x520	1x M20x460 (8.8)	38,9	18,0	20,9	23,9	26,9
	GL 24h	380			40,5	18,7	21,8	24,9	28,0
	GL 28h	410			42,1	19,4	22,7	25,9	29,1
	GL 32h	430			43,1	19,9	23,2	26,5	29,8
	CLT	380			40,5	18,7	21,8	24,9	28,0
MEGANT® 550x60x40 $n_{45,J}=15$; $n_{90,J}=5$ $n_{45,H}=15$; $n_{90,H}=5$	Gl 24c	350	100x640	1x M20x580 (8.8)	48,1	22,2	25,9	29,6	33,3
	GL 24h	380			50,1	23,1	27,0	30,8	34,7
	GL 28h	410			52,0	24,0	28,0	32,0	36,0
	GL 32h	430			53,3	24,6	28,7	32,8	36,9
	CLT	380			50,1	23,1	27,0	30,8	34,7

F_{45} Characteristic and design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk} \times f_{size}$	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{45,ser}$ [kN/mm]
MEGANT® 310x60x40 $n_{45,J}=7$; $n_{90,J}=5$ $n_{45,H}=7$; $n_{90,H}=5$	Gl 24c	350	100x440	1x M20x340 (8.8)	36,9	32,0	14,8	17,2	19,7	22,2	6,2
	GL 24h	380				33,4	15,4	18,0	20,6	23,1	6,6
	GL 28h	410				34,7	16,0	18,7	21,4	24,0	7,0
	GL 32h	430				35,5	16,4	19,1	21,8	24,6	7,3
	CLT	380				33,4	15,4	18,0	20,6	23,1	6,6
MEGANT® 430x60x40 $n_{45,J}=11$; $n_{90,J}=5$ $n_{45,H}=11$; $n_{90,H}=5$	Gl 24c	350	100x520	1x M20x460 (8.8)	40,6	50,4	18,7	21,9	25,0	28,1	6,2
	GL 24h	380				52,5					6,6
	GL 28h	410				54,5					7,0
	GL 32h	430				55,8					7,3
	CLT	380				52,5					6,6
MEGANT® 550x60x40 $n_{45,J}=15$; $n_{90,J}=5$ $n_{45,H}=15$; $n_{90,H}=5$	Gl 24c	350	100x640	1x M20x580 (8.8)	44,3	68,7	20,4	23,8	27,2	30,7	6,2
	GL 24h	380				71,5					6,6
	GL 28h	410				74,3					7,0
	GL 32h	430				76,1					7,3
	CLT	380				71,5					6,6

M_{tor} Torsionmoment of the joist of softwood

Design values $M_{tor,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ [kNm] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kN/mm]
MEGANT® 310x60x40 $n_{45,J}=7$; $n_{90,J}=5$ $n_{45,H}=7$; $n_{90,H}=5$	Gl 24c	350	100x440	1x M20x340 (8.8)	2,6	1,2	1,4	1,6	1,8	200
	GL 24h	380			2,7	1,2	1,4	1,7	1,9	227
	GL 28h	410			2,8	1,3	1,5	1,7	1,9	254
	GL 32h	430			2,9	1,3	1,6	1,8	2,0	273
	CLT	380			2,7	1,2	1,4	1,7	1,9	227
MEGANT® 430x60x40 $n_{45,J}=11$; $n_{90,J}=5$ $n_{45,H}=11$; $n_{90,H}=5$	Gl 24c	350	100x520	1x M20x460 (8.8)	5,5	2,5	3,0	3,4	3,8	639
	GL 24h	380			5,8	2,7	3,1	3,6	4,0	723
	GL 28h	410			6,1	2,8	3,3	3,8	4,2	810
	GL 32h	430			6,3	2,9	3,4	3,9	4,4	870
	CLT	380			5,8	2,7	3,1	3,6	4,0	723
MEGANT® 550x60x40 $n_{45,J}=15$; $n_{90,J}=5$ $n_{45,H}=15$; $n_{90,H}=5$	Gl 24c	350	100x640	1x M20x580 (8.8)	9,7	4,5	5,2	6,0	6,7	1569
	GL 24h	380			10,2	4,7	5,5	6,3	7,1	1775
	GL 28h	410			10,8	5,0	5,8	6,6	7,5	1989
	GL 32h	430			11,1	5,1	6,0	6,8	7,7	2137
	CLT	380			10,2	4,7	5,5	6,3	7,1	1775

Service class: 1-2

GL24c/GL24h/GL28h/GL32h — Glued laminated timber of softwood

CLT — Cross laminated timber of softwood with $\rho_k \geq 380$ kg/m³

γ_M = 1,3 — Partial safety factor for timber joints

MEGANT® 60 Hardwood ETA-15/0667 CE

Header/joist-connector

F_2 Characterisitc and design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 60 with screws CS 8x120 for header and joist of hardwood /glued laminated timber

Torsional fixed main beam (header) — Charact. values [kN] — Design values $F_{2,Rd}$, γ_M=1,3 [kN] — $K_{2,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{3,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	150,40	176,40	132,5	61,2	71,3	81,5	91,7	51,9
	D35 (GL_H)	540					136,5	63,0	73,5	84,0	94,5	52,7
	D40 (GL_H)	550					140,6	64,9	75,7	86,5	97,3	53,5
	D50 (GL_H)	≥ 590					157,3	72,6	84,7	96,8	108,9	56,6
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	150,40	176,40	208,2	96,1	112,1	128,1	136,7	51,9
	D35 (GL_H)	540					214,5	99,0	115,5	132,0		52,7
	D40 (GL_H)	550					220,9	102,0	119,0	136,0		53,5
	D50 (GL_H)	≥ 590					247,2	114,1	133,1	136,7		56,6
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	150,40	176,40	283,9	131,0	136,7	136,7	136,7	51,9
	D35 (GL_H)	540					292,6	135,0				52,7
	D40 (GL_H)	550					301,3	136,7				53,5
	D50 (GL_H)	≥ 590					337,1	136,7				56,6

Service class: 1-2
$F_{2,KCC,Rk}$ = 150,4 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

Torsional not fixed main beam (header) — Charact. values [kN] — Design values $F_{2,Rd}$, γ_M=1,3 [kN] — $K_{2,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	130,1	176,4	132,5	61,2	71,3	81,5	91,7	42,7
	D35 (GL_H)	540					136,5	63,0	73,5	84,0	94,5	43,3
	D40 (GL_H)	550					140,6	64,9	75,7	86,5	97,3	44,0
	D50 (GL_H)	≥ 590					157,3	72,6	84,7	96,8	108,9	46,5
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	130,1	176,4	208,2	96,1	112,1	118,3	118,3	42,7
	D35 (GL_H)	540					214,5	99,0	115,5			43,3
	D40 (GL_H)	550					220,9	102,0	118,3			44,0
	D50 (GL_H)	≥ 590					247,2	114,1				46,5
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	130,1	176,4	283,9	118,3	118,3	118,3	118,3	42,7
	D35 (GL_H)	540					292,6					43,3
	D40 (GL_H)	550					301,3					44,0
	D50 (GL_H)	≥ 590					337,1					46,5

Service class: 1-2
$F_{2,KCC,Rk}$ = 130,1 kN for torsional not fixed main beam (header)
f_{R2} = 1,00 *(1 main beam width B_H ≤ 140 mm (or reduction according to table)
γ_M = 1,30 Partial safety factor for timber joints
$\gamma_{M,1}$ = 1,10 Partial safety factor for aluminium
$\gamma_{M,2}$ = 1,25 Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	140	160	180	200	220	240	260	280	300	320
Eccentricity e =	e ≤ 90	e= 100	e= 110	e= 120	e= 130	e= 140	e= 150	e= 160	e= 170	e= 180
f_{R2} =	1,00	0,94	0,89	0,83	0,78	0,72	0,67	0,61	0,56	0,50

Design values $M_{2,\varphi,Rd}$ for MEGANT® 60 with screws CS 8x160 for header and joist of hardwood / glued laminated timber

$M_{2,\varphi,Rk}$ — Design values $M_{2,\varphi,Rd}$ — $K_{2,\varphi,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	[kNm]	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kNm/rad]
MEGANT® 310x60x40 $n_{45,J}$ =7; $n_{90,J}$ =5 $n_{45,H}$ =7; $n_{90,H}$ =5	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	3,0	1,4	1,6	1,8	2,1	294
	D35 (GL_H)	540			3,0	1,4	1,6	1,9	2,1	298
	D40 (GL_H)	550			3,1	1,4	1,7	1,9	2,1	302
	D50 (GL_H)	≥ 590			3,3	1,5	1,8	2,0	2,3	320
MEGANT® 430x60x40 $n_{45,J}$ =11; $n_{90,J}$ =5 $n_{45,H}$ =11; $n_{90,H}$ =5	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	4,4	2,0	2,4	2,7	3,1	643
	D35 (GL_H)	540			4,5	2,1	2,4	2,8	3,1	653
	D40 (GL_H)	550			4,6	2,1	2,5	2,8	3,2	663
	D50 (GL_H)	≥ 590			4,8	2,2	2,6	3,0	3,3	701
MEGANT® 550x60x40 $n_{45,J}$ =15; $n_{90,J}$ =5 $n_{45,H}$ =15; $n_{90,H}$ =5	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	5,9	2,7	3,2	3,6	4,1	1127
	D35 (GL_H)	540			6,0	2,8	3,2	3,7	4,1	1144
	D40 (GL_H)	550			6,0	2,8	3,3	3,7	4,2	1161
	D50 (GL_H)	≥ 590			6,4	3,0	3,4	3,9	4,4	1228

MEGANT® 60 Hardwood

ETA-15/0667

CE

Header/joist-connector

F_3 Characterisitc and design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 60 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x100x40 $n_{45,J}=9$; $n_{90,J}=8$ $n_{45,H}=9$; $n_{90,H}=8$	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	46,8	21,6	25,2	28,8	32,4
	D35 (GL_H)	540			47,5	21,9	25,6	29,2	32,9
	D40 (GL_H)	550			48,1	22,2	25,9	29,6	33,3
	D50 (GL_H)	≥ 590			50,5	23,3	27,2	31,1	35,0
MEGANT® 430x100x40 $n_{45,J}=15$; $n_{90,J}=8$ $n_{45,H}=15$; $n_{90,H}=8$	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	61,5	28,4	33,1	37,8	42,6
	D35 (GL_H)	540			62,3	28,8	33,5	38,3	43,1
	D40 (GL_H)	550			63,1	29,1	34,0	38,8	43,7
	D50 (GL_H)	≥ 590			66,0	30,5	35,5	40,6	45,7
MEGANT® 550x100x40 $n_{45,J}=21$; $n_{90,J}=8$ $n_{45,H}=21$; $n_{90,H}=8$	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	76,3	35,2	41,1	47,0	52,8
	D35 (GL_H)	540			77,2	35,6	41,6	47,5	53,4
	D40 (GL_H)	550			78,1	36,0	42,1	48,1	54,1
	D50 (GL_H)	≥ 590			81,5	37,6	43,9	50,2	56,4

F_{45} Characterisitc and design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 60 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk} \times f_{size}$	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x60x40 $n_{45,J}=7$; $n_{90,J}=5$ $n_{45,H}=7$; $n_{90,H}=5$	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	36,9	49,2	17,0	19,9	22,7	25,5	8,6
	D35 (GL_H)	540				50,1					8,7
	D40 (GL_H)	550				51,1					8,9
	D50 (GL_H)	≥ 590				54,3					9,4
MEGANT® 430x60x40 $n_{45,J}=11$; $n_{90,J}=5$ $n_{45,H}=11$; $n_{90,H}=5$	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	40,6	77,3	18,7	21,9	25,0	28,1	8,6
	D35 (GL_H)	540				78,8					8,7
	D40 (GL_H)	550				80,3					8,9
	D50 (GL_H)	≥ 590				85,4					9,4
MEGANT® 550x60x40 $n_{45,J}=15$; $n_{90,J}=5$ $n_{45,H}=15$; $n_{90,H}=5$	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	44,3	105,3	20,4	23,8	27,2	30,7	8,6
	D35 (GL_H)	540				107,4					8,7
	D40 (GL_H)	550				109,4					8,9
	D50 (GL_H)	≥ 590				116,5					9,4

M_{tor} Torsionmoment of the joist of hardwood

Design values $M_{tor,Rd}$ for MEGANT® 60 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kNm/rad]
MEGANT® 310x60x40 $n_{45,J}=7$; $n_{90,J}=5$ $n_{45,H}=7$; $n_{90,H}=5$	D30 (GL_H)	530	100x440	1x M20x340 (8.8)	3,5	1,6	1,9	2,2	2,4	374
	D35 (GL_H)	540			3,5	1,6	1,9	2,2	2,4	384
	D40 (GL_H)	550			3,6	1,7	1,9	2,2	2,5	395
	D50 (GL_H)	≥ 590			3,9	1,8	2,1	2,4	2,7	439
MEGANT® 430x60x40 $n_{45,J}=11$; $n_{90,J}=5$ $n_{45,H}=11$; $n_{90,H}=5$	D30 (GL_H)	530	100x520	1x M20x460 (8.8)	7,5	3,5	4,0	4,6	5,2	1190
	D35 (GL_H)	540			7,7	3,6	4,1	4,7	5,3	1224
	D40 (GL_H)	550			7,8	3,6	4,2	4,8	5,4	1258
	D50 (GL_H)	≥ 590			8,5	3,9	4,6	5,2	5,9	1398
MEGANT® 550x60x40 $n_{45,J}=15$; $n_{90,J}=5$ $n_{45,H}=15$; $n_{90,H}=5$	D30 (GL_H)	530	100x640	1x M20x580 (8.8)	13,2	6,1	7,1	8,1	9,1	2924
	D35 (GL_H)	540			13,5	6,2	7,3	8,3	9,3	3007
	D40 (GL_H)	550			13,8	6,4	7,4	8,5	9,6	3091
	D50 (GL_H)	≥ 590			14,9	6,9	8,0	9,2	10,3	3434

Service class: 1-2
D30/D35/D40/D50 solid hardwood
GL_H Glued laminated timber of hardwood
γ_M = 1,3 Partial safety factor for timber joints

MEGANT® 100 Softwood ETA-15/0667

Header/joist-connector

F_2 Characterisitc and design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 100 with screws CS 8x160 for header and joist of softwood

Torsional fixed main beam (header)

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
					Charact. values [kN]			Design values $F_{2,Rd}$, γ_M=1,3 [kN]				
MEGANT® 310x100x40 $n_{45,J}$=9; $n_{90,J}$=8 $n_{45,H}$=9; $n_{90,H}$=8	Gl 24c	350	140x440	2x M16x340 (8.8)	224,2	226,1	113,2	52,3	61,0	69,7	78,4	53,6
	GL 24h	380					120,9	55,8	65,1	74,4	83,7	57,2
	GL 28h	410					128,5	59,3	69,2	79,1	89,0	60,8
	GL 32h	430					133,5	61,6	71,9	82,2	92,4	67,1
	CLT	380					120,9	55,8	65,1	74,4	83,7	57,2
MEGANT® 430x100x40 $n_{45,J}$=15; $n_{90,J}$=8 $n_{45,H}$=15; $n_{90,H}$=8	Gl 24c	350	140x520	2x M16x460 (8.8)	224,2	226,1	188,7	87,1	101,6	116,1	130,6	53,6
	GL 24h	380					201,6	93,0	108,5	124,0	139,5	57,2
	GL 28h	410					214,2	98,9	115,3	131,8	148,3	60,8
	GL 32h	430					222,5	102,7	119,8	136,9	154,0	67,1
	CLT	380					201,6	93,0	108,5	124,0	139,5	57,2
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$=8 $n_{45,H}$=21; $n_{90,H}$=8	Gl 24c	350	140x640	2x M16x580 (8.8)	224,2	226,1	264,2	121,9	142,3	162,6	180,9	53,6
	GL 24h	380					282,2	130,2	151,9	173,6		57,2
	GL 28h	410					299,9	138,4	161,5	180,9		60,8
	GL 32h	430					311,5	143,8	167,7			67,1
	CLT	380					282,2	130,2	151,9	173,6		57,2

Service class: 1-2
$F_{2,KCC,Rk}$ = 224,20 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

Torsional not fixed main beam (header)

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
					Charact. values [kN]			Design values $F_{2,Rd}$, γ_M=1,3 [kN]				
MEGANT® 310x100x40 $n_{45,J}$=9; $n_{90,J}$=8 $n_{45,H}$=9; $n_{90,H}$=8	Gl 24c	350	140x440	2x M16x340 (8.8)	206,6	226,1	113,2	52,3	61,0	69,7	78,4	45,5
	GL 24h	380					120,9	55,8	65,1	74,4	83,7	48,6
	GL 28h	410					128,5	59,3	69,2	79,1	89,0	51,6
	GL 32h	430					113,5	52,4	61,1	69,8	78,6	57,0
	CLT	380					120,9	55,8	65,1	74,4	83,7	48,6
MEGANT® 430x100x40 $n_{45,J}$=15; $n_{90,J}$=8 $n_{45,H}$=15; $n_{90,H}$=8	Gl 24c	350	140x520	2x M16x460 (8.8)	206,6	226,1	188,7	87,1	101,6	116,1	130,6	45,5
	GL 24h	380					201,6	93,0	108,5	124,0	139,5	48,6
	GL 28h	410					214,2	98,9	115,3	131,8	148,3	51,6
	GL 32h	430					222,5	102,7	119,8	136,9	154,0	57,0
	CLT	380					201,6	93,0	108,5	124,0	139,5	48,6
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$=8 $n_{45,H}$=21; $n_{90,H}$=8	Gl 24c	350	140x640	2x M16x580 (8.8)	206,6	226,1	264,2	121,9	142,3	162,6	180,9	45,5
	GL 24h	380					282,2	130,2	151,9	173,6		48,6
	GL 28h	410					299,9	138,4	161,5	180,9		51,6
	GL 32h	430					311,5	143,8	167,7			57,0
	CLT	380					282,2	130,2	151,9	173,6		48,6

Service class: 1-2
$F_{2,KCC,Rk}$ = 206,60 kN for torsional not fixed main beam (header)
f_{R2} = 1,00 *(1 main beam width $B_H \leq$ 140 mm (or reduction according to table)
γ_M = 1,30 Partial safety factor for timber joints
$\gamma_{M,1}$ = 1,10 Partial safety factor for aluminium
$\gamma_{M,2}$ = 1,25 Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	140	160	180	200	220	240	260	280	300	320	340	360
Eccentricity e =	e ≤ 90	e= 100	e= 110	e= 120	e= 130	e= 140	e= 150	e= 160	e= 170	e= 180	e= 190	e= 200
f_{R2} =	1,00	0,95	0,91	0,86	0,82	0,77	0,73	0,68	0,64	0,59	0,55	0,50

Design values $M_{2,\varphi,Rd}$ for MEGANT® 100 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{2,\varphi,Rk}$ [kNm]	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,\varphi,ser}$ [kNm/rad]
						Design values $M_{2,\varphi,Rd}$ [kNm]				
MEGANT® 310x100x40 $n_{45,J}$=9; $n_{90,J}$=8 $n_{45,H}$=9; $n_{90,H}$=8	Gl 24c	350	140x440	2x M16x340 (8.8)	3,3	1,5	1,8	2,0	2,3	387
	GL 24h	380			3,5	1,6	1,9	2,2	2,4	413
	GL 28h	410			3,7	1,7	2,0	2,3	2,6	439
	GL 32h	430			4,1	1,9	2,2	2,5	2,8	485
	CLT	380			3,5	1,6	1,9	2,2	2,4	413
MEGANT® 430x100x40 $n_{45,J}$=15; $n_{90,J}$=8 $n_{45,H}$=15; $n_{90,H}$=8	Gl 24c	350	140x520	2x M16x460 (8.8)	4,8	2,2	2,6	2,9	3,3	846
	GL 24h	380			5,1	2,4	2,7	3,1	3,5	904
	GL 28h	410			5,4	2,5	2,9	3,3	3,8	961
	GL 32h	430			6,0	2,8	3,2	3,7	4,1	1061
	CLT	380			5,1	2,4	2,7	3,1	3,5	904
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$=8 $n_{45,H}$=21; $n_{90,H}$=8	Gl 24c	350	140x640	2x M16x580 (8.8)	6,4	2,9	3,4	3,9	4,4	1484
	GL 24h	380			6,8	3,1	3,7	4,2	4,7	1585
	GL 28h	410			7,2	3,3	3,9	4,4	5,0	1684
	GL 32h	430			8,0	3,7	4,3	4,9	5,5	1859
	CLT	380			6,8	3,1	3,7	4,2	4,7	1585

MEGANT® 100 Softwood ETA-15/0667

Header/joist-connector

F_3 Characterisitc and design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 100 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x100x40 $n_{45,J}=9$; $n_{90,J}=8$ $n_{45,H}=9$; $n_{90,H}=8$	Gl 24c	350	140x440	2x M16x340 (8.8)	48,1	22,2	25,9	29,6	33,3
	GL 24h	380			50,1	23,1	27,0	30,8	34,7
	GL 28h	410			52,0	24,0	28,0	32,0	36,0
	GL 32h	430			53,3	24,6	28,7	32,8	36,9
	CLT	380			50,1	23,1	27,0	30,8	34,7
MEGANT® 430x100x40 $n_{45,J}=15$; $n_{90,J}=8$ $n_{45,H}=15$; $n_{90,H}=8$	Gl 24c	350	140x520	2x M16x460 (8.8)	61,8	28,5	33,3	38,0	42,8
	GL 24h	380			64,4	29,7	34,7	39,6	44,6
	GL 28h	410			66,9	30,9	36,0	41,2	46,3
	GL 32h	430			68,5	31,6	36,9	42,2	47,4
	CLT	380			64,4	29,7	34,7	39,6	44,6
MEGANT® 550x100x40 $n_{45,J}=21$; $n_{90,J}=8$ $n_{45,H}=21$; $n_{90,H}=8$	Gl 24c	350	140x640	2x M16x580 (8.8)	75,5	34,8	40,7	46,5	52,3
	GL 24h	380			78,7	36,3	42,4	48,4	54,5
	GL 28h	410			81,7	37,7	44,0	50,3	56,6
	GL 32h	430			83,7	38,6	45,1	51,5	57,9
	CLT	380			78,7	36,3	42,4	48,4	54,5

F_{45} Characterisitc and design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 100 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk}$ x f_{size}	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{45,ser}$ [kN/mm]
MEGANT® 310x100x40 $n_{45,J}=9$; $n_{90,J}=8$ $n_{45,H}=9$; $n_{90,H}=8$	Gl 24c	350	140x440	2x M16x340 (8.8)	62,4	41,2	19,0	22,2	25,4	28,5	8,4
	GL 24h	380				42,9	19,8	23,1	26,4	29,7	9,0
	GL 28h	410				44,6	20,6	24,0	27,4	30,9	9,6
	GL 32h	430				45,7	21,1	24,6	28,1	31,6	9,9
	CLT	380				42,9	19,8	23,1	26,4	29,7	9,0
MEGANT® 430x100x40 $n_{45,J}=15$; $n_{90,J}=8$ $n_{45,H}=15$; $n_{90,H}=8$	Gl 24c	350	140x520	2x M16x460 (8.8)	68,6	68,7	31,7	37,0	42,2	47,5	8,4
	GL 24h	380				71,5					9,0
	GL 28h	410				74,3					9,6
	GL 32h	430				76,1					9,9
	CLT	380				71,5					9,0
MEGANT® 550x100x40 $n_{45,J}=21$; $n_{90,J}=8$ $n_{45,H}=21$; $n_{90,H}=8$	Gl 24c	350	140x640	2x M16x580 (8.8)	74,9	96,1	34,6	40,3	46,1	51,8	8,4
	GL 24h	380				100,2					9,0
	GL 28h	410				104,0					9,6
	GL 32h	430				106,6					9,9
	CLT	380				100,2					9,0

M_{tor} Torsionmoment of the joist of softwood

Design values $M_{tor,Rd}$ for MEGANT® 100 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ [kNm] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kN/mm]
MEGANT® 310x100x40 $n_{45,J}=9$; $n_{90,J}=8$ $n_{45,H}=9$; $n_{90,H}=8$	Gl 24c	350	140x440	2x M16x340 (8.8)	4,2	1,9	2,3	2,6	2,9	346
	GL 24h	380			4,4	2,0	2,4	2,7	3,0	391
	GL 28h	410			4,6	2,1	2,5	2,8	3,2	438
	GL 32h	430			4,8	2,2	2,6	3,0	3,3	471
	CLT	380			4,4	2,0	2,4	2,7	3,0	391
MEGANT® 430x100x40 $n_{45,J}=15$; $n_{90,J}=8$ $n_{45,H}=15$; $n_{90,H}=8$	Gl 24c	350	140x520	2x M16x460 (8.8)	8,6	4,0	4,7	5,4	6,0	1066
	GL 24h	380			9,2	4,2	5,0	5,7	6,4	1206
	GL 28h	410			9,7	4,5	5,2	6,0	6,7	1352
	GL 32h	430			10,0	4,6	5,4	6,2	6,9	1452
	CLT	380			9,2	4,2	5,0	5,7	6,4	1206
MEGANT® 550x100x40 $n_{45,J}=21$; $n_{90,J}=8$ $n_{45,H}=21$; $n_{90,H}=8$	Gl 24c	350	140x640	2x M16x580 (8.8)	14,9	6,9	8,1	9,2	10,4	2443
	GL 24h	380			15,9	7,3	8,6	9,8	11,0	2764
	GL 28h	410			16,6	7,7	8,9	10,2	11,5	3098
	GL 32h	430			17,2	7,9	9,3	10,6	11,9	3327
	CLT	380			15,9	7,3	8,6	9,8	11,0	2764

Service class: 1-2

GL24c/GL24h/GL28h/GL32h Glued laminated timber of softwood

CLT Cross laminated timber of softwood with $\rho_k \geq 380$ kg/m³

γ_M = 1,3 Partial safety factor for timber joints

MEGANT® 100 Hardwood ETA-15/0667 CE

Header/joist-connector

F_2 Characterisitc and Design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 100 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

Torsional fixed main beam (header)

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1 (Charact. values [kN])	$F_{t,Rk}$ Threaded rod (Charact. values [kN])	$F_{3,Rk}$ (Charact. values [kN])	k_{mod} 0,6 (Design values $F_{2,Rd}$, γ_M=1,3 [kN])	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	224,2	226,1	170,4	78,6	91,7	104,8	117,9	74,6
	D35 (GL$_H$)	540					175,5	81,0	94,5	108,0	121,5	75,8
	D40 (GL$_H$)	550					180,8	83,4	97,3	111,2	125,1	76,9
	D50 (GL$_H$)	≥ 590					202,3	93,3	108,9	124,5	140,0	81,3
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	224,2	226,1	283,9	131,0	152,9	174,7	180,9	74,6
	D35 (GL$_H$)	540					292,6	135,0	157,5	180,9		75,8
	D40 (GL$_H$)	550					301,3	139,0	162,2			76,9
	D50 (GL$_H$)	≥ 590					337,1	155,6	180,9			81,3
MEGANT® 550x100x40 $n_{45,J}$ =21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	224,2	226,1	397,5	180,9	180,9	180,9	180,9	74,6
	D35 (GL$_H$)	540					409,6					75,8
	D40 (GL$_H$)	550					421,8					76,9
	D50 (GL$_H$)	≥ 590					471,9					81,3

Service class: 1-2
$F_{2,KCC,Rk}$ = 224,20 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

Torsional not fixed main beam (header)

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1 (Charact. values [kN])	$F_{t,Rk}$ Threaded rod (Charact. values [kN])	$F_{2,Rk}$ (Charact. values [kN])	k_{mod} 0,6 (Design values $F_{2,Rd}$, γ_M=1,3 [kN])	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	206,6	226,1	170,4	78,6	91,7	104,8	117,9	63,4
	D35 (GL$_H$)	540					175,5	81,0	94,5	108,0	121,5	64,4
	D40 (GL$_H$)	550					180,8	83,4	97,3	111,2	125,1	65,3
	D50 (GL$_H$)	≥ 590					202,3	93,3	108,9	124,5	140,0	69,1
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	206,6	226,1	283,9	131,0	152,9	174,7	180,9	63,4
	D35 (GL$_H$)	540					292,6	135,0	157,5	180,0		64,4
	D40 (GL$_H$)	550					301,3	139,0	162,2	180,9		65,3
	D50 (GL$_H$)	≥ 590					337,1	155,6	180,9			69,1
MEGANT® 550x100x40 $n_{45,J}$ =21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	206,6	226,1	397,5	180,9	180,9	180,9	180,9	63,4
	D35 (GL$_H$)	540					409,6					64,4
	D40 (GL$_H$)	550					421,8					65,3
	D50 (GL$_H$)	≥ 590					471,9					69,1

Service class: 1-2
$F_{2,KCC,Rk}$ = 206,60 kN for torsional not fixed main beam (header)
f_{R2} = 1,00 *(1 main beam width B_H ≤ 140 mm (or reduction according to table)
γ_M = 1,30 Partial safety factor for timber joints
$\gamma_{M,1}$ = 1,10 Partial safety factor for aluminium
$\gamma_{M,2}$ = 1,25 Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	140	160	180	200	220	240	260	280	300	320	340	360
Eccentricity e =	e ≤ 90	e= 100	e= 110	e= 120	e= 130	e= 140	e= 150	e= 160	e= 170	e= 180	e= 190	e= 200
f_{R2} =	1,00	0,95	0,91	0,86	0,82	0,77	0,73	0,68	0,64	0,59	0,55	0,50

Design values $M_{2,\varphi,Rd}$ for MEGANT® 100 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{2,\varphi,Rk}$ [kNm]	k_{mod} 0,6 (Design values $M_{2,\varphi,Rd}$)	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,\varphi,ser}$ [kNm/rad]
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	4,5	2,1	2,4	2,8	3,1	539
	D35 (GL$_H$)	540			4,6	2,1	2,5	2,8	3,2	547
	D40 (GL$_H$)	550			4,7	2,1	2,5	2,9	3,2	555
	D50 (GL$_H$)	≥ 590			4,9	2,3	2,6	3,0	3,4	587
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	6,7	3,1	3,6	4,1	4,6	1.180
	D35 (GL$_H$)	540			6,8	3,1	3,7	4,2	4,7	1.197
	D40 (GL$_H$)	550			6,9	3,2	3,7	4,2	4,8	1.215
	D50 (GL$_H$)	≥ 590			7,3	3,4	3,9	4,5	5,0	1.285
MEGANT® 550x100x40 $n_{45,J}$ =21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	8,8	4,1	4,8	5,4	6,1	2.068
	D35 (GL$_H$)	540			9,0	4,1	4,8	5,5	6,2	2.100
	D40 (GL$_H$)	550			9,1	4,2	4,9	5,6	6,3	2.131
	D50 (GL$_H$)	≥ 590			9,6	4,4	5,2	5,9	6,7	2.254

MEGANT® 100 Hardwood ETA-15/0667 CE

Header/joist-connector

F_3 Characterisitc and design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 100 with screws 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	75,3	34,8	40,5	46,3	52,1
	D35 (GL$_H$)	540			76,4	35,3	41,1	47,0	52,9
	D40 (GL$_H$)	550			77,5	35,8	41,7	47,7	53,7
	D50 (GL$_H$)	≥ 590			81,5	37,6	43,9	50,2	56,4
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	97,3	44,9	52,4	59,9	67,4
	D35 (GL$_H$)	540			98,7	45,6	53,1	60,7	68,3
	D40 (GL$_H$)	550			100,0	46,2	53,8	61,5	69,2
	D50 (GL$_H$)	≥ 590			104,8	48,4	56,4	64,5	72,6
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$=8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	119,4	55,1	64,3	73,5	82,7
	D35 (GL$_H$)	540			120,9	55,8	65,1	74,4	83,7
	D40 (GL$_H$)	550			122,5	56,5	66,0	75,4	84,8
	D50 (GL$_H$)	≥ 590			128,1	59,1	69,0	78,8	88,7

F_{45} Characterisitc and design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 100 with screws 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk}$ x f_{size}	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	62,4	63,2	28,8	33,6	38,4	43,2	11,7
	D35 (GL$_H$)	540				64,4					11,9
	D40 (GL$_H$)	550				65,7					12,1
	D50 (GL$_H$)	≥ 590				69,9					12,8
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	68,6	105,3	31,7	37,0	42,2	47,5	11,7
	D35 (GL$_H$)	540				107,4					11,9
	D40 (GL$_H$)	550				109,4					12,1
	D50 (GL$_H$)	≥ 590				116,5					12,8
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$=8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	74,9	147,5	34,6	40,3	46,1	51,8	11,7
	D35 (GL$_H$)	540				150,3					11,9
	D40 (GL$_H$)	550				153,2					12,1
	D50 (GL$_H$)	≥ 590				163,0					12,8

M_{tor} Torsionmoment of the joist of softwood

Design values $M_{tor,Rd}$ for MEGANT® 100 with screws 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kNm/rad]
MEGANT® 310x100x40 $n_{45,J}$ =9; $n_{90,J}$ =8 $n_{45,H}$ =9; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x440	2x M16x340 (8.8)	5,7	2,6	3,1	3,5	3,9	644
	D35 (GL$_H$)	540			5,8	2,7	3,1	3,6	4,0	662
	D40 (GL$_H$)	550			5,9	2,7	3,2	3,6	4,1	681
	D50 (GL$_H$)	≥ 590			6,4	3,0	3,4	3,9	4,4	757
MEGANT® 430x100x40 $n_{45,J}$ =15; $n_{90,J}$ =8 $n_{45,H}$ =15; $n_{90,H}$ =8	D30 (GL$_H$)	530	140x520	2x M16x460 (8.8)	11,9	5,5	6,4	7,3	8,2	1986
	D35 (GL$_H$)	540			12,1	5,6	6,5	7,4	8,4	2043
	D40 (GL$_H$)	550			12,4	5,7	6,7	7,6	8,6	2100
	D50 (GL$_H$)	≥ 590			13,4	6,2	7,2	8,2	9,3	2333
MEGANT® 550x100x40 $n_{45,J}$=21; $n_{90,J}$ =8 $n_{45,H}$ =21; $n_{90,H}$=8	D30 (GL$_H$)	530	140x640	2x M16x580 (8.8)	20,5	9,5	11,0	12,6	14,2	4553
	D35 (GL$_H$)	540			20,9	9,6	11,3	12,9	14,5	4683
	D40 (GL$_H$)	550			21,3	9,8	11,5	13,1	14,7	4813
	D50 (GL$_H$)	≥ 590			23,0	10,6	12,4	14,2	15,9	5348

Service class: 1-2
D30/D35/D40/D50 solid hardwood
GL$_H$ Glued laminated timber of hardwood
γ_M = 1,3 Partial safety factor for timber joints

MEGANT® 150 Sofwood ETA-15/0667 CE

Header/joist-connector

F_2 Characterisitc and Design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

Torsional fixed main beam (header) — **Charact. values [kN]** — **Design values $F_{2,Rd}$, γ_M=1,3 [kN]** — **$K_{2,ser}$**

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	Gl 24c	350	190x410	1x M20x340 (8.8)	375,0	176,4	146,4	67,6	78,8	90,1	101,4	82,6
	GL 24h	380					156,4	72,2	84,2	96,2	108,3	88,2
	GL 28h	410					166,2	76,7	89,5	102,3	115,1	93,7
	GL 32h	430					172,7	79,7	93,0	106,2	119,5	103,5
	CLT	380					156,4	72,2	84,2	96,2	108,3	88,2
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	Gl 24c	350	190x520	2x M20x460 (8.8)	375,0	352,8	244,1	112,6	131,4	150,2	169,0	82,6
	GL 24h	380					260,7	120,3	140,4	160,4	180,5	88,2
	GL 28h	410					277,0	127,8	149,1	170,5	191,8	93,7
	GL 32h	430					287,8	132,8	154,9	177,1	199,2	103,5
	CLT	380					260,7	120,3	140,4	160,4	180,5	88,2
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	Gl 24c	350	190x640	3x M20x580 (8.8)	375,0	529,2	341,7	157,7	184,0	210,3	236,5	82,6
	GL 24h	380					364,9	168,4	196,5	224,6	252,6	88,2
	GL 28h	410					387,8	179,0	208,8	238,6	268,5	93,7
	GL 32h	430					402,9	185,9	216,9	247,9	278,9	103,5
	CLT	380					364,9	168,4	196,5	224,6	252,6	88,2
MEGANT® 610x150x50 $n_{45,J}$ =32; $n_{90,J}$ =12 $n_{45,H}$ =32; $n_{90,H}$ =12	Gl 24c	350	190x710	3x M20x640 (8.8)	375,0	529,2	390,5	180,2	210,3	240,3	270,3	82,6
	GL 24h	380					417,0	192,5	224,6	256,6	288,7	88,2
	GL 28h	410					443,2	204,5	238,6	272,7	306,8	93,7
	GL 32h	430					460,4	212,5	247,9	283,3	318,7	103,5
	CLT	380					417,0	192,5	224,6	256,6	288,7	88,2
MEGANT® 670x150x50 $n_{45,J}$ =36; $n_{90,J}$ =12 $n_{45,H}$ =36; $n_{90,H}$ =12	Gl 24c	350	190x770	3x M20x700 (8.8)	375,0	529,2	439,3	202,8	236,5	270,3	304,1	82,6
	GL 24h	380					469,2	216,5	252,6	288,7	324,8	88,2
	GL 28h	410					498,6	230,1	268,5	306,8	340,9	93,7
	GL 32h	430					517,9	239,0	278,9	318,7	340,9	103,5
	CLT	380					469,2	216,5	252,6	288,7	324,8	88,2
MEGANT® 730x150x50 $n_{45,J}$ =40; $n_{90,J}$ =12 $n_{45,H}$ =40; $n_{90,H}$ =12	Gl 24c	350	190x830	3x M20x760 (8.8)	375,0	529,2	488,1	225,3	262,8	300,4	337,9	82,6
	GL 24h	380					521,3	240,6	280,7	320,8	340,9	88,2
	GL 28h	410					554,0	255,7	298,3	340,9		93,7
	GL 32h	430					575,5	265,6	309,9	340,9		103,5
	CLT	380					521,3	240,6	280,7	320,8		88,2
MEGANT® 790x150x50 $n_{45,J}$ =44; $n_{90,J}$ =12 $n_{45,H}$ =44; $n_{90,H}$ =12	Gl 24c	350	190x890	3x M20x820 (8.8)	375,0	529,2	536,9	247,8	289,1	330,4	340,9	82,6
	GL 24h	380					573,4	264,7	308,8	340,9		88,2
	GL 28h	410					609,4	281,3	328,1			93,7
	GL 32h	430					633,0	292,2	340,9			103,5
	CLT	380					573,4	264,7	308,8			88,2
MEGANT® 850x150x50 $n_{45,J}$ =48; $n_{90,J}$ =15 $n_{45,H}$ =48; $n_{90,H}$ =15	Gl 24c	350	190x950	3x M20x910 (8.8)	375,0	529,2	585,7	270,3	315,4	340,9	340,9	82,6
	GL 24h	380					625,6	288,7	336,8			88,2
	GL 28h	410					664,8	306,8	340,9			93,7
	GL 32h	430					690,6	318,7	340,9			103,5
	CLT	380					625,6	288,7	336,8			88,2
MEGANT® 910x150x50 $n_{45,J}$ =48; $n_{90,J}$ =15 $n_{45,H}$ =48; $n_{90,H}$ =15	Gl 24c	350	190x1010	3x M20x970 (8.8)	375,0	529,2	585,7	270,3	315,4	340,9	340,9	82,6
	GL 24h	380					625,6	288,7	336,8			88,2
	GL 28h	410					664,8	306,8	340,9			93,7
	GL 32h	430					690,6	318,7	340,9			103,5
	CLT	380					625,6	288,7	336,8			88,2
MEGANT® 970x150x50 $n_{45,J}$ =48; $n_{90,J}$ =15 $n_{45,H}$ =48; $n_{90,H}$ =15	Gl 24c	350	190x1070	3x M20x1030 (8.8)	375,0	529,2	585,7	270,3	315,4	340,9	340,9	82,6
	GL 24h	380					625,6	288,7	336,8			88,2
	GL 28h	410					664,8	306,8	340,9			93,7
	GL 32h	430					690,6	318,7	340,9			103,5
	CLT	380					625,6	288,7	336,8			88,2
MEGANT® 1030x150x50 $n_{45,J}$ =48; $n_{90,J}$ =15 $n_{45,H}$ =48; $n_{90,H}$ =15	Gl 24c	350	190x1130	3x M20x1090 (8.8)	375,0	529,2	585,7	270,3	315,4	340,9	340,9	82,6
	GL 24h	380					625,6	288,7	336,8			88,2
	GL 28h	410					664,8	306,8	340,9			93,7
	GL 32h	430					690,6	318,7				103,5
	CLT	380					625,6	288,7	336,8			88,2
MEGANT® 1090x150x50 $n_{45,J}$ =52; $n_{90,J}$ =15 $n_{45,H}$ =52; $n_{90,H}$ =15	Gl 24c	350	190x1190	3x M20x1150 (8.8)	375,0	529,2	634,6	292,9	340,9	340,9	340,9	82,6
	GL 24h	380					677,7	312,8				88,2
	GL 28h	410					720,2	332,4				93,7
	GL 32h	430					748,1	340,9				103,5
	CLT	380					677,7	312,8				88,2

Service class: 1-2
$F_{2,KCC,Rk}$ = 325,90 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

MEGANT® 150 Softwood

ETA-15/0667

Header/joist-connector

F_2 Characterisitc and Design values in direction of insertion

Design values $F_{2,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

Torsional not fixed main beam (header) — Charact. values [kN] — Design values $F_{2,Rd}$, γ_M=1,3 [kN] — $K_{2,ser}$

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x150x50 $n_{45,J}$=12; $n_{90,J}$=12 $n_{45,H}$=12; $n_{90,H}$=12	Gl 24c	350	190x410	1x M20x360 (8.8)	366,5	176,4	146,4	67,6	78,8	90,1	101,4	68,2
	GL 24h	380					156,4	72,2	84,2	96,2	108,3	72,8
	GL 28h	410					166,2	76,7	89,5	102,3	115,1	77,4
	GL 32h	430					172,7	79,7	93,0	106,2	119,5	85,4
	CLT	380					156,4	72,2	84,2	96,2	108,3	72,8
MEGANT® 430x150x50 $n_{45,J}$=20; $n_{90,J}$=12 $n_{45,H}$=20; $n_{90,H}$=12	Gl 24c	350	190x520	2x M20x460 (8.8)	366,5	352,8	244,1	112,6	131,4	150,2	169,0	68,2
	GL 24h	380					260,7	120,3	140,4	160,4	180,5	72,8
	GL 28h	410					277,0	127,8	149,1	170,5	191,8	77,4
	GL 32h	430					287,8	132,8	154,9	177,1	199,2	85,4
	CLT	380					260,7	120,3	140,4	160,4	180,5	72,8
MEGANT® 550x150x50 $n_{45,J}$=28; $n_{90,J}$=12 $n_{45,H}$=28; $n_{90,H}$=12	Gl 24c	350	190x640	3x M20x580 (8.8)	366,5	529,2	341,7	157,7	184,0	210,3	236,5	68,2
	GL 24h	380					364,9	168,4	196,5	224,6	252,6	72,8
	GL 28h	410					387,8	179,0	208,8	238,6	268,5	77,4
	GL 32h	430					402,9	185,9	216,9	247,9	278,9	85,4
	CLT	380					364,9	168,4	196,5	224,6	252,6	72,8
MEGANT® 610x150x50 $n_{45,J}$=32; $n_{90,J}$=12 $n_{45,H}$=32; $n_{90,H}$=12	Gl 24c	350	190x710	3x M20x640 (8.8)	366,5	529,2	390,5	180,2	210,3	240,3	270,3	68,2
	GL 24h	380					417,0	192,5	224,6	256,6	288,7	72,8
	GL 28h	410					443,2	204,5	238,6	272,7	306,8	77,4
	GL 32h	430					460,4	212,5	247,9	283,3	318,7	85,4
	CLT	380					417,0	192,5	224,6	256,6	288,7	72,8
MEGANT® 670x150x50 $n_{45,J}$=36; $n_{90,J}$=12 $n_{45,H}$=36; $n_{90,H}$=12	Gl 24c	350	190x770	3x M20x700 (8.8)	366,5	529,2	439,3	202,8	236,5	270,3	304,1	68,2
	GL 24h	380					469,2	216,5	252,6	288,7	324,8	72,8
	GL 28h	410					498,6	230,1	268,5	306,8	333,2	77,4
	GL 32h	430					517,9	239,0	278,9	318,7		85,4
	CLT	380					469,2	216,5	252,6	288,7	324,8	72,8
MEGANT® 730x150x50 $n_{45,J}$=40; $n_{90,J}$=12 $n_{45,H}$=40; $n_{90,H}$=12	Gl 24c	350	190x830	3x M20x760 (8.8)	366,5	529,2	488,1	225,3	262,8	300,4	333,2	68,2
	GL 24h	380					521,3	240,6	280,7	320,8		72,8
	GL 28h	410					554,0	255,7	298,3	333,2		77,4
	GL 32h	430					575,5	265,6	309,9			85,4
	CLT	380					521,3	240,6	280,7	320,8		72,8
MEGANT® 790x150x50 $n_{45,J}$=44; $n_{90,J}$=12 $n_{45,H}$=44; $n_{90,H}$=12	Gl 24c	350	190x890	3x M20x820 (8.8)	366,5	529,2	536,9	247,8	289,1	330,4	333,2	68,2
	GL 24h	380					573,4	264,7	308,8	333,2		72,8
	GL 28h	410					609,4	281,3	328,1			77,4
	GL 32h	430					633,0	292,2	333,2			85,4
	CLT	380					573,4	264,7	308,8			72,8
MEGANT® 850x150x50 $n_{45,J}$=48; $n_{90,J}$=15 $n_{45,H}$=48; $n_{90,H}$=15	Gl 24c	350	190x950	3x M20x910 (8.8)	366,5	529,2	585,7	270,3	315,4	333,2	333,2	68,2
	GL 24h	380					625,6	288,7	333,2			72,8
	GL 28h	410					664,8	306,8				77,4
	GL 32h	430					690,6	318,7				85,4
	CLT	380					625,6	288,7				72,8
MEGANT® 910x150x50 $n_{45,J}$=48; $n_{90,J}$=15 $n_{45,H}$=48; $n_{90,H}$=15	Gl 24c	350	190x1010	3x M20x970 (8.8)	366,5	529,2	585,7	270,3	315,4	333,2	333,2	68,2
	GL 24h	380					625,6	288,7	333,2			72,8
	GL 28h	410					664,8	306,8				77,4
	GL 32h	430					690,6	318,7				85,4
	CLT	380					625,6	288,7				72,8
MEGANT® 970x150x50 $n_{45,J}$=48; $n_{90,J}$=15 $n_{45,H}$=48; $n_{90,H}$=15	Gl 24c	350	190x1070	3x M20x1030 (8.8)	366,5	529,2	585,7	270,3	315,4	333,2	333,2	68,2
	GL 24h	380					625,6	288,7	333,2			72,8
	GL 28h	410					664,8	306,8				77,4
	GL 32h	430					690,6	318,7				85,4
	CLT	400					625,6	288,7				72,8
MEGANT® 1030x150x50 $n_{45,J}$=48; $n_{90,J}$=15 $n_{45,H}$=48; $n_{90,H}$=15	Gl 24c	350	190x1130	3x M20x1090 (8.8)	366,5	529,2	585,7	270,3	315,4	333,2	333,2	68,2
	GL 24h	380					625,6	288,7	333,2			72,8
	GL 28h	410					664,8	306,8				77,4
	GL 32h	430					690,6	318,7				85,4
	CLT	380					625,6	288,7				72,8
MEGANT® 1090x150x50 $n_{45,J}$=52; $n_{90,J}$=15 $n_{45,H}$=52; $n_{90,H}$=15	Gl 24c	350	190x1190	3x M20x1150 (8.8)	366,5	529,2	634,6	292,9	333,2	333,2	333,2	68,2
	GL 24h	380					677,7	312,8				72,8
	GL 28h	410					720,2	332,4				77,4
	GL 32h	430					748,1	333,2				85,4
	CLT	380					677,7	312,8				72,8

Service class: 1-2

$F_{2,KCC,Rk}$ = 366,50 kN for torsional not fixed main beam (header)

f_{R2} = 1,00 *(1 main beam width $B_H \le 200$ mm (or reduction according to table)

γ_M = 1,30 Partial safety factor for timber joints

$\gamma_{M,1}$ = 1,10 Partial safety factor for aluminium

$\gamma_{M,2}$ = 1,25 Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	200	220	240	260	280	300	320	340	360	400	420	450
Eccentricity e =	e ≤125	e= 135	e= 145	e= 155	e= 165	e= 175	e= 185	e= 195	e= 205	e= 225	e= 235	e= 250
f_{R2} =	1,00	0,96	0,92	0,88	0,84	0,80	0,76	0,72	0,68	0,60	0,56	0,50

MEGANT® 150 Softwood ETA-15/0667 CE

Header/joist-connector

Design values $M_{2,\varphi,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{2,\varphi,Rk}$ [kNm]	Design values $M_{2,\varphi,Rd}$ [kNm] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,\varphi,ser}$ [kNm/rad]
MEGANT® 310x150x50	Gl 24c	350			4,3	2,0	2,3	2,7	3,0	614
$n_{45,J}$ =12; $n_{90,J}$ =12	GL 24h	380		1x M20x360	4,6	2,1	2,5	2,8	3,2	656
$n_{45,H}$ =12; $n_{90,H}$ =12	GL 28h	410	190x410	(8.8)	4,9	2,3	2,6	3,0	3,4	697
	GL 32h	430			5,4	2,5	2,9	3,3	3,7	770
	CLT	380			4,6	2,1	2,5	2,8	3,2	656
MEGANT® 430x150x50	Gl 24c	350			6,5	3,0	3,5	4,0	4,5	1346
$n_{45,J}$ =20; $n_{90,J}$ =12	GL 24h	380		2x M20x460	6,9	3,2	3,7	4,2	4,8	1437
$n_{45,H}$ =20; $n_{90,H}$ =12	GL 28h	410	190x520	(8.8)	7,3	3,4	3,9	4,5	5,1	1527
	GL 32h	430			8,1	3,7	4,4	5,0	5,6	1686
	CLT	380			6,9	3,2	3,7	4,2	4,8	1437
MEGANT® 550x150x50	Gl 24c	350			8,5	3,9	4,6	5,2	5,9	2360
$n_{45,J}$ =28; $n_{90,J}$ =12	GL 24h	380		3x M20x580	9,1	4,2	4,9	5,6	6,3	2521
$n_{45,H}$ =28; $n_{90,H}$ =12	GL 28h	410	190x640	(8.8)	9,7	4,5	5,2	6,0	6,7	2679
	GL 32h	430			10,7	4,9	5,7	6,6	7,4	2957
	CLT	380			9,1	4,2	4,9	5,6	6,3	2521
MEGANT® 610x150x50	Gl 24c	350			9,6	4,4	5,1	5,9	6,6	2974
$n_{45,J}$ =32; $n_{90,J}$ =12	GL 24h	380		3x M20x640	10,2	4,7	5,5	6,3	7,1	3176
$n_{45,H}$ =32; $n_{90,H}$ =12	GL 28h	410	190x710	(8.8)	10,8	5,0	5,8	6,7	7,5	3375
	GL 32h	430			12,0	5,5	6,4	7,4	8,3	3726
	CLT	380			10,2	4,7	5,5	6,3	7,1	3176
MEGANT® 670x150x50	Gl 24c	350			10,6	4,9	5,7	6,5	7,3	3658
$n_{45,J}$ =36; $n_{90,J}$ =12	GL 24h	380		3x M20x700	11,3	5,2	6,1	7,0	7,8	3907
$n_{45,H}$ =36; $n_{90,H}$ =12	GL 28h	410	190x770	(8.8)	12,0	5,5	6,5	7,4	8,3	4152
	GL 32h	430			13,3	6,1	7,1	8,2	9,2	4583
	CLT	380			11,3	5,2	6,1	7,0	7,8	3907
MEGANT® 730x150x50	Gl 24c	350			11,7	5,4	6,3	7,2	8,1	4413
$n_{45,J}$ =40; $n_{90,J}$ =12	GL 24h	380		3x M20x760	12,5	5,8	6,7	7,7	8,7	4713
$n_{45,H}$ =40; $n_{90,H}$ =12	GL 28h	410	190x830	(8.8)	13,3	6,1	7,2	8,2	9,2	5008
	GL 32h	430			14,7	6,8	7,9	9,0	10,2	5529
	CLT	380			12,5	5,8	6,7	7,7	8,7	4713
MEGANT® 790x150x50	Gl 24c	350			12,7	5,9	6,9	7,8	8,8	5239
$n_{45,J}$ =44; $n_{90,J}$ =12	GL 24h	380		3x M20x820	13,6	6,3	7,3	8,4	9,4	5595
$n_{45,H}$ =44; $n_{90,H}$ =12	GL 28h	410	190x890	(8.8)	14,5	6,7	7,8	8,9	10,0	5946
	GL 32h	430			16,0	7,4	8,6	9,8	11,0	6564
	CLT	380			13,6	6,3	7,3	8,4	9,4	5595
MEGANT® 850x150x50	Gl 24c	350			13,8	6,4	7,4	8,5	9,5	6136
$n_{45,J}$ =48; $n_{90,J}$ =15	GL 24h	380		3x M20x910	14,7	6,8	7,9	9,0	10,2	6553
$n_{45,H}$ =48; $n_{90,H}$ =15	GL 28h	410	190x950	(8.8)	15,6	7,2	8,4	9,6	10,8	6964
	GL 32h	430			17,2	8,0	9,3	10,6	11,9	7688
	CLT	380			14,7	6,8	7,9	9,0	10,2	6553
MEGANT® 910x150x50	Gl 24c	350			14,8	6,8	8,0	9,1	10,2	7103
$n_{45,J}$ =48; $n_{90,J}$ =15	GL 24h	380		3x M20x970	15,8	7,3	8,5	9,7	10,9	7586
$n_{45,H}$ =48; $n_{90,H}$ =15	GL 28h	410	190x1010	(8.8)	16,8	7,7	9,0	10,3	11,6	8061
	GL 32h	430			18,5	8,6	10,0	11,4	12,8	8899
	CLT	380			15,8	7,3	8,5	9,7	10,9	7586
MEGANT® 970x150x50	Gl 24c	350			15,8	7,3	8,5	9,7	11,0	8141
$n_{45,J}$ =48; $n_{90,J}$ =15	GL 24h	380		3x M20x1030	16,9	7,8	9,1	10,4	11,7	8695
$n_{45,H}$ =48; $n_{90,H}$ =15	GL 28h	410	190x1070	(8.8)	18,0	8,3	9,7	11,1	12,4	9240
	GL 32h	430			19,8	9,2	10,7	12,2	13,7	10200
	CLT	400			16,9	7,8	9,1	10,4	11,7	8695
MEGANT® 1030x150x50	Gl 24c	350			16,9	7,8	9,1	10,4	11,7	9250
$n_{45,J}$ =48; $n_{90,J}$ =15	GL 24h	380		3x M20x1090	18,0	8,3	9,7	11,1	12,5	9879
$n_{45,H}$ =48; $n_{90,H}$ =15	GL 28h	410	190x1130	(8.8)	19,1	8,8	10,3	11,8	13,2	10498
	GL 32h	430			21,1	9,7	11,4	13,0	14,6	11589
	CLT	400			18,0	8,3	9,7	11,1	12,5	9879
MEGANT® 1090x150x50	Gl 24c	350			17,9	8,3	9,6	11,0	12,4	10430
$n_{45,J}$ =52; $n_{90,J}$ =15	GL 24h	380		3x M20x1150	19,1	8,8	10,3	11,8	13,2	11139
$n_{45,H}$ =52; $n_{90,H}$ =15	GL 28h	410	190x1190	(8.8)	20,3	9,4	10,9	12,5	14,1	11837
	GL 32h	430			22,4	10,3	12,1	13,8	15,5	13068
	CLT	380			19,1	8,8	10,3	11,8	13,2	11139

MEGANT® 150 Softwood

ETA-15/0667

Header/joist-connector

F_3 Characterisitc and Design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	Gl 24c	350	190x410	1x M20x360 (8.8)	64,1	29,6	34,5	39,4	44,4
	GL 24h	380			66,8	30,8	36,0	41,1	46,2
	GL 28h	410			69,4	32,0	37,4	42,7	48,0
	GL 32h	430			71,0	32,8	38,2	43,7	49,2
	CLT	380			66,8	30,8	36,0	41,1	46,2
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	Gl 24c	350	190x520	2x M20x460 (8.8)	82,4	38,0	44,4	50,7	57,0
	GL 24h	380			85,9	39,6	46,3	52,9	59,5
	GL 28h	410			89,2	41,2	48,0	54,9	61,8
	GL 32h	430			91,3	42,1	49,2	56,2	63,2
	CLT	380			85,9	39,6	46,3	52,9	59,5
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	Gl 24c	350	190x640	3x M20x580 (8.8)	100,7	46,5	54,2	62,0	69,7
	GL 24h	380			104,9	48,4	56,5	64,6	72,6
	GL 28h	410			109,0	50,3	58,7	67,1	75,5
	GL 32h	430			111,6	51,5	60,1	68,7	77,3
	CLT	380			104,9	48,4	56,5	64,6	72,6
MEGANT® 610x150x50 bis $n_{45,J}$ =32; $n_{90,J}$ =12 MEGANT® 1090x150x50 $n_{45,H}$ =52; $n_{90,H}$ =15	Gl 24c	350	190x710 bis 190x1190	3x M20x580 bis 3x M20x1150 (8.8)	100,7	46,5	54,2	62,0	69,7
	GL 24h	380			104,9	48,4	56,5	64,6	72,6
	GL 28h	410			109,0	50,3	58,7	67,1	75,5
	GL 32h	430			111,6	51,5	60,1	68,7	77,3
	CLT	380			104,9	48,4	56,5	64,6	72,6

F_{45} Characterisitc and Design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk} \times f_{size}$	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{45,ser}$ [kN/mm]
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	Gl 24c	350	190x410	1x M20x360 (8.8)	68,0	54,9	25,3	29,6	33,8	38,0	12,3
	GL 24h	380				57,2	26,4	30,8	35,2	39,6	13,1
	GL 28h	410				59,5	27,5	32,0	36,6	41,2	13,9
	GL 32h	430				60,9	28,1	32,8	37,5	42,2	14,5
	CLT	380				57,2	26,4	30,8	35,2	39,6	13,1
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	Gl 24c	350	190x520	2x M20x460 (8.8)	74,8	91,6	34,5	40,3	46,0	51,8	12,3
	GL 24h	380				95,4					13,1
	GL 28h	410				99,1					13,9
	GL 32h	430				101,5					14,5
	CLT	380				95,4					13,1
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	Gl 24c	350	190x640	3x M20x580 (8.8)	81,6	128,2	37,7	43,9	50,2	56,5	12,3
	GL 24h	380				133,6					13,1
	GL 28h	410				138,7					13,9
	GL 32h	430				142,1					14,5
	CLT	380				133,6					13,1
MEGANT® 610x150x50 bis $n_{45,J}$ =32; $n_{90,J}$ =12 MEGANT® 1090x150x50 $n_{45,H}$ =52; $n_{90,H}$ =15	Gl 24c	350	190x710 bis 190x1190"	3x M20x580 bis 3x M20x1150 (8.8)	81,6	128,2	37,7	43,9	50,2	56,5	12,3
	GL 24h	380				133,6					13,1
	GL 28h	410				138,7					13,9
	GL 32h	430				142,1					14,5
	CLT	380				133,6					13,1

Service class: 1-2

GL24c/GL24h/GL28h/GL32h — Glued laminated timber of softwood

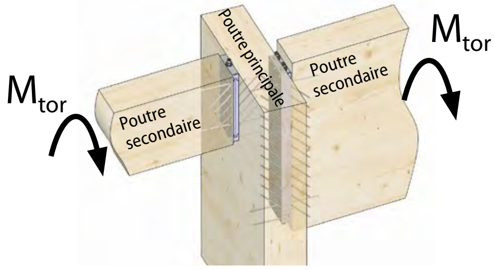
CLT — Cross laminated timber of softwood with $\rho_k \geq 380$ kg/m³

γ_M = 1,3 — Partial safety factor for timber joints

MEGANT® 150 Softwood ETA-15/0667

Header/joist-connector

M_{tor} Torsionmoment of the joist of softwood



Design values $M_{tor,Rd}$ for MEGANT® 150 with screws CS 8x160 for header and joist of softwood

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ [kNm] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kN/mm]
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	Gl 24c	350	190x410	1x M20x360 (8.8)	3,9	1,8	2,1	2,4	2,7	304
	GL 24h	380			4,2	1,9	2,3	2,6	2,9	344
	GL 28h	410			4,4	2,0	2,4	2,7	3,0	386
	GL 32h	430			4,5	2,1	2,4	2,8	3,1	414
	CLT	380			4,2	1,9	2,3	2,6	2,9	344
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	Gl 24c	350	190x520	2x M20x460 (8.8)	12,5	5,8	6,7	7,7	8,7	1594
	GL 24h	380			13,3	6,1	7,2	8,2	9,2	1803
	GL 28h	410			13,9	6,4	7,5	8,6	9,6	2021
	GL 32h	430			14,4	6,6	7,8	8,9	10,0	2171
	CLT	380			13,3	6,1	7,2	8,2	9,2	1803
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	Gl 24c	350	190x640	3x M20x580 (8.8)	20,9	9,6	11,3	12,9	14,5	3488
	GL 24h	380			22,3	10,3	12,0	13,7	15,4	3946
	GL 28h	410			23,4	10,8	12,6	14,4	16,2	4422
	GL 32h	430			24,1	11,1	13,0	14,8	16,7	4750
	CLT	380			22,3	10,3	12,0	13,7	15,4	3946
MEGANT® 610x150x50 bis $n_{45,J/H}$ =32; $n_{90,J/H}$ =12 MEGANT® 1090x150x50 $n_{45,J/H}$ =52; $n_{90,J/H}$ =15	Gl 24c	350	190x710 bis 190x1190	3x M20x580 bis 3x M20x1150 (8.8)	20,9	9,6	11,3	12,9	14,5	3488
	GL 24h	380			22,3	10,3	12,0	13,7	15,4	3946
	GL 28h	410			23,4	10,8	12,6	14,4	16,2	4422
	GL 32h	430			24,1	11,1	13,0	14,8	16,7	4750
	CLT	380			22,3	10,3	12,0	13,7	15,4	3946

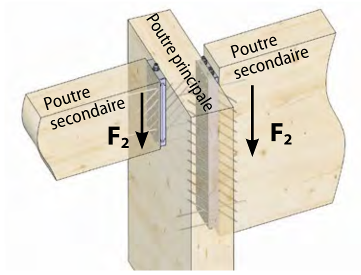
Service class: 1-2	
GL24c/GL24h/ GL28h/GL32h	Glued laminated timber of softwood
CLT	Cross laminated timber of softwood with $\rho_k \geq 380$ kg/m³
γ_M = 1,3	Partial safety factor for timber joints

MEGANT® 150 Hardwood

ETA-15/0667 CE

Header/joist-connector

F_2 Characterisitc and Design values in direction of insertion



Design values $F_{2,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

Torsional fixed main beam (header)

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN]: $F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{3,Rk}$	Design values $F_{2,Rd}$, γ_M=1,3 [kN]: k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x150x50 $n_{45,J}$=12; $n_{90,J}$=12 $n_{45,H}$=12; $n_{90,H}$=12	D30 (GL$_H$)	530	190x410	2x M20x340 (8.8)	375,0	352,8	216,8	100,1	116,7	133,4	150,1	115,1
	D35 (GL$_H$)	540					223,4	103,1	120,3	137,5	154,7	116,8
	D40 (GL$_H$)	550					230,1	106,2	123,9	141,6	159,3	118,6
	D50 (GL$_H$)	≥ 590					257,4	118,8	138,6	158,4	178,2	125,4
MEGANT® 430x150x50 $n_{45,J}$=20; $n_{90,J}$=12 $n_{45,H}$=20; $n_{90,H}$=12	D30 (GL$_H$)	530	190x520	3x M20x460 (8.8)	375,0	529,2	361,4	166,8	194,6	222,4	250,2	115,1
	D35 (GL$_H$)	540					372,3	171,8	200,5	229,1	257,8	116,8
	D40 (GL$_H$)	550					383,4	177,0	206,5	236,0	265,5	118,6
	D50 (GL$_H$)	≥ 590					429,0	198,0	231,0	264,0	297,0	125,4
MEGANT® 550x150x50 $n_{45,J}$=28; $n_{90,J}$=12 $n_{45,H}$=28; $n_{90,H}$=12	D30 (GL$_H$)	530	190x640	3x M20x580 (8.8)	375,0	529,2	505,9	233,5	272,4	311,3	340,9	115,1
	D35 (GL$_H$)	540					521,3	240,6	280,7	320,8		116,8
	D40 (GL$_H$)	550					536,8	247,8	289,0	330,3		118,6
	D50 (GL$_H$)	≥ 590					600,6	277,2	323,4	340,9		125,4
MEGANT® 610x150x50 $n_{45,J}$=32; $n_{90,J}$=12 $n_{45,H}$=32; $n_{90,H}$=12	D30 (GL$_H$)	530	190x710	3x M20x640 (8.8)	375,0	529,2	578,2	266,9	311,3	340,9	340,9	115,1
	D35 (GL$_H$)	540					595,7	275,0	320,8			116,8
	D40 (GL$_H$)	550					613,5	283,1	330,3			118,6
	D50 (GL$_H$)	≥ 590					686,4	316,8	340,9			125,4
MEGANT® 670x150x50 $n_{45,J}$=36; $n_{90,J}$=12 $n_{45,H}$=36; $n_{90,H}$=12	D30 (GL$_H$)	530	190x770	3x M20x700 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 730x150x50 $n_{45,J}$=36; $n_{90,J}$=12 $n_{45,H}$=36; $n_{90,H}$=12	D30 (GL$_H$)	530	190x830	3x M20x760 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 790x150x50 $n_{45,J}$=36; $n_{90,J}$=12 $n_{45,H}$=36; $n_{90,H}$=12	D30 (GL$_H$)	530	190x890	3x M20x820 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 850x150x50 $n_{45,J}$=36; $n_{90,J}$=15 $n_{45,H}$=36; $n_{90,H}$=15	D30 (GL$_H$)	530	190x950	3x M20x910 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 910x150x50 $n_{45,J}$=36; $n_{90,J}$=15 $n_{45,H}$=36; $n_{90,H}$=15	D30 (GL$_H$)	530	190x1010	3x M20x970 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 970x150x50 $n_{45,J}$=36; $n_{90,J}$=15 $n_{45,H}$=36; $n_{90,H}$=15	D30 (GL$_H$)	530	190x1070	3x M20x1030 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 1030x150x50 $n_{45,J}$=36; $n_{90,J}$=15 $n_{45,H}$=36; $n_{90,H}$=15	D30 (GL$_H$)	530	190x1130	3x M20x1090 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4
MEGANT® 1090x150x50 $n_{45,J}$=36; $n_{90,J}$=15 $n_{45,H}$=36; $n_{90,H}$=15	D30 (GL$_H$)	530	190x1190	3x M20x1150 (8.8)	375,0	529,2	650,5	300,2	340,9	340,9	340,9	115,1
	D35 (GL$_H$)	540					670,2	309,3				116,8
	D40 (GL$_H$)	550					690,2	318,5				118,6
	D50 (GL$_H$)	≥ 590					772,2	340,9				125,4

Service class: 1-2
$F_{2,KCC,Rk}$ = 375,00 kN for torsional fixed main beam (header)
f_{R2} = 1,00 *(1

MEGANT® 150 Hardwood ETA-15/0667 CE

Header/joist-connector

Design values $F_{2,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

Torsional not fixed main beam (header) — **Charact. values [kN]** — **Design values $F_{2,Rd}$, γ_M=1,3 [kN]** — **$K_{2,ser}$**

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$F_{2,KCC,Rk}$ x f_{R2} *(1	$F_{t,Rk}$ Threaded rod	$F_{2,Rk}$	k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	[kN/mm]
MEGANT® 310x150x50	D30 (GL_H)	530	190x410	2x M20x340 (8.8)	366,5	352,8	216,8	100,1	116,7	133,4	150,1	95,0
$n_{45,J}$ =12; $n_{90,J}$ =12	D35 (GL_H)	540					223,4	103,1	120,3	137,5	154,7	96,4
$n_{45,H}$ =12; $n_{90,H}$ =12	D40 (GL_H)	550					230,1	106,2	123,9	141,6	159,3	97,9
	D50 (GL_H)	≥ 590					257,4	118,8	138,6	158,4	178,2	103,5
MEGANT® 430x150x50	D30 (GL_H)	530	190x520	3x M20x460 (8.8)	366,5	529,2	361,4	166,8	194,6	222,4	250,2	95,0
$n_{45,J}$ =20; $n_{90,J}$ =12	D35 (GL_H)	540					372,3	171,8	200,5	229,1	257,8	96,4
$n_{45,H}$ =20; $n_{90,H}$ =12	D40 (GL_H)	550					383,4	177,0	206,5	236,0	265,5	97,9
	D50 (GL_H)	≥ 590					429,0	198,0	231,0	264,0	297,0	103,5
MEGANT® 550x150x50	D30 (GL_H)	530	190x640	3x M20x580 (8.8)	366,5	529,2	505,9	233,5	272,4	311,3	333,2	95,0
$n_{45,J}$ =28; $n_{90,J}$ =12	D35 (GL_H)	540					521,3	240,6	280,7	320,8		96,4
$n_{45,H}$ =28; $n_{90,H}$ =12	D40 (GL_H)	550					536,8	247,8	289,0	330,3		97,9
	D50 (GL_H)	≥ 590					600,6	277,2	323,4	333,2		103,5
MEGANT® 610x150x50	D30 (GL_H)	530	190x710	3x M20x640 (8.8)	366,5	529,2	578,2	266,9	311,3	333,2	333,2	95,0
$n_{45,J}$ =32; $n_{90,J}$ =12	D35 (GL_H)	540					595,7	275,0	320,8			96,4
$n_{45,H}$ =32; $n_{90,H}$ =12	D40 (GL_H)	550					613,5	283,1	330,3			97,9
	D50 (GL_H)	≥ 590					686,4	316,8	333,2			103,5
MEGANT® 670x150x50	D30 (GL_H)	530	190x770	3x M20x700 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =12	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =12	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 730x150x50	D30 (GL_H)	530	190x830	3x M20x760 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =12	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =12	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 790x150x50	D30 (GL_H)	530	190x890	3x M20x820 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =12	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =12	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 850x150x50	D30 (GL_H)	530	190x950	3x M20x910 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =15	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =15	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 910x150x50	D30 (GL_H)	530	190x1010	3x M20x970 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =15	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =15	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 970x150x50	D30 (GL_H)	530	190x1070	3x M20x1030 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =15	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =15	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 1030x150x50	D30 (GL_H)	530	190x1130	3x M20x1090 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =15	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =15	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5
MEGANT® 1090x150x50	D30 (GL_H)	530	190x1190	3x M20x1150 (8.8)	366,5	529,2	650,5	300,2	333,2	333,2	333,2	95,0
$n_{45,J}$ =36; $n_{90,J}$ =15	D35 (GL_H)	540					670,2	309,3				96,4
$n_{45,H}$ =36; $n_{90,H}$ =15	D40 (GL_H)	550					690,2	318,5				97,9
	D50 (GL_H)	≥ 590					772,2	333,2				103,5

Service class:	1-2	
$F_{2,KCC,Rk}$ =	366,50 kN	for torsional not fixed main beam (header)
f_{R2} =	1,00	*(1 main beam width B_H ≤ 200 mm (or reduction according to table)
γ_M =	1,30	Partial safety factor for timber joints
$\gamma_{M,1}$ =	1,10	Partial safety factor for aluminium
$\gamma_{M,2}$ =	1,25	Partial safety factor for steel construction threaded rod connections

Main beam width B_H =	200	220	240	260	280	300	320	340	360	400	420	450
Eccentricity e =	e ≤ 125	e= 130	e= 140	e= 150	e= 160	e= 170	e= 180	e= 190	e= 200	e= 210	e= 220	e= 250
f_{R2} =	1,00	0,98	0,94	0,90	0,86	0,82	0,78	0,74	0,70	0,66	0,62	0,50

MEGANT® 150 Hardwood

ETA-15/0667

Header/joist-connector

Design values $M_{2,\varphi,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{2,\varphi,Rk}$ [kNm]	Design values $M_{2,\varphi,Rd}$ k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,\varphi,ser}$ [kNm/rad]
MEGANT® 310x150x50 $n_{45,J}=12$; $n_{90,J}=12$ $n_{45,H}=12$; $n_{90,H}=12$	D30 (GL_H)	530	190x410	2x M20x340 (8.8)	6,1	2,8	3,3	3,8	4,2	856
	D35 (GL_H)	540			6,1	2,8	3,3	3,7	4,2	656
	D40 (GL_H)	550			6,2	2,9	3,3	3,8	4,3	882
	D50 (GL_H)	≥ 590			6,6	3,0	3,6	4,1	4,6	933
MEGANT® 430x150x50 $n_{45,J}=20$; $n_{90,J}=12$ $n_{45,H}=20$; $n_{90,H}=12$	D30 (GL_H)	530	190x520	3x M20x460 (8.8)	9,0	4,2	4,8	5,5	6,2	1875
	D35 (GL_H)	540			9,1	4,2	4,9	5,6	6,3	1437
	D40 (GL_H)	550			9,3	4,3	5,0	5,7	6,4	1932
	D50 (GL_H)	≥ 590			9,8	4,5	5,3	6,0	6,8	2044
MEGANT® 550x150x50 $n_{45,J}=28$; $n_{90,J}=12$ $n_{45,H}=28$; $n_{90,H}=12$	D30 (GL_H)	530	190x640	3x M20x580 (8.8)	11,9	5,5	6,4	7,3	8,2	3290
	D35 (GL_H)	540			12,1	5,6	6,5	7,4	8,3	2521
	D40 (GL_H)	550			12,2	5,6	6,6	7,5	8,5	3389
	D50 (GL_H)	≥ 590			12,9	6,0	7,0	8,0	9,0	3585
MEGANT® 610x150x50 $n_{45,J}=32$; $n_{90,J}=12$ $n_{45,H}=32$; $n_{90,H}=12$	D30 (GL_H)	530	190x710	3x M20x640 (8.8)	13,3	6,1	7,2	8,2	9,2	4145
	D35 (GL_H)	540			13,5	6,2	7,3	8,3	9,4	3176
	D40 (GL_H)	550			13,7	6,3	7,4	8,4	9,5	4269
	D50 (GL_H)	≥ 590			14,5	6,7	7,8	8,9	10,0	4516
MEGANT® 670x150x50 $n_{45,J}=36$; $n_{90,J}=12$ $n_{45,H}=36$; $n_{90,H}=12$	D30 (GL_H)	530	190x770	3x M20x700 (8.8)	14,8	6,8	8,0	9,1	10,2	5099
	D35 (GL_H)	540			15,0	6,9	8,1	9,2	10,4	3907
	D40 (GL_H)	550			15,2	7,0	8,2	9,3	10,5	5252
	D50 (GL_H)	≥ 590			16,1	7,4	8,7	9,9	11,1	5555
MEGANT® 730x150x50 $n_{45,J}=36$; $n_{90,J}=12$ $n_{45,H}=36$; $n_{90,H}=12$	D30 (GL_H)	530	190x830	3x M20x760 (8.8)	16,2	7,5	8,7	10,0	11,2	6150
	D35 (GL_H)	540			16,6	7,6	8,9	10,2	11,5	4713
	D40 (GL_H)	550			16,8	7,8	9,0	10,3	11,6	6335
	D50 (GL_H)	≥ 590			17,7	8,2	9,5	10,9	12,3	6702
MEGANT® 790x150x50 $n_{45,J}=36$; $n_{90,J}=12$ $n_{45,H}=36$; $n_{90,H}=12$	D30 (GL_H)	530	190x890	3x M20x820 (8.8)	17,7	8,2	9,6	10,9	12,3	7302
	D35 (GL_H)	540			18,0	8,3	9,7	11,1	12,5	5595
	D40 (GL_H)	550			18,3	8,4	9,8	11,2	12,7	7521
	D50 (GL_H)	≥ 590			19,3	8,9	10,4	11,9	13,4	7956
MEGANT® 850x150x50 $n_{45,J}=36$; $n_{90,J}=15$ $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x950	3x M20x910 (8.8)	19,2	8,9	10,3	11,8	13,3	8551
	D35 (GL_H)	540			19,5	9,0	10,5	12,0	13,5	6553
	D40 (GL_H)	550			19,8	9,1	10,6	12,2	13,7	8809
	D50 (GL_H)	≥ 590			20,9	9,6	11,3	12,9	14,5	9317
MEGANT® 910x150x50 $n_{45,J}=36$; $n_{90,J}=15$ $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x1010	3x M20x970 (8.8)	20,6	9,5	11,1	12,7	14,3	9900
	D35 (GL_H)	540			20,9	9,7	11,3	12,9	14,5	7586
	D40 (GL_H)	550			21,2	9,8	11,4	13,1	14,7	10197
	D50 (GL_H)	≥ 590			22,5	10,4	12,1	13,8	15,6	10787
MEGANT® 970x150x50 $n_{45,J}=36$; $n_{90,J}=15$ $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x1070	3x M20x1030 (8.8)	22,1	10,2	11,9	13,6	15,3	11347
	D35 (GL_H)	540			22,4	10,3	12,1	13,8	15,5	8695
	D40 (GL_H)	550			22,7	10,5	12,2	14,0	15,7	11688
	D50 (GL_H)	≥ 590			24,0	11,1	12,9	14,8	16,6	12363
MEGANT® 1030x150x50 $n_{45,J}=36$; $n_{90,J}=15$ $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x1130	3x M20x1090 (8.8)	23,5	10,8	12,6	14,5	16,3	12892
	D35 (GL_H)	540			23,8	11,0	12,8	14,7	16,5	9879
	D40 (GL_H)	550			24,2	11,2	13,0	14,9	16,8	13279
	D50 (GL_H)	≥ 590			25,6	11,8	13,8	15,7	17,7	14047
MEGANT® 1090x150x50 $n_{45,J}=36$; $n_{90,J}=15$ $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x1190	3x M20x1150 (8.8)	25,0	11,5	13,5	15,4	17,3	14536
	D35 (GL_H)	540			25,3	11,7	13,6	15,6	17,5	11139
	D40 (GL_H)	550			25,7	11,8	13,8	15,8	17,8	14973
	D50 (GL_H)	≥ 590			27,2	12,5	14,6	16,7	18,8	15839

MEGANT® 150

ETA-15/0667 CE

Header/joist-connector

F_3 Characterisitc and Design values against the direction of insertion

Design values $F_{3,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{3,Rk}$	Design values $F_{3,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	D30 (GL_H)	530	190x360	1x M20x410 (8.8)	100,3	46,3	54,0	61,7	69,4
	D35 (GL_H)	540			101,8	47,0	54,8	62,6	70,5
	D40 (GL_H)	550			103,3	47,7	55,6	63,6	71,5
	D50 (GL_H)	≥ 590			108,7	50,2	58,5	66,9	75,3
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	D30 (GL_H)	530	190x520	2x M20x460 (8.8)	129,8	59,9	69,9	79,9	89,9
	D35 (GL_H)	540			131,5	60,7	70,8	80,9	91,0
	D40 (GL_H)	550			133,3	61,5	71,8	82,0	92,3
	D50 (GL_H)	≥ 590			139,8	64,5	75,3	86,0	96,8
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	D30 (GL_H)	530	190x640	3x M20x580 (8.8)	159,2	73,5	85,7	98,0	110,2
	D35 (GL_H)	540			161,3	74,4	86,9	99,3	111,7
	D40 (GL_H)	550			163,3	75,4	87,9	100,5	113,1
	D50 (GL_H)	≥ 590			170,8	78,8	92,0	105,1	118,2
MEGANT® 610x150x50 bis $n_{45,J}$ =32; $n_{90,J}$ =12 MEGANT® 1090x150x50 $n_{45,H}$ =36; $n_{90,H}$ =15	D30 (GL_H)	530	190x710 bis 190x1190	3x M20x580 bis 3x M20x1150 (8.8)	159,2	73,5	85,7	98,0	110,2
	D35 (GL_H)	540			161,3	74,4	86,9	99,3	111,7
	D40 (GL_H)	550			163,3	75,4	87,9	100,5	113,1
	D50 (GL_H)	≥ 590			170,8	78,8	92,0	105,1	118,2

F_{45} Characterisitc and Design values centric perpendicular to the direction of insertion

Design values $F_{45,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	Charact. values [kN] $F_{45,KCC,Rk} \times f_{size}$	$F_{45,Rk}$	Design values $F_{45,Rd}$, γ_M=1,3 [kN] k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{2,ser}$ [kN/mm]
MEGANT® 310x150x50 $n_{45,J}$ =12; $n_{90,J}$ =12 $n_{45,H}$ =12; $n_{90,H}$ =12	D30 (GL_H)	530	190x360	1x M20x410 (8.8)	68,0	84,3	31,4	36,6	41,8	47,1	17,1
	D35 (GL_H)	540				85,9					17,4
	D40 (GL_H)	550				87,6					17,6
	D50 (GL_H)	≥ 590				93,2					18,6
MEGANT® 430x150x50 $n_{45,J}$ =20; $n_{90,J}$ =12 $n_{45,H}$ =20; $n_{90,H}$ =12	D30 (GL_H)	530	190x520	2x M20x460 (8.8)	74,8	140,5	34,5	40,3	46,0	51,8	17,1
	D35 (GL_H)	540				143,2					17,4
	D40 (GL_H)	550				145,9					17,6
	D50 (GL_H)	≥ 590				155,3					18,6
MEGANT® 550x150x50 $n_{45,J}$ =28; $n_{90,J}$ =12 $n_{45,H}$ =28; $n_{90,H}$ =12	D30 (GL_H)	530	190x640	3x M20x580 (8.8)	81,6	196,7	37,7	43,9	50,2	56,5	17,1
	D35 (GL_H)	540				200,5					17,4
	D40 (GL_H)	550				204,3					17,6
	D50 (GL_H)	≥ 590				217,4					18,6
MEGANT® 610x150x50 bis $n_{45,J}$ =32; $n_{90,J}$ =12 MEGANT® 1090x150x50 $n_{45,H}$ =36; $n_{90,H}$ =15	D30 (GL_H)	530	190x710 bis 190x1190	3x M20x580 bis 3x M20x1150 (8.8)	81,6	196,7	37,7	43,9	50,2	56,5	17,1
	D35 (GL_H)	540				200,5					17,4
	D40 (GL_H)	550				204,3					17,6
	D50 (GL_H)	≥ 590				217,4					18,6

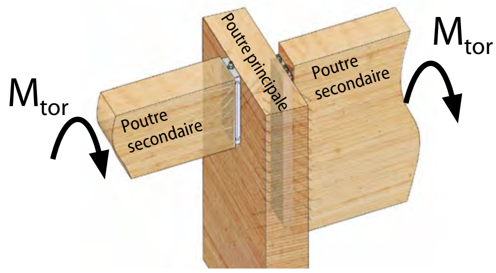
Service class: 1-2
D30/D35/D40/D50 solid hardwood
GL_H Glued laminated timber of hardwood
γ_M = 1,3 Partial safety factor for timber joints

MEGANT® 150

ETA-15/0667

Header/joist-connector

M_{tor} Torsionmoment of the joist of softwood



Design values $M_{tor,Rd}$ for MEGANT® 150 with screws CS 8x120 for header and joist of hardwood / glued laminated timber

KNAPP® Connector	Wood material	Char. density ρ_k [kg/m³]	Min. joist cross section [mm]	Threaded rod	$M_{tor,Rk}$ [kNm]	Design values $M_{tor,Rd}$ k_{mod} 0,6	k_{mod} 0,7	k_{mod} 0,8	k_{mod} 0,9	$K_{tor,ser}$ [kNm/rad]
MEGANT® 310x150x50 $n_{45,J}=12$; $n_{90,J}=12$ $n_{45,H}=12$; $n_{90,H}=12$	D30 (GL_H)	530	190x410	1x M20x360 (8.8)	5,4	2,5	2,9	3,3	3,7	567
	D35 (GL_H)	540			5,5	2,5	3,0	3,4	3,8	583
	D40 (GL_H)	550			5,6	2,6	3,0	3,4	3,9	599
	D50 (GL_H)	≥ 590			6,1	2,8	3,3	3,8	4,2	666
MEGANT® 430x150x50 $n_{45,J}=20$; $n_{90,J}=12$ $n_{45,H}=20$; $n_{90,H}=12$	D30 (GL_H)	530	190x520	2x M20x460 (8.8)	17,1	7,9	9,2	10,5	11,8	2970
	D35 (GL_H)	540			17,5	8,1	9,4	10,8	12,1	3055
	D40 (GL_H)	550			17,8	8,2	9,6	11,0	12,3	3140
	D50 (GL_H)	≥ 590			19,3	8,9	10,4	11,9	13,4	3489
MEGANT® 550x150x50 $n_{45,J}=28$; $n_{90,J}=12$ $n_{45,H}=28$; $n_{90,H}=12$	D30 (GL_H)	530	190x640	3x M20x580 (8.8)	28,7	13,2	15,5	17,7	19,9	6500
	D35 (GL_H)	540			29,3	13,5	15,8	18,0	20,3	6685
	D40 (GL_H)	550			29,9	13,8	16,1	18,4	20,7	6871
	D50 (GL_H)	≥ 590			32,3	14,9	17,4	19,9	22,4	7634
MEGANT® 610x150x50 bis $n_{45,J}=32$; $n_{90,J}=12$ MEGANT® 1090x150x50 $n_{45,H}=36$; $n_{90,H}=15$	D30 (GL_H)	530	190x710 bis 190x1190	3x M20x580 bis 3x M20x1150 (8.8)	28,7	13,2	15,5	17,7	19,9	6500
	D35 (GL_H)	540			29,3	13,5	15,8	18,0	20,3	6685
	D40 (GL_H)	550			29,9	13,8	16,1	18,4	20,7	6871
	D50 (GL_H)	≥ 590			32,3	14,9	17,4	19,9	22,4	7634

Service class: 1-2
D30/D35/D40/D50 solid hardwood
GL_H Glued laminated timber of hardwood
γ_M = 1,3 Partial safety factor for timber joints

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Header/joist-connector

Calculation and design formulas for MEGANT® (AW 6082) - proposal for ETA of main beam or column and secondary beam

1.) $F_{1,Rd}$ – force acting in direction of secondary beam:

$$F_{1,Rd} = \min \begin{cases} F_{1,J,Rd} & \text{... see 1a)} \\ F_{1,H,Rd} & \text{... see 1a)} \\ F_{t,Rd} & \text{... see 1b)} \\ F_{1,KCC,Rd} & \text{... see 1c)} \end{cases}$$

1a) Load bearing capacity of tension screws in softwood and hardwood for Joist/Header $F_{1,J/H,Rd}$:

Secondary beam (joist)	Main beam (header) or column
Design withdrawal resistance in softwood: $F_{1,J,Rd} = \frac{k_{mod}}{\gamma_M} \cdot \frac{n_{ef} \cdot f_{ax,J,k} \cdot d \cdot l_{ef,J} \cdot k_{ax}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$	Design withdrawal resistance in softwood: $F_{1,H,Rd} = \frac{k_{mod}}{\gamma_M} \cdot \frac{n_{ef} \cdot f_{ax,H,k} \cdot d \cdot l_{ef,H} \cdot k_{ax}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$
$n_{ef} = n_{90}$	$n_{ef} = n_{90}$
Design withdrawal resistance in hardwood: $F_{1,J,Rd} = \frac{k_{mod} \cdot F_{ax,J,Rk}}{\gamma_M}$ $F_{ax,J,Rk} = n_{ef,J} \cdot 2 \cdot 10^{-3} \cdot l_{ef,J} \cdot \rho_k^{1,6} \cdot d^{0,66} \cdot (1 - 0{,}01 \cdot (30° - 0°))$	Design withdrawal resistance in hardwood: $F_{1,H,Rd} = \frac{k_{mod} \cdot F_{ax,H,Rk}}{\gamma_M}$ $F_{ax,H,Rk} = n_{ef,H} \cdot 2 \cdot 10^{-3} \cdot l_{ef,H} \cdot \rho_k^{1,6} \cdot d^{0,66}$
For MEGANT® AW 6082: Megant 60: n_{90} = 3,00 Megant 100: n_{90} = 4,67 Megant 150: n_{90} = 6,33	For MEGANT® AW 6082: Megant 60: n_{90} = 3,00 Megant 100: n_{90} = 4,67 Megant 150: n_{90} = 6,33
$f_{ax,J,k} = 0{,}52 \cdot d^{-0,5} \cdot l_{ef,J}^{-0,1} \cdot \rho_k^{0,8}$	$f_{ax,H,k} = 0{,}52 \cdot d^{-0,5} \cdot l_{ef,H}^{-0,1} \cdot \rho_k^{0,8}$
$l_{ef,J} = L_{Scr,J} - 14$	
$k_{ax} = 1{,}0$	
$\alpha = 0°$	$\alpha = 90°$
γ_M = 1,3 for timber connections	
Length of screws l_{Scr} = min. 80 mm to max. 240 mm Standard screws CS 8x160 mm for softwood and CS 8x120 for hardwood	

1b) $F_{t,Rd}$ – tensile strength of horizontal screws
Tensile strength of one fully threaded screw d= 8 mm: f_{tens} = 20 kN (ETA-10/0189)

$n_{ef} = n_{90}$ (see table 1a)

$$F_{t,Rd} = \frac{n_{ef} \cdot f_{tens}}{\gamma_{M,2}}$$ with $\gamma_{M,2}$ = 1,25 partial factor for tensile strength steel

1c) Maximum load bearing capacity $F_{1,KCC,Rk}$ of KNAPP Clip Connector (KCC) MEGANT®

$$F_{1,KCC,Rd} = \frac{F_{1,KCC,Rk}}{\gamma_{M2}}$$ with $\gamma_{M,2}$= 1,25 partial factor for tensile strength aluminum

2.) $F_{2,Rd}$ – force acting in direction of insertion (top - down):

$$F_{2,Rd} = \min \begin{cases} F_{2,J,Rd} & \text{... see 2a)} \\ F_{2,H,Rd} & \text{... see 2a)} \\ F_{2,KCC,Rd} & \text{... see 2b)} \end{cases}$$

2a) Load bearing capacity of 45° screws in softwood and hardwood for joist/header $F_{2;J/H,Rk}$:

Secondary beam (joist)	Main beam (header) or column
$F_{2,J,Rd} = \frac{1{,}35 \cdot n_{ef45,J} \cdot F_{ax,45,J,Rk}}{\sqrt{2}} \cdot \frac{k_{mod}}{\gamma_M}$	$F_{2,H,Rd} = \frac{1{,}35 \cdot n_{ef45,H} \cdot F_{ax,45,H,Rk}}{\sqrt{2}} \cdot \frac{k_{mod}}{\gamma_M}$

γ_M= 1,3 partial factor for timber connection
Factor 1,35: includes friction between connector plate and beam

Design load bearing capacity of α=45° screws in softwood and hardwood:

Secondary beam (joist)	Main beam (header) or column
$F_{ax,45,J,Rk} = \frac{0{,}52 \cdot \sqrt{d} \cdot l_{ef,J}^{0,9} \cdot \rho_{k,J}^{0,8}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$ Softwood	$F_{ax,45,H,Rk} = \frac{0{,}52 \cdot \sqrt{d} \cdot l_{ef,H}^{0,9} \cdot \rho_{k,H}^{0,8}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$ Softwood
$F_{ax,45,Rk} = 2 \cdot 10^{-3} \cdot l_{ef} \cdot \rho_k^{1,6} \cdot d^{0,66}$ Hardwood	$F_{ax,45,Rk} = 2 \cdot 10^{-3} \cdot l_{ef} \cdot \rho_k^{1,6} \cdot d^{0,66}$ Hardwood
$n_{ef,45,J} = n_{45,J}$	$n_{ef,45,H} = n_{45,H}$
$l_{ef,J} = l_{Scr,J}$ -10 (Megant 60, 100 *) $l_{ef,J} = l_{Scr,J}$ -20 (Megant 150 **)	$l_{ef,H} = l_{Scr,H}$ -10 (Megant 60, 100 *) $l_{ef,H} = l_{Scr,H}$-20 (Megant 150 **)

*) for MEGANT® connector plate width of 60 and 100 mm
**) for MEGANT® connector plate width of 150 mm

Angle between screw axis and direction of grain α=**45°:**
Length of screws l_{Scr} = min. 80 mm to max. 240 mm
Standard screws CS 8x160 mm for softwood and CS 8x120 for hardwood

Use of 2 different screw lengths within a connector plate to reduce height of secondary beam or for tilted joints:

Secondary beam (joist)	Main beam (header) or column
$F_{2,J,Rd} = \frac{1{,}35}{\sqrt{2}} \cdot \frac{k_{mod}}{\gamma_M} \cdot \left[n_{ef45,J,1} \cdot F_{ax,45,J,1,Rk} + \left(\frac{2}{3}\right) \cdot n_{ef45,J,2} \cdot F_{ax,45,J,2,Rk} \right]$	Identical formula for $F_{2,H,Rd}$

$l_{ef,J,1} > l_{ef,J,2}$
$l_{ef,H,1} > l_{ef,H,2}$

2b) Maximum load bearing capacity $F_{2,KCC,Rk}$ of Knapp Clip Connector (KCC): MEGANT®

$$F_{2,KCC,Rd} = \frac{F_{2,KCC,Rk}}{\gamma_{M,1}}$$

$\gamma_{M,1}$= 1,1 for aluminum

MEGANT®

Header/joist-connector

2c) to 2f) provides further calculation rules for MEGANT®

2c) Tensile force of the metrical threaded rod:
Standard steel grade for threaded rods is 8.8 according EN ISO 898-1:
$f_{u,b}$ =800 N/mm²
Alternatively metric rods made of stainless steel A2-70 or A4-70 can be used!
Reduction factor for rods made of steel or stainless steel of lower grade can be calculated (EC3-1-8/3.6.1):

$$F_{t,Rd} = \frac{n \cdot k_2 \cdot f_{ub} \cdot A_s}{\gamma_{M2}}$$

n: number of threaded rods
k_2 = 0,9 (factor)
$f_{u,b}$ characteristic tensile strength of threaded rod
$\gamma_{M,2}$ = 1,25 partial factor for steel, stainless steel
A_S … tensile stress area of the two threaded rods:

- ∅ 16 mm => A_S =1,57 cm²
- ∅ 20 mm => A_S =2,45 cm²

2d) Embedment strength of metric thread in aluminum (e.g. thread in clamping jaw):

$$F_{\tau,Rd} = \frac{R_{p0,2,k} \cdot A_M \cdot \beta_M}{\gamma_M}$$

$R_{p0,2,k} = f_O$ … 0,2% yield strength according EN1999-1-1:

-EN AW 6005, T6: $R_{p0,2,k} = f_O$ = 200 N/mm²
-EN AW 6082, T6: $R_{p0,2,k} = f_O$ = 240 N/mm²

$$A_M = n \cdot d_B \cdot t \cdot \pi$$

n: number of threaded rods
d_B: hole diameter
t: length of thread in aluminum e.g. clamping jaw
β_M = 0,4 reduction factor for aluminum thread
$\gamma_{M,1}$ = 1,1 partial factor for aluminum

2e) Screw length correction:
Standard screw length is 160 mm. Special applications as tilted joint, reduced timber height of secondary beam requires shorter length of all or a part of screws. Very high loads can require longer screws up to 240 mm. The correct screw length can be calculated using the formulas of 2a).

Minimum screw length is 80 mm and maximum screw length is 240 mm.

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2f) Reduction factor f_{R2} for torsional not fixed main beam loaded in direction of insertion (R2):

Test results of MEGANT® are summarized in table G1 and G2.
Eccentricity is defined as
$e = B_H / 2 + t_{MEGANT} / 2$ for torsional not fixed main beam and
$e = t_{MEGANT} / 2$ for torsional fixed main beam.

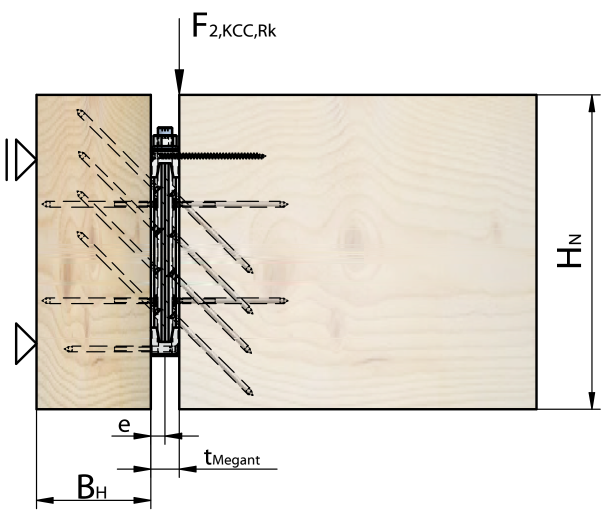
Table G1: $F_{2,KCC,Rk}$ for MEGANT® made of aluminum 6005 T6 or of similar or better quality:

Knapp Clip Connector MEGANT® [mm]	Torsional fixed main beam (header)		Torsional not fixed main beam (header)	
	$F_{2, KCC,Rk}$ [kN]	Eccentricity e [mm]	$F_{2, KCC,Rk}$ [kN]	Eccentricity e [mm]
b = 60 (t_{Megant}=40)	111,4	20	97,6	90
b = 100 (t_{Megant}=40)	187,3	20	155,0	90
b = 150 (t_{Megant}=50)	325,9	25	299,6	125

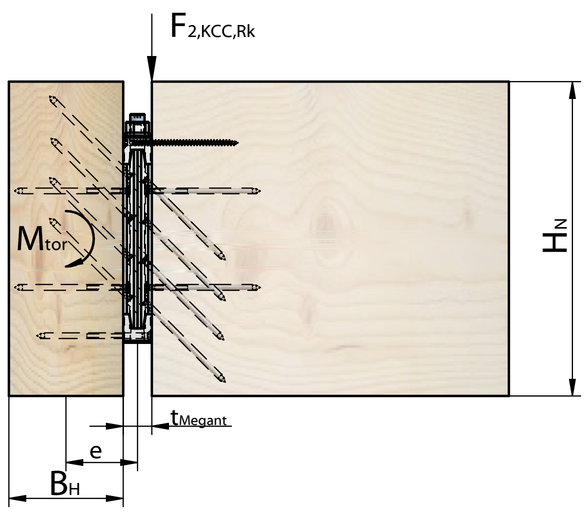
Table G2: $F_{2,KCC,Rk}$ for MEGANT® made of aluminum 6082 T6 or of similar or better quality:

Knapp Clip Connector MEGANT® [mm]	Torsional fixed main beam (header)		Torsional not fixed main beam (header)	
	$F_{2, KCC,Rk}$ [kN]	Eccentricity e [mm]	$F_{2, KCC,Rk}$ [kN]	Eccentricity e [mm]
b = 60 (t_{Megant}=40)	150,4	20	130,1	90
b = 100 (t_{Megant}=40)	224,2	20	206,6	90
b = 150 (t_{Megant}=50)	375,0	25	366,5	125

Torsional fixed main beam (header)



Torsional not fixed main beam (header)



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For torsional not fixed main beams a reduction factor f_{R2} has to be used for the load bearing capacity of Knapp Clip Connectors MEGANT® as given in figure G1:

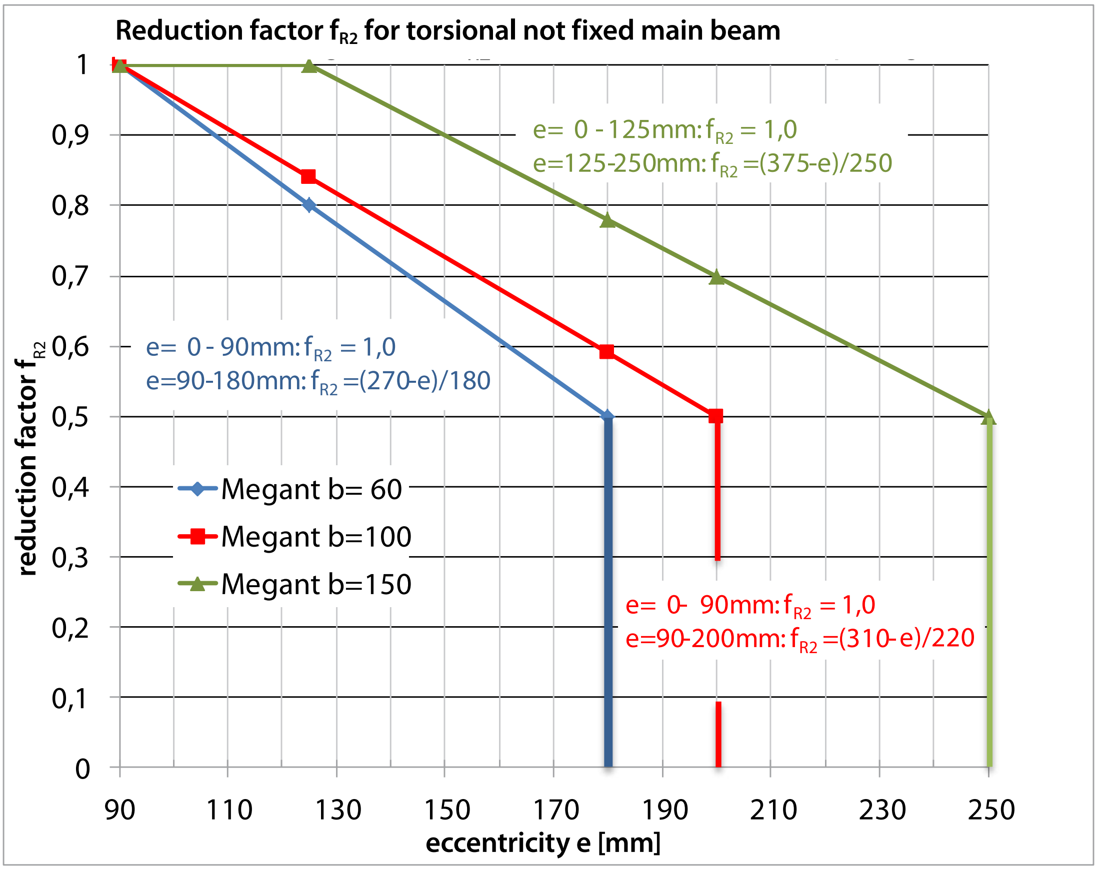

Figure G1: Reduction factor f_{R2} for torsional not fixed main beam

If the eccentricity is greater than given in Figure G1, additional reinforcement has to be used to avoid higher moment for the MEGANT® connector

($M_{2,Rk} = F_{2,Rk}$ **x e**)

The following reinforcement measures can be carried out in the lower part of the MEGANT® connector.

- Add additional horizontal tension screws from the main beam to the secondary. This will prevent the rotation of the main beam (anti-torsion safety).

- If the main and secondary beams have the same height, it is possible to use perforated plates from below to transfer the tensile forces. (Provided that the main and secondary beams are covered)

- A crossed slanted screwing (α = 30 °) will transfer the tensile forces.

3.) $F_{3,Rd}$ – force against direction of insertion:

$$F_{3,Rd} = \frac{k_{mod}}{\gamma_M} \cdot \min \begin{cases} F_{3,J,Rk} \\ F_{3,H,Rk} \end{cases}$$

Secondary beam (joist)	Main beam (header) or column
$F_{3,J,Rk} = n_{45,J} \cdot F_{v,45,J,Rk} + n_{0,J} \cdot F_{v,0,J,Rk}$	$F_{3,H,Rk} = n_{45,H} \cdot F_{v,45,H,Rk} + n_{90,H} \cdot F_{v,90,H,Rk}$
$F_{v,0,J,Rk} = 2{,}3 \cdot \sqrt{M_{y,Rk} \cdot f_{h,J,k} \cdot d} + \frac{F_{ax,0,J,Rk}}{4}$	$F_{v,90,H,Rk} = 2{,}3 \cdot \sqrt{M_{y,Rk} \cdot f_{h,H,k} \cdot d} + \frac{F_{ax,90,H,Rk}}{4}$
$F_{v,45,J,Rk} = 2{,}3 \cdot \sqrt{M_{y,Rk} \cdot f_{h,J,k} \cdot d}$	$F_{v,45,H,Rk} = 2{,}3 \cdot \sqrt{M_{y,Rk} \cdot f_{h,H,k} \cdot d}$
$f_{h,J,k} = 0{,}033 \cdot \rho_k \cdot d^{-0,3}$ … *1)* (α = 0° for end grain)	$f_{h,H,k} = 0{,}082 \cdot \rho_k \cdot d^{-0,3}$ … *EC5* (α= 90° for side grain)

1) … Expert report of Prof. Blaß / KIT (05.12.2009) & ETA-11/0190; values are 10% lower as given in expert report of Prof. Blaß / KIT (03.04.2007):

$$f_{h,J,k} = 0{,}022 \cdot \rho_k^{1,24} \cdot d^{-0,3}$$

4.) $F_{45,Rd}$ – force acting perpendicular to direction of insertion (centric load):

$$F_{45,Rd} = \frac{F_{45,Rk} \cdot k_{mod}}{\gamma_M} \cdot f_{size}$$

γ_M = 1,3 partial factor for timber connections
f_{Size} ... factor for connector height

	MEGANT® height		
	h = 310 mm	h = 430 mm	h = 550 mm
f_{size}	1,0	1,1	1,2

5.) Combined loading:

$$\left(\frac{F_{1,d}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2,d}}{F_{2,Rd}}\right)^2 + \left(\frac{F_{45,d}}{F_{45,Rd}}\right)^2 + \left(\frac{M_{tor,d}}{M_{tor,Rd}}\right) \leq 1{,}0$$

6.) Interlayer (based on ETA-10/0189:2014)

An interlayer between MEGANT® and the header or between MEGANT® and the joist can be used, if the density of the interlayer is similar or higher as the characteristic density of the timber used for the header or the joist. The screw length has to be raised depending to the thickness of the interlayer. The effective screw length l_{ef} is the thread length in the header or joist.

An interlayer between MEGANT® and steel construction can be used. The calculation of the screws has to be carried out according EC3.

7.) Tension reinforcement

a) Tension perpendicular to the grain in main- and secondary beam loaded in direction of insertion F_2

No further calculation is needed if:

$a/H_H > 0{,}7$ and $a/H_J > 0{,}7$

$a_{J/H}$ ... Distance of screw row to the loaded edge of the wood member

$H_{J/H}$ ... Height of secondary and main beam

Tension perpendicular to grain for timber members with $0{,}2 \leq a/H_{H/J} \leq 0{,}7$:

The following expressions shall be satisfied for timber members **without** reinforcement:

<table>
<tr><th>Main beam (header):</th><th>Secondary beam (joist):</th></tr>
<tr><td>$\left(\frac{F_{90,d}}{F_{90,H,Rd}}\right) \leq 1{,}0$</td><td>$\left(\frac{F_{90,d}}{F_{90,J,Rd}}\right) \leq 1{,}0$</td></tr>
<tr><td colspan="2">$F_{90,H/J,Rd} = k_{H/J} \cdot k_{s,H/J} \cdot k_{r,H/J} \cdot \left[6{,}5 + 18 \cdot \left(\frac{a}{H_{H/J}}\right)^2\right] \cdot \left(t_{ef} \cdot H_{H/J}\right)^{0{,}8} \cdot f_{t,90,d}$</td></tr>
<tr><td>$k_H = 1{,}0$
$k_{s,H} = \max\begin{cases}1 \\ 0{,}7 + \frac{1{,}4 \cdot a_{r,H}}{H_H}\end{cases}$
MEGANT b= 60 mm: $a_{r,H}$ = 40 mm
MEGANT b= 100 mm: $a_{r,H}$ = 80 mm
MEGANT b= 150 mm: $a_{r,H}$ = 130 mm
$k_{r,H} = \frac{n_H}{\sum_{i=1}^{n_H}\left(\frac{h_{1,H}}{h_{i,H}}\right)^2}$
$t_{ef} = \min\begin{cases}B_H \\ l_{ef,H}/\sqrt{2}\end{cases}$</td><td>$k_J = 0{,}5$
$k_{s,J} = \max\begin{cases}1 \\ 0{,}7 + \frac{1{,}4 \cdot a_{r,J}}{H_J}\end{cases}$
MEGANT b= 60 mm: $a_{r,H}$ = 40 mm
MEGANT b= 100 mm: $a_{r,H}$ = 80 mm
MEGANT b= 150 mm: $a_{r,H}$ = 130 mm
$k_{r,J} = \frac{n_J}{\sum_{i=1}^{n_J}\left(\frac{h_{1,J}}{h_{i,J}}\right)^2}$
$t_{ef} = \min\begin{cases}B_J \\ l_{ef,J}/\sqrt{2}\end{cases}$</td></tr>
</table>

h_i … distance of screw-row to unloaded edge

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The following expressions shall be used to **reinforce** timber members:

Main beam (header)	Secondary beam (joist)
$\left(\frac{F_{t,90,H,d}}{n \cdot F_{ax,Rd}}\right) \leq 1{,}0$	$\left(\frac{F_{t,90,J,d}}{n \cdot F_{ax,Rd}}\right) \leq 1{,}0$
$F_{t,90,H,d} = \left[1 - 3 \cdot \left(\frac{a}{H_H}\right)^2 + 2 \cdot \left(\frac{a}{H_H}\right)^3\right] \cdot F_{90,d}$	$F_{t,90,J,d} = \left[1 - 3 \cdot \left(\frac{a}{H_J}\right)^2 + 2 \cdot \left(\frac{a}{H_J}\right)^3\right] \cdot F_{90,d}$

Formulas are based on DIN1052:2008, DIN EN 1995-1-1/NA: 2010-12, 6.8.2 and used for static calculations for connections / connectors based on ETA-10/0189 within European community.
n … number of fully threaded self-tapping screws for reinforcement

$F_{ax,Rd}$ has to be calculated following the rules:

- Self-tapping fully threaded screws according EN 1995-1-1, formula 8.38 or according ETA

- Glued bolts / threaded rods can be calculated according DIN 1052:2008 / DIN EN 1995-1-1/NA 11.2 or similar design rules:

$$\boxed{F_{ax,Rd} = \min\left\{f_{y,d} \cdot A_{ef} ; \pi \cdot d \cdot l_{ad} \cdot f_{k1,d}\right\}}$$

$f_{y,d}$ ... design tensile strength of threaded rods / steel rods
A_{ef} ... net cross section of threaded rods / steel rods

l_{ad} ... glued in length of threaded rods / steel rods
$f_{k1,d}$ ... design shear strength of glue (according to suppliers declaration)

- Similar connectors can be used; structural analysis has to be done according EC5 or ETA

8.) Control of tension perpendicular to direction of insertion (F4, F5) for main- and secondary beam and calculation of load carrying capacity to reinforce timber members

Simple control method with no further calculation needed for tension perpendicular in main or secondary beam:

$a/B_H > 0{,}7$ and $a/B_J > 0{,}7$

$a_{J/H}$ ... Distance of screw row to the loaded edge of the wood member
$B_{J/H}$ ... Width of secondary and main beam

Calculation of tension perpendicular to grain for timber members with $0{,}2 \le a/B_{H/J} \le 0{,}7$ loaded perpendicular to direction of insertion (F_4, F_5):

The following expressions shall be satisfied for timber members **without** reinforcement:

Main beam (only for column):	Secondary beam (joist):
$\left(\frac{F_{90,d}}{F_{90,H,Rd}}\right) \le 1{,}0$	$\left(\frac{F_{90,d}}{F_{90,J,Rd}}\right) \le 1{,}0$
$F_{90,H/J,Rd} = k_{H/J} \cdot k_{s,H/J} \cdot k_{r,H/J} \cdot \left[6{,}5 + 18 \cdot \left(\frac{a}{B_{H/J}}\right)^2\right] \cdot \left(t_{ef} \cdot B_{H/J}\right)^{0,8} \cdot f_{t,90,d}$	
$k_H = 1{,}0$ $k_{s,H} = \max\begin{Bmatrix} 1 \\ 0{,}7 + \frac{1{,}4 \cdot a_{r,H}}{B_H} \end{Bmatrix}$ $a_{r,H}$ … values are given below $k_{r,H} = \frac{m_H}{\sum_{i=1}^{n_H}\left(\frac{b_{1,H}}{b_{i,H}}\right)^2}$ $t_{ef} = \min\begin{Bmatrix} B_H \\ l_{ef,H}/\sqrt{2} \end{Bmatrix}$	$k_J = 0{,}5$ $k_{s,J} = \max\begin{Bmatrix} 1 \\ 0{,}7 + \frac{1{,}4 \cdot a_{r,J}}{B_J} \end{Bmatrix}$ $a_{r,H}$ … values are given below $k_{r,J} = \frac{m_J}{\sum_{i=1}^{n_J}\left(\frac{b_{1,J}}{b_{i,J}}\right)^2}$ $t_{ef} = \min\begin{Bmatrix} B_J \\ l_{ef,J}/\sqrt{2} \end{Bmatrix}$

For load direction perpendicular to direction of insertion (F_4 and F_5) following factors has to be used:

a_r … outermost distance of screws within connector plate, ar depends on size of MEGANT®:

MEGANT h= 290, 310 mm: $a_{r,H}$ = 171 mm
MEGANT b= 405, 430 mm: $a_{r,H}$ = 285 mm
MEGANT b= 520, 550 mm: $a_{r,H}$ = 399 mm

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The following expressions shall be used to **reinforce** timber members:

Main beam (column):	Secondary beam (joist):
$\left(\frac{F_{t,90,H,d}}{n \cdot F_{ax,Rd}}\right) \leq 1{,}0$	$\left(\frac{F_{t,90,J,d}}{n \cdot F_{ax,Rd}}\right) \leq 1{,}0$
$F_{t,90,H,d} = \left[1 - 3 \cdot \left(\frac{a}{B_C}\right)^2 + 2 \cdot \left(\frac{a}{B_C}\right)^3\right] \cdot F_{90,d}$	$F_{t,90,J,d} = \left[1 - 3 \cdot \left(\frac{a}{B_J}\right)^2 + 2 \cdot \left(\frac{a}{B_J}\right)^3\right] \cdot F_{90,d}$

Formulas are based onDIN1052:2008, DIN EN 1995-1-1/NA: 2010-12, 6.8.2 and used for static calculations for connectors based on ETA-10/0189 within European community.
n … number of fully threaded self-tapping screws for reinforcement
$F_{ax,Rd}$ has to be calculated following the rules:

- Self-tapping fully threaded screws according EN 1995-1-1, formula 8.38 or according ETA

- Glued threaded rods / steel rods can be calculated according DIN 1052:2008 / DIN EN 1995-1-1/NA 11.2 or similar design rules:

$$\boxed{F_{ax,Rd} = \min\left\{f_{y,d} \cdot A_{ef} ; \pi \cdot d \cdot l_{ad} \cdot f_{k1,d}\right\}}$$

$f_{y,d}$ ... design tensile strength of threaded rods / steel rods
A_{ef} ... net cross section of threaded rods / steel rods

l_{ad} ...glued in length of threaded rods / steel rods
$f_{k1,d}$ ... design shear strength of glue (according to suppliers declaration)

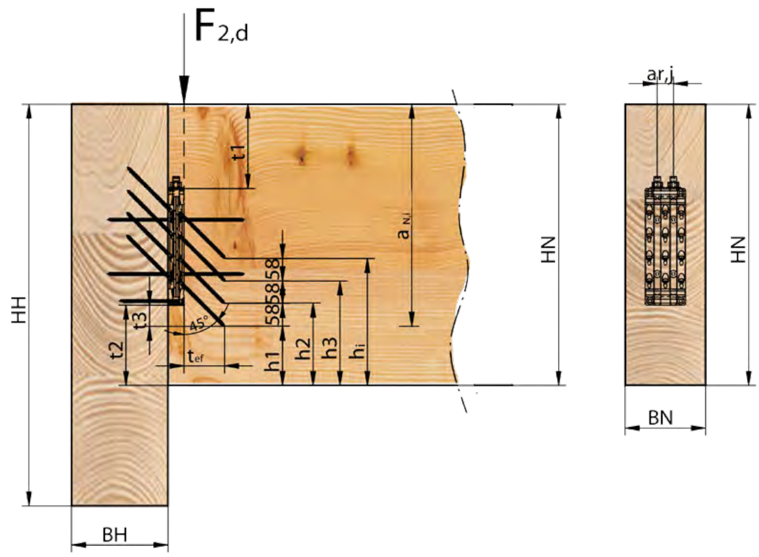
- Similar connectors can be used; structural analysis has to be done according EC5 or ETA

MEGANT®

ETA-15/0667

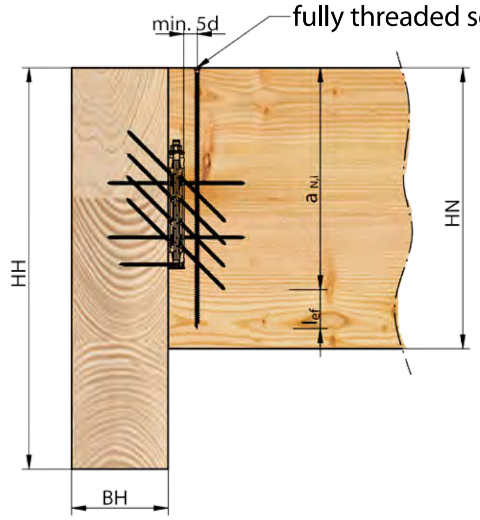
Header/joist-connector

Tension reinforcement in joist – F_2



Proof of transverse tension of joist
Simple control method with no further calculation needed for tension perpendicular in secondary beam (joist):

$a_{N,i}/H_N$	> 0,7



fully threaded self-tapping screws

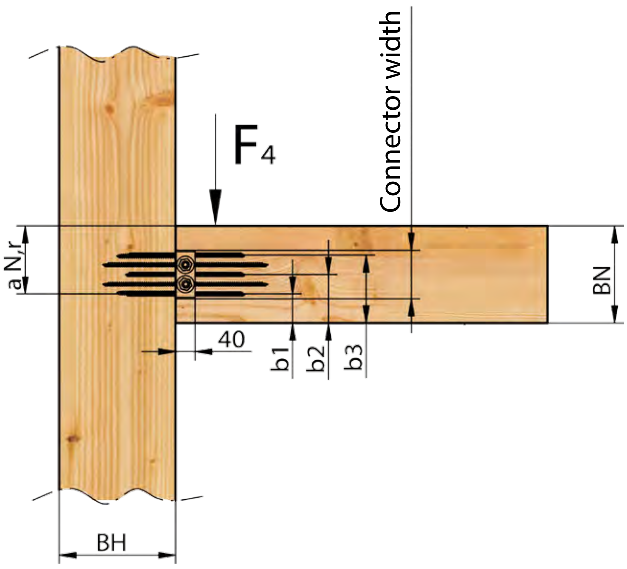
$a_{N,i} = H_N - t_2 + t_3$

$h_{N,i} = h_1 + n \cdot 58$

n=number of levels

Proof of transverse tension of latch
Simple control method with no further calculation needed for tension perpendicular in secondary beam (latch):

$a_{N,r}/B_N$	> 0,7



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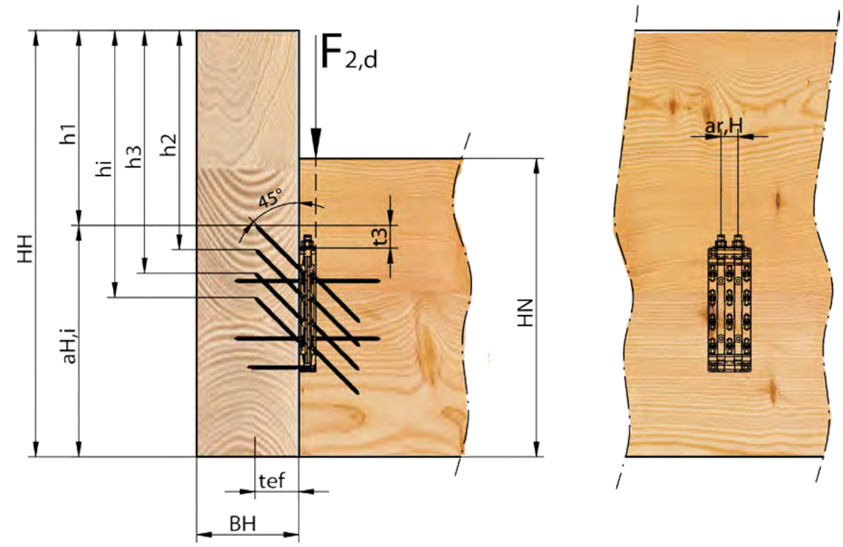
Header/joist-connector

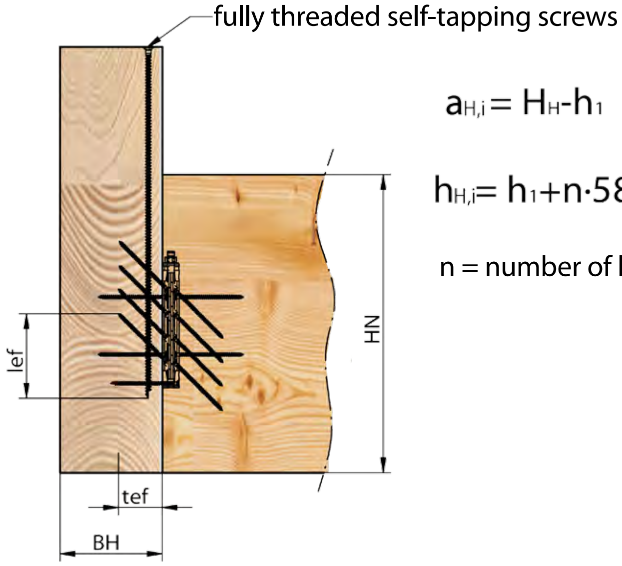
Tension reinforcement in main beam (header) – F_2



Proof of transverse tension of main beam

Simple control method with no further calculation needed for tension perpendicular in main or secondary beam:

$a_{N,i}/H_N$	> 0,7
$a_{H,i}/H_H$	> 0,7



$a_{H,i} = H_H - h_1$

$h_{H,i} = h_1 + n \cdot 58$

n = number of levels

Comparative calculation ÖNORM B 1995-1-1: 2015, section 6.5.2 (NA)

Significance:
(1) Reinforcement of transverse tension according to static requirements
(2) Risk of transversal splitting

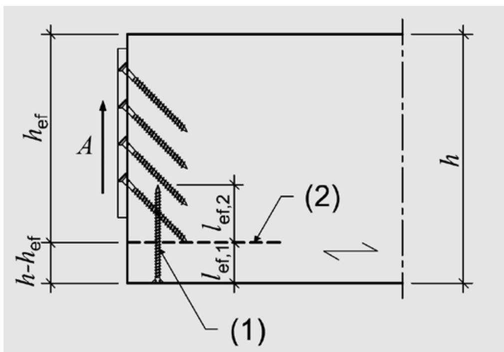
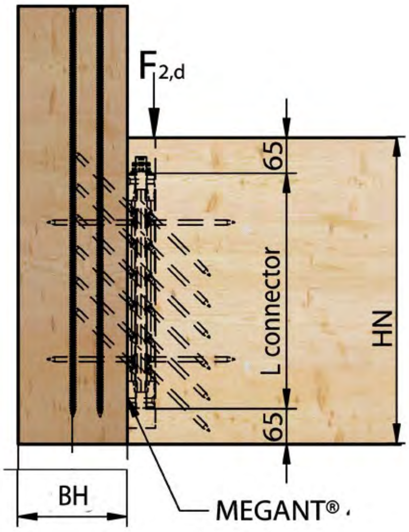


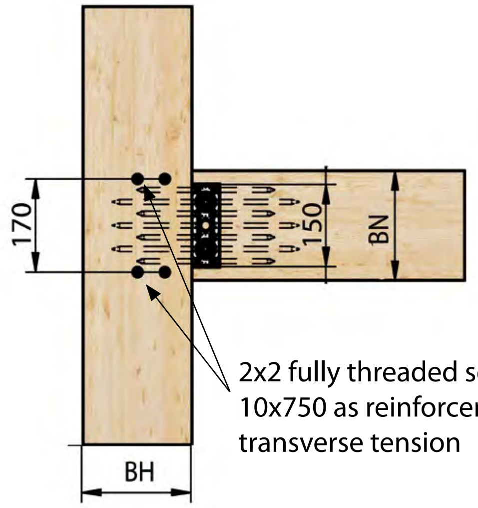
Image NA.6.10-E1 – shear force connection of bending bars with connector groups

MEGANT®

Reinforcement of transverse tension

MEGANT® main and secondary beam assembly with transversal tensile stuctural analysis and transverse tension reinforcement.

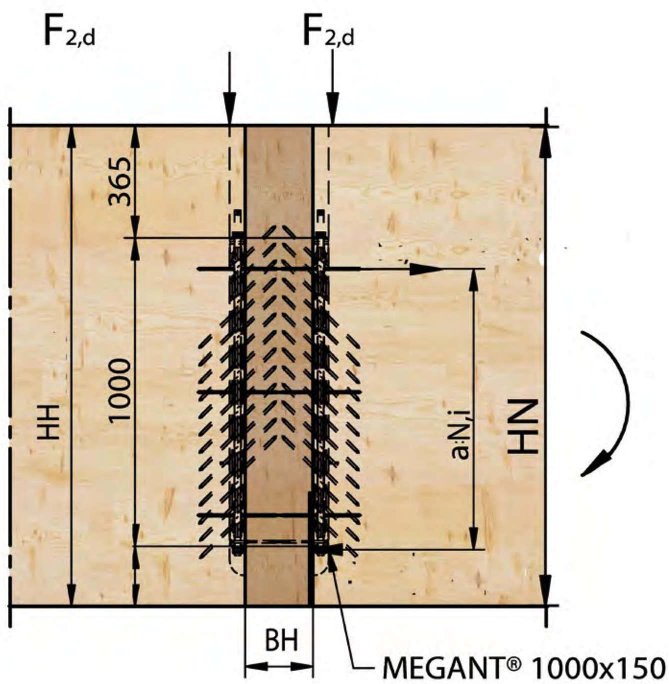




Calculation of tensile forces $F_{t,90,d}$ for additional transverse tension reinforcement screwing protecting the main beam from splitting.

$$F_{t,90,d} = [1-3 \cdot (a_{H,i}/H_H)^2 + 2 \cdot (a_{H,i}/H_H)^3] \cdot F_{90}$$

Avoidance of transverse tension reinforcement for main and secondary beam assembled by partly screwed MEGANT® connection.



Structural analysis proportion a/H_H

Secondary beam: $a_{N,i}/H_n$ > 0,7 **Main beam :** $a_{H,i}/H_n$ > 0,7

A tensional reinforcement screws with total thread can be avoided by the arrangement of the slanted screwing in the lower part of the secondary beam and in the upper part of the main beam. (See picture)

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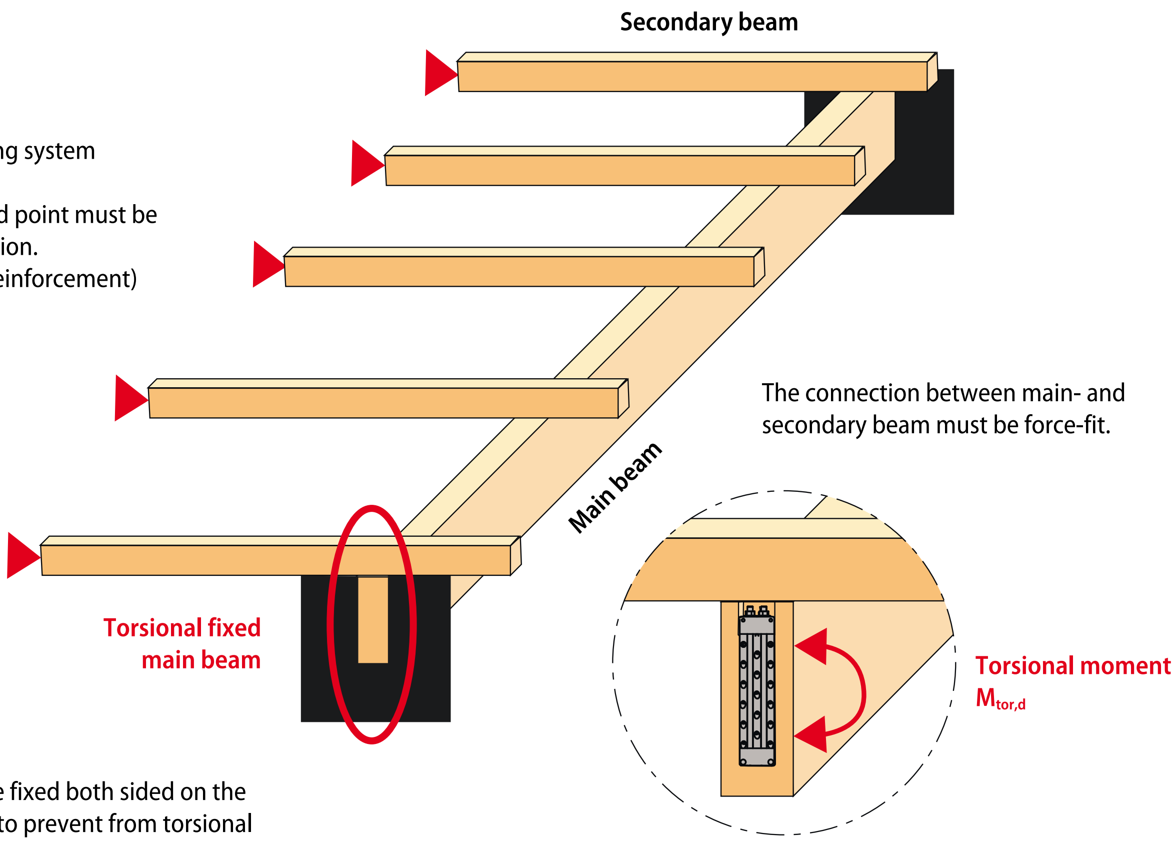
ETA-15/0667

Tilting (main beam)

Tilting bracket in bracing system

The stability of the fixed point must be ensured to the foundation.
(Roofing and bracing reinforcement)

The connection between main- and secondary beam must be force-fit.



The main beam must be fixed both sided on the bottom and on the top to prevent from torsional moment. The concrete structure must be designed to fix the torsional moment of the main beam. See picture.

MEGANT® can also be used to transfer the torsional moments of the secondary beam.

9.) MEGANT® - timber to steel connections:

Main beam as steel- and secondary beam as timber construction for load direction F_2:

$$F_{2,Rd} = \min \begin{cases} F_{2,J,Rd} \\ F_{2,steel,Rd} \end{cases}$$

Structural analysis of timber connection with KNAPP® Clip Connector MEGANT®:

$$F_{2,J,Rd} = \min \begin{cases} F_{2;KCC,Rk} / \gamma_{M1} & \gamma_{M1} = 1{,}1 \\ \dfrac{F_{2;Rk}}{\gamma_{M,timber}} \cdot k_{mod} & \gamma_{M,timber} = 1{,}30 \end{cases}$$

Structural analysis of steel conections wirh KNAPP® Clip Connector MEGANT®:

$$F_{2,Steel,Rd} = \min \begin{cases} n \cdot F_{v,Rd} \\ n \cdot F_{b,Megant,Rd} \\ n \cdot F_{b,Steelplate,Rd} \end{cases}$$

γ_{M2} = 1,25 ... shear strength of metric screw

γ_{M1} = 1,25 ... embedment in aluminum base plate

γ_{M2} = 1,25 ... embedment in steel

$F_{v,Rd}$ … see EC3-1-8/3.6.1 $$F_{v,Rd} = \frac{n \cdot \alpha_v \cdot f_{ub,k} \cdot A_s}{\gamma_{M2}}$$

$F_{b,Megant,Rd}$ … see EC9 $$F_{b,Megant,Rd} = \frac{k_1 \cdot \alpha_b \cdot f_u \cdot d_1 \cdot t}{\gamma_{M2}}$$

$F_{b,Steelplate,Rd}$ … see EC3-1-8/3.6.1 $$F_{b,Steelplate,Rd} = \frac{n \cdot k_1 \cdot \alpha_b \cdot f_u \cdot d_1 \cdot t}{\gamma_{M2}}$$

Other load directions have to be calculated similar, following the rules of EC3 and EC9.

10.) MEGANT® - timber to concrete connections:

Concrete dowels with ETA can be used. Calculation of concrete connection has to follow the rules of the supplier of the concrete dowels.

MEGANT®

ETA-15/0667 CE

Timber-concrete –connection

Example of a saddle roof beam / concrete wall connection with MEGANT®

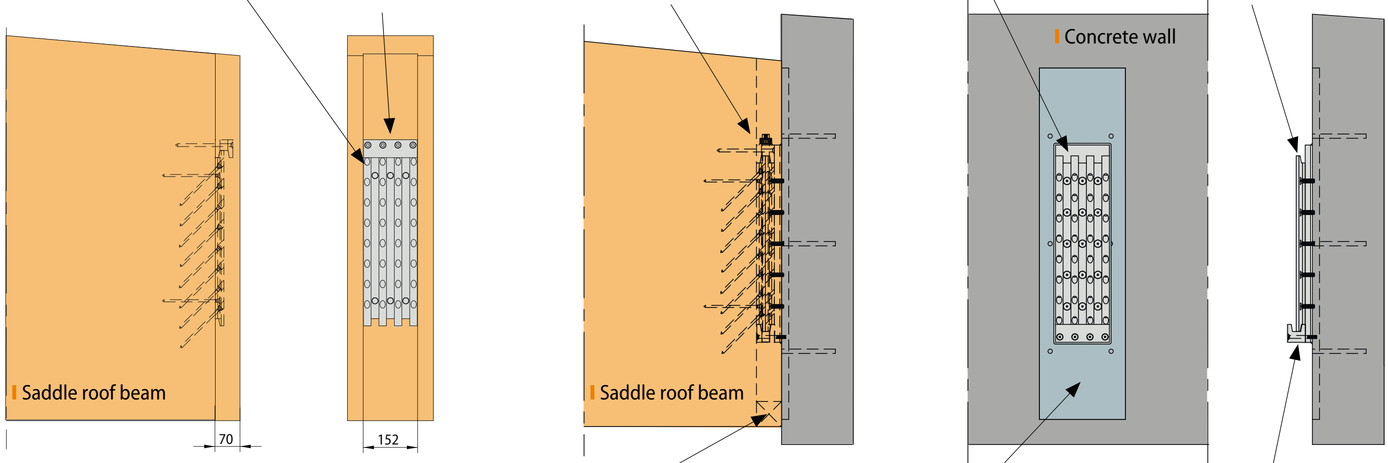
I Screwing MEGANT® connector plate with CS 8x160

I Screwing MEGANT® clamping jaw on top with 4 CS 8x160

I MEGANT® connector 550x150x50 (timber-steel-connection)

I Leveling and welded steel plate 550x150x20 mm

I Screwing MEGANT® connector plate with 15 CS M10x40



I Continuous groove milling e.g. 152x70 mm for 3 sided covered MEGANT® connection

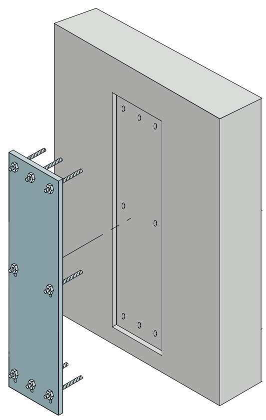
I Wooden block for groove milling (3 sided covered MEGANT® connections)

I Reinforced anchor steel plate e.g. 240x980x20 mm

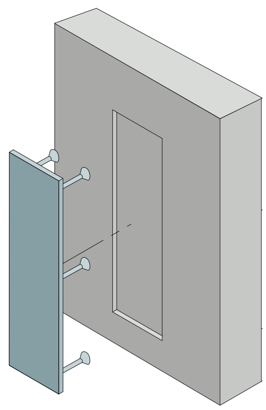
I Screwing MEGANT® clamping jaw with 4 screws CS M8x80

Examples: Connection anchor steel plate- concrete wall / column

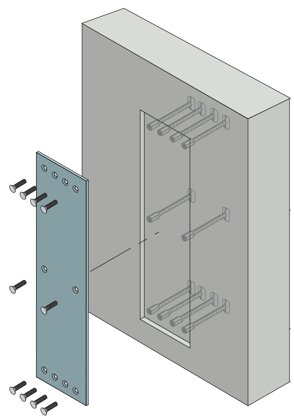
Gluing: Fischer Superbond-System FIS SB 390 S



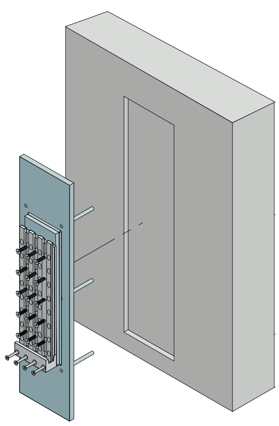
I The steel plate and the concrete component are put together with glued threaded rods with Fischer Superbond System FIS SB 390 S. Alternatively, the anchor steel plate can be set into the concrete component flush. **www.fischer.co.uk**



I SBKL Peikko anchor steel plate inserted flush in the concrete component. **www.peikko.de**



I Halfen HSC-B anchor steel plate inserted flush in the concrete component. **www.halfen.com**



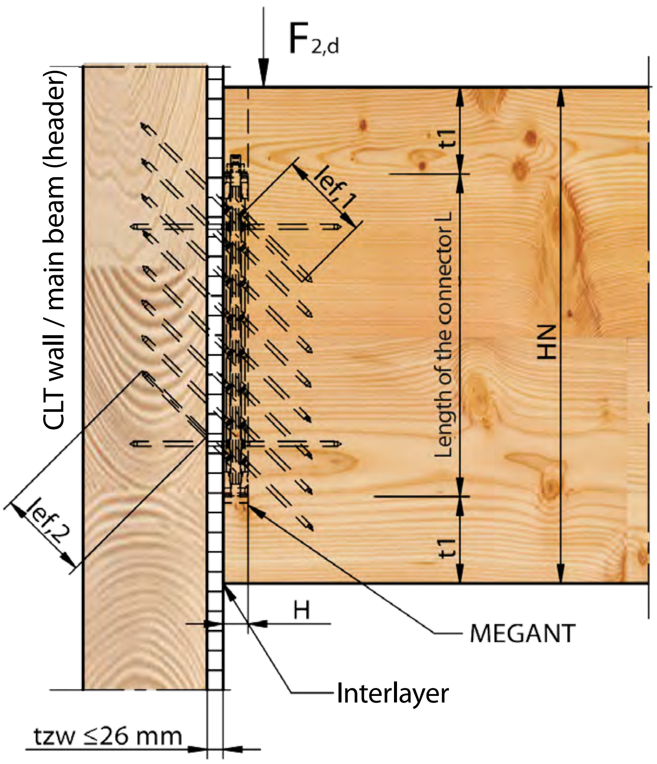
I MEGANT® connector mounted on steel plate connecting with welded rods or similar support surfaces inserted flush in the concrete component.

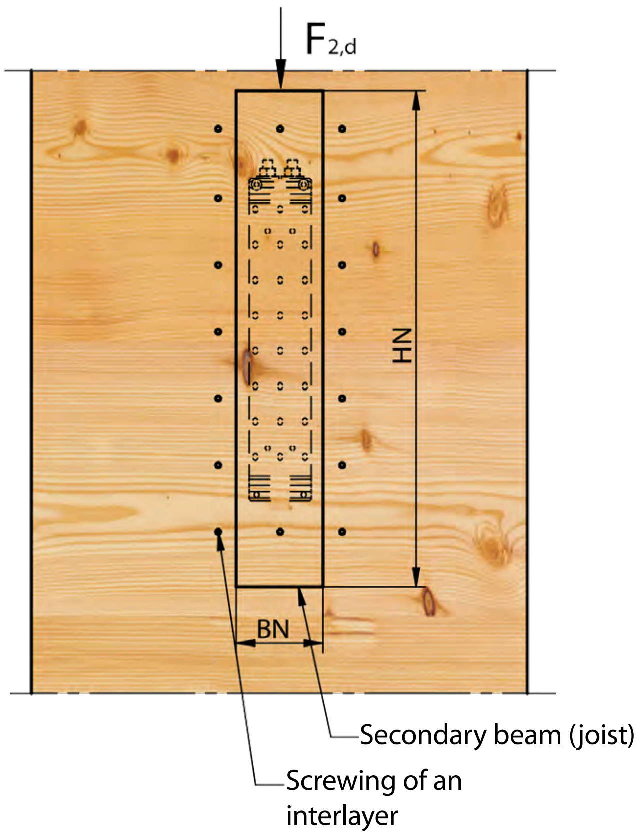
KNAPP® recommends different systems for anchor steel plates:
- Halfen HSC-B (Z-1.8-1974)
- Fischer Superbond System FIS SB 390 S.
- Peikko anchor steel plates
- Standard welded steel plates

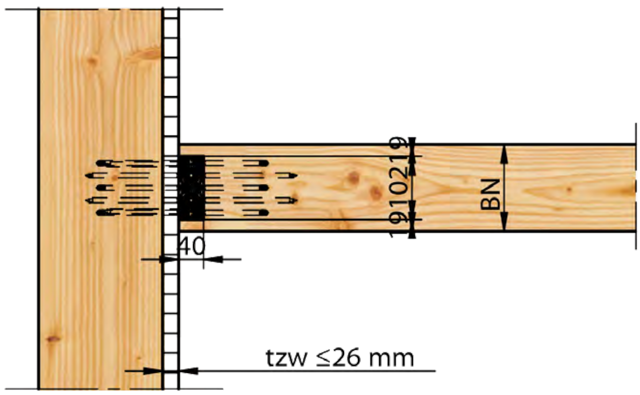
The necessary static calculation for concrete connections is to be calculated by structural engineers to garantee the safety of the connection. An anchor steel plate ajusted accuratly can replace the elaborate mounting of the welded additional steel plate on the building site. After all the MEGANT® connector can be screwed on an ajusted anchor steel plate.

MEGANT®

Header/joist-connector







Signification :

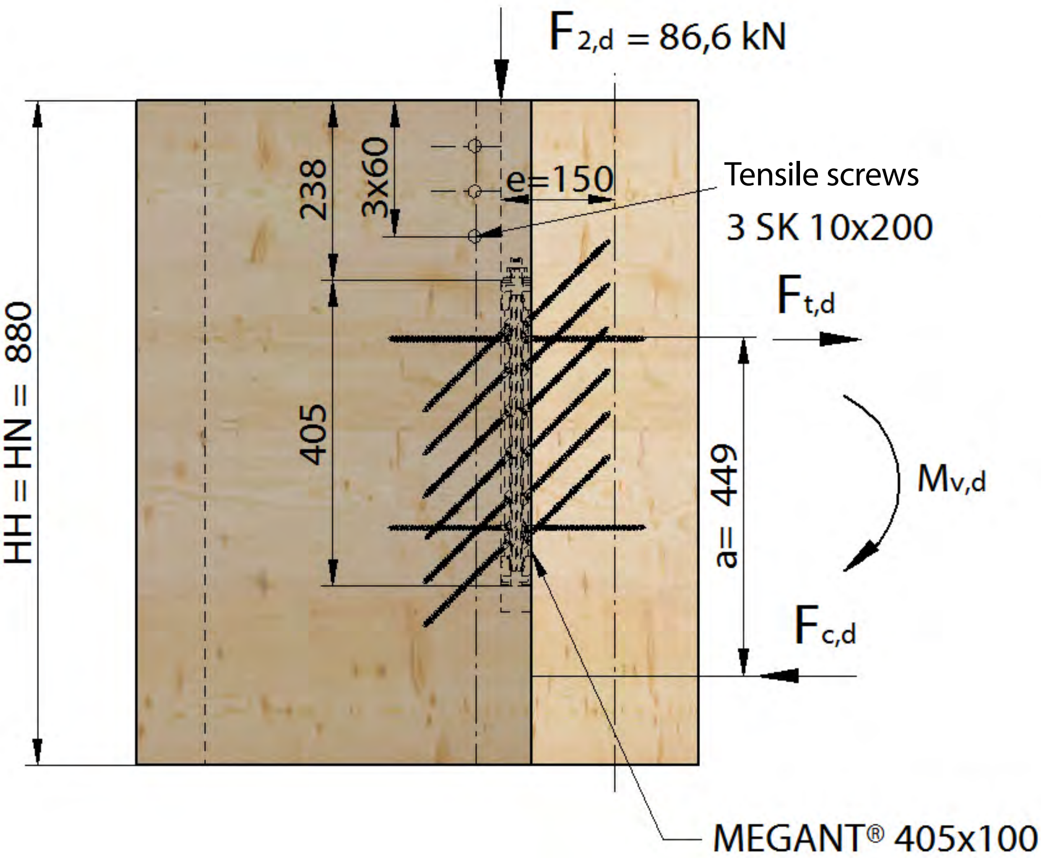
$L_{ef,1}$ = Effective screw length secondary beam
$L_{ef,2}$ = Effective screw length main beam
tzw = Intermediate thickness

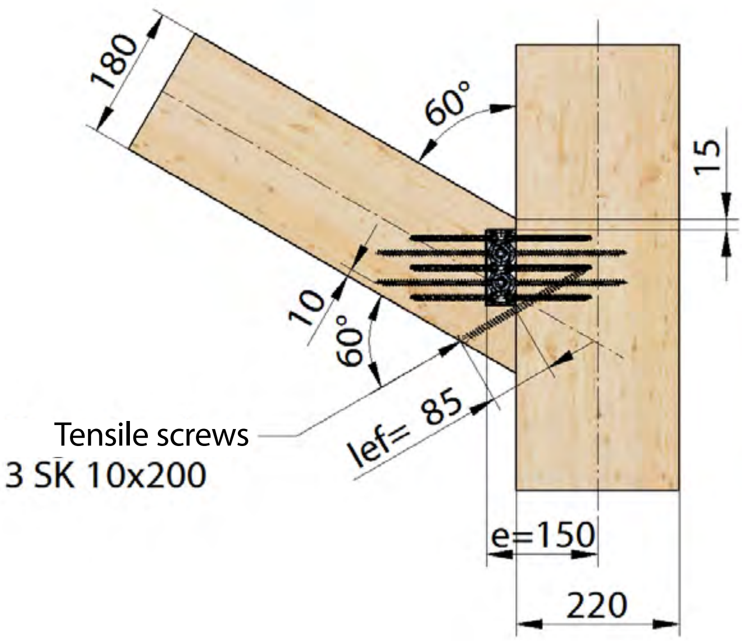
It is possible to attach the MEGANT® connector directly to an interlayer of the following wood materials:

- OSB (Oriented Strand Board) of the type OSB/3 and OSB/4 according to DIN EN13986 (DIN EN 300) and DIN 20000-1 or technical approval.
- Particleboard according to DIN EN13986 (DIN EN 312) or technical approval.
- Plywood panels according to DIN EN13986 (DIN EN 636) and DIN 20000 - 1 or technical approval.

MEGANT®

Eccentric load in direction of insertion





Torsional moment of eccentric load

$M_{v,d} = F_{2,d}$ x e= 13 kNm

$F_{t,d} = F_{c,d} = M_{v,d}$ /a =29,1 kN
MEGANT® transmet : $F_{1,Rd}$ = 16,8 kN

The remainder of the tensile force $\Delta F_{t,d}$ = 12,3 kN is taken up by 3 complementary tensile screws 10x200. The tensile force is calculated as follows:

$$F_{ax,\alpha,Rd} = \frac{k_{mod}}{\gamma_M} \cdot \frac{n_{ef} \cdot f_{ax,k} \cdot l_{ef} \cdot d}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$$

$$F_{ax,45,Rd} = \frac{0{,}8}{1{,}3} \cdot \frac{3^{0{,}9} \cdot 12{,}5 \cdot 10 \cdot 85}{1{,}2\cos^2 45° + \sin^2 45°} = 16{,}0 \text{ kN}$$

Structural analysis: $\left(\frac{\Delta F_{td}}{F_{ax,\alpha,Rd}}\right) \leq 1{,}0 = \left(\frac{12{,}3}{16{,}0}\right) = 0{,}77 < 1{,}0$

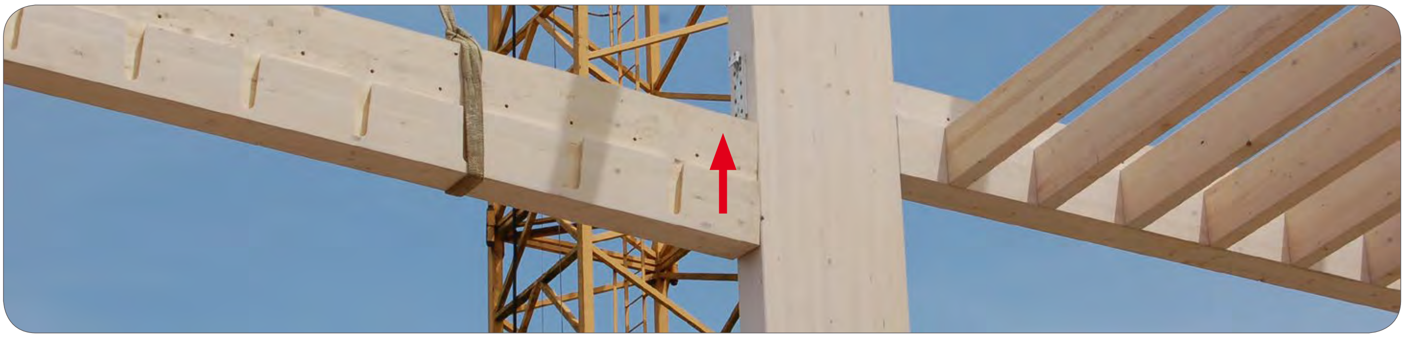
An alternative to screwing can be nailing a perforated steel plate on top of the beams!

MEGANT®

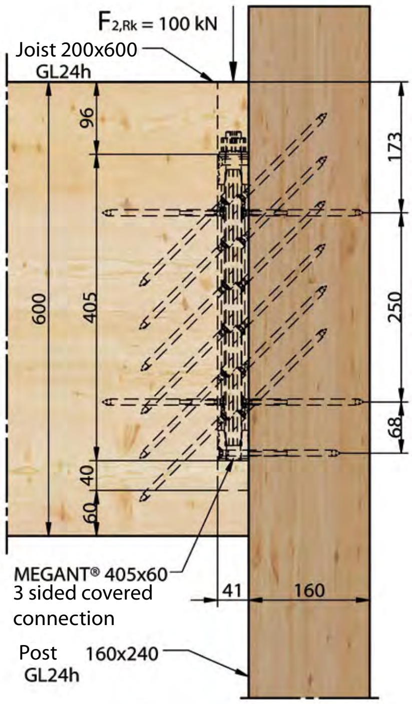
Fire protection

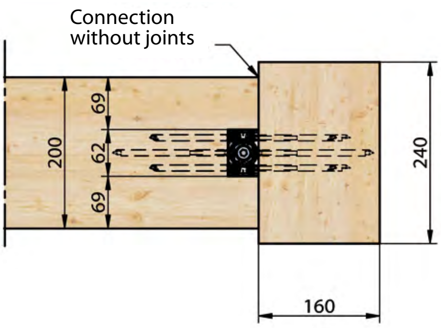
- Is an invisible connection required or particular requirements for fire protection, the system can be easily processed on 3 sides covered.
- Jointless connection - no additional covers or fire protection ribbons required.
- According to EN 1995-1-2 28 mm wood covering are required for 30 minutes fire resistance. Even a higher fire resistance (i.e. R60) is possible.

3 sided covered connection – hang up between two posts from bottom to top.



Mounting 3 sided covered – hang up top to bottom.





Fire resistance / fire protection calculation

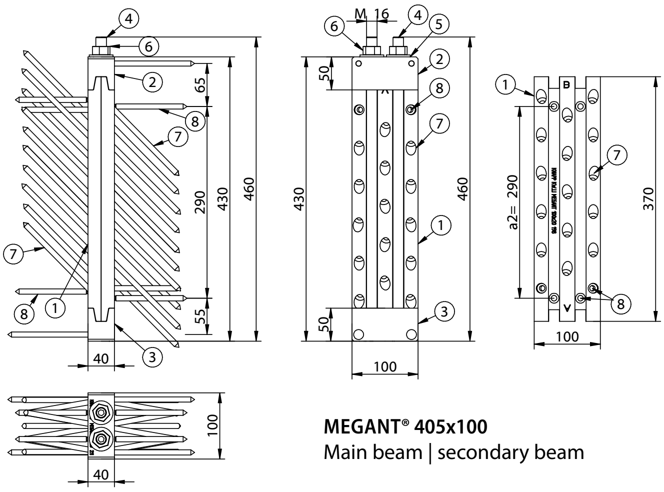
Calculation of the protection of wood covering for the fire resistance of KNAPP MEGANT® connectors according to EN 1995-1-2 chap. 4.2 :
General formula: $d_{ef} = \beta_n \cdot t + k_0 \cdot d_0$
Wood overlap for 30 min in GL24h: $d_{ef} = 0{,}7 \cdot 30 + 1 \cdot 7 = 28$ mm
Wood overlap for 60 min in GL24h : $d_{ef} = 0{,}7 \cdot 60 + 1 \cdot 7 = 49$ mm
Wood overlap for 90 min in GL24h : $d_{ef} = 0{,}7 \cdot 90 + 1 \cdot 7 = 70$ mm
Example : Lateral thickness: d_{vorh} = 69 mm > d_{ef} = 49 mm Lower thickness: d_{vorh} = 60 mm > d_{ef} = 49 mm
This example of a MEGANT® connection fulfills the fire resistance class R60

Example: Main- and secondary beam connection with MEGANT® 430x100x40

Shear and tensile load in direction and perpendicular of insertion

Connecting loads:

Dead loads (shear force)	$F_{2,g,k}$ =	13,90		[kN]
	γ_g	1,35		
Life load (shear force)	$F_{2,q,k}$ =	48,00		[kN]
	γ_Q	1,50		
	ψ_0	0,70		
Wind load (tensile force)	$F_{1,w,k}$ =	7,00		[kN]
	γ_Q	1,50		
	ψ0	0,60		
		Shear	Tensile	
Load combinations	LF K1 EG + P	90,77	-	[kN]
Structural analysis with	LF K2 EG + P + Vent	90,77	10,50	[kN]
		$F_{1,KCC,RK}$	$F_{2,KCC,Rk}$	
Design value of a load-carrying capacity of MEGANT®		55,3	224,2	[kN]



MEGANT® 405x100
Main beam | secondary beam

Connector designation

1 Connector plate 365x100x20
2 Clamping jaw top 100x40x40 with drill hole d=16 mm
3 Clamping jaw bottom 100x40x40 with thread hole M16
4 Threaded rod M16x435
5 Washer M16
6 Nut M16
7 Slanting screw CS 8x160
8 Horizontal screw CS 8x160

Calculation of the tensile load of the 45° screws in header and joist ($F_{2,Rd}$)

Number of 45° arranged screws:
18 KNAPP fully threaded self-tapping screws 8x160

According to ETA 15/0667

Length	l	160,00	mm		
Diameter	d	8,00	mm		
Screw series	m	3,00			
Effective number of screws	n_{ef}	15	Vis	$n_{ef} = n$	
Wood material (quality)		GL24h			
Characteristic density	ρ_k	380,00	kg/m³		
Angle between grain and screw axis	α	45,00	°		
Effective screw length	l_{ef}	150,00	mm	$l_{ef} = l - 10$	
Char. embedment strength	$f_{h,k}$	16,70	N/mm²	$f_{h,k} = -0{,}082 \cdot \rho_k \cdot d^{(-0,3)}$	According to EC5 (8.15) Page 94
Char. yield moment	$M_{y,k}$	20000,00	Nmm		According to ETA-15/0667
Tensile load of one 45° screw	$F_{ax,\alpha,Rk}$	14,08	kN	$F_{ax,\alpha,RK} = \frac{n_{ef}\, 0{,}52\sqrt{d} \cdot l_{ef}^{0,9} \cdot \rho_k^{0,8}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$	According to ETA-15/0667 mit n_{ef}=n
Modification factor	k_{mod}	0,80			Load duration class: short term, service class:1
Partial factor for material properties	γ_M	1,30			
Desig value of screws	$F_{2,J/H,Rd}$	124,0	kN	$F_{2,J/H,Rd} = \frac{1{,}35 \cdot n_{ef} \cdot k_{mod} \cdot F_{ax,\alpha,Rk}}{\gamma_M \cdot \sqrt{2}}$	Increase $F_{2,Rd}$ by 35% friction between connector plate and wooden beam
Structural analysis	$\frac{F_{2,d}}{F_{2,J/H,Rd}}$ =	0,73	< 1,0	Calculation according to EC 5 with **n_{ef} = n and 35% friction**	
	$\frac{F_{2,d}}{F_{2,KCC,Rd}}$ =	0,45	< 1,0		$F_{2,KCC,Rd} = \frac{224{,}2}{1{,}1}$ = 203,8 kN

Connection of both connector parts with threaded rods

Threaded rods: 2 M16x460 quality 8.8

Number of thread rods	n	2	Pieces
Diameter	d	16,00	mm
Factor	k_2	0,90	
Char. tensile strength of threaded rods	f_{ub}	800	N/mm^2
	γ_M	1,25	
Cross section	A	1,57	cm^2
Design value of tensile force	$F_{t,Rd}$	180,86	kN
Structural analysis		0,50	< 1,0

According to: http://www.schrauben-lexikon.de/td3-werkstoffe-stahl.asp

Calculation according to EC 3

$$F_{t,Rd} = \frac{n \cdot k_2 \cdot f_{ub} \cdot A}{\gamma_{M2}}$$

Calculation of the tensile load of the 0° and 90° screws in header and joist ($F_{1,Rd}$)

Number of 0°and 90° arranged screws:
18 KNAPP fully threaded self-tapping screws 8x160

According to ETA 15/0667

Length	l	160,00	mm		
Diameter	d	8,00	mm		
Wood material (quality)		GL24h			
Characteristic density	ρ_k	380,00	kg/m^3		
Angle between grain and screw axis	α	0,00	°		
Effective number of screws	n_{ef}	4,67		$n_{ef} = n$	
Effective screw length	l_{ef}	146,00	mm		
Char. anchorage capacity	$f_{ax,k}$	12,91	N/mm^2	$F_{ax,K} = 0{,}52 \cdot d^{-0,5} \cdot t_{ef}^{-0,1} \cdot \rho_k^{0,8}$	According to ETA 15/0667
Reduction factor	k_d	1,00		for screws: $d \geq 8mm \Rightarrow k_d = 1$	According to ETA 15/0667
Tensile load of one 0° screw	$F_{ax,\alpha,Rk}$	58,8	kN		According to ETA 15/0667
Modification factor	k_{mod}	0,90		$F_{1,J,A,K} = \frac{n_{ef} \cdot f_{ax,J,K} \cdot d \cdot l_{ef} \cdot k_{ax}}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$	Load duration class: short term, Service class:1
Partial factor for material properties	γ_M	1,30		$F_{ax,\alpha,Rd} = F_{ax,Rk} = \frac{k_{mod}}{\gamma_M}$	
Design value of screws	$F_{ax,\alpha,Rd}$	40,7	kN		According to EC5 (8.38) Page109
Structural analysis	$\frac{F_{1,d}}{F_{ax,\alpha,Rd}}$	0,26	< 1,0		
	$\frac{F_{1,d}}{F_{1,KCC,Rd}}$	0,24	< 1,0		
	$F_{1,KCC,Rd}$	$\frac{55{,}3}{1{,}25}$	= 44,2kN		
Combined loading (F1 + F2)	$\left(\frac{F_{1,d}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2,d}}{F_{2,Rd}}\right)^2 \leq 1{,}0$	0,60 < 1,0			

Example: Main- and secondary beam connection with MEGANT® 430x100x40

Calculation of bearing stress of the metric thread in the clamping jaw

Selected: clamping jaw - 100 x 50 x 40 - aluminum AW 6082, T6

For aluminum according to EN 1999-1-1

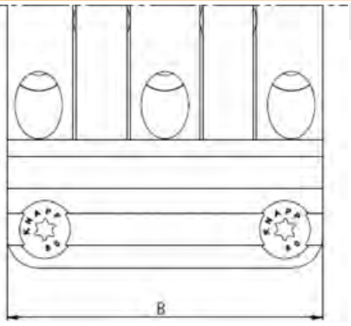
Char. 0,2% yield strength	$R_{p0,2,Rk}$	240,00	N/mm²	
Partial factor for material properties	γ_M	1,10		
Design value of 0,2% yield strength	$R_{p0,2,Rd}$	218,18	N/mm²	
Number of threaded rods	n	2	Pièces	
Height of clamping jaw	H	50,00	mm	
Threaded diameter	d_{GB}	16,00	mm	
Rest depth of clamping jaw	t_{Rest}	30,00	mm	
Shear stress factor for Alu-threaded	β_M	0,40		
Shear area	A_τ	3015,93	mm²	$A_\tau = n \cdot d_{GB} \cdot t_{Rest} \cdot \pi$
Shear stress	$\tau_M d$	30,1	N/mm²	
Shear force	$\max F_{\tau,Rd} =$	263,21	kN	$\tau_{M,d} = \dfrac{F_{2,d}}{A_\tau}$
Structural analysis	$F_{2,d} / \max F_{\tau,Rd}$	0,34	<=1,0	$\dfrac{\tau_{M,d}}{\beta_M \cdot R_{p0,2,Rd}} \leq 1{,}0$

Ceiling beam

Width	b	0,16	m
Height	h	0,60	m
Length	l	7,50	m
Density	w	5,00	kN/m
Partial factor	γ_M	1,3	
Reaction load	$A_{V,d}=B_{V,d}$	2,43	kN

Clamping jaw on column / main beam connection during the assembly

Select: 2 KNAPP® fully threaded self-tapping screws 8x160 — According to ETA 15/0667



Length	l	160,00	mm		
Diameter	d	8,00	mm		
Number of screws	n	2,00			
Effective number of screws	n_{ef}	2,00	$n_{ef} = n$		
Wood material (quality)		GL24h			
Characteristic density	ρ_k	380,00	kg/m³		
Angle between grain and screw axis	α	90,00	°		
Clamping jaw width	t_4	40,00	mm		
Effective screw length	l_{ef}	120,00	mm	$l_{ef} = l - t_4$	
Char. embedment strength	$f_{h,k}$	16,70	N/mm²		According to EC5 (8.15) Page 94
Char. yield moment	$M_{y,k}$	20000,00	Nmm		According to ETA 15/0667
Tensile load of one 90° screw	$F_{ax,Rk}$	12,39	kN	$F_{ax,\alpha,Rk} = \frac{n_{ef} \cdot f_{ax,K} \cdot d \cdot l_{ef} \cdot k_d}{1{,}2 \cdot \cos^2\alpha + \sin^2\alpha}$	
Char. anchorage capacity	$f_{ax,k}$	12,90	N/mm²		According to EC 5 (8.39)
Reductionfactor	k_d	1,00		For screws: d≥ 8mm => k_d =1	According to EC5 (8.40) Page110
Modification factor	k_{mod}	0,90			Load duration class: short term, Service class:1
Partial factor for material properties	γ_M	1,30			

$F_{v,Rk}$ each screw, according to EC5 (8.10) Page 89

$$F_{v,Rk} = \min \begin{Bmatrix} f_{hk} \cdot t_1 \cdot d \\ f_{hk} \cdot t_1 \cdot d \cdot \sqrt{2 + \frac{4M_{y,Rk}}{f_{hk} \cdot d \cdot t_1^2}} + \frac{F_{(ax,Rk)}}{4} \\ 2 \cdot 3 \cdot \sqrt{M_{y,Rk} \cdot f_{hk} \cdot d} + \frac{F_{(ax,Rk)}}{4} \end{Bmatrix}$$

$F_{v,Rk}$= 16,03
$F_{v,Rk}$= 26,00
$F_{v,Rk}$= 6,88

Char. shear force for one screw	$F_{v,Rk}$	6,88	kN
Design shear force of one screw	$F_{2,Rd}$	4,77	kN
Structural analysis	$A_{v,d}/(n_{ef} \cdot F_{2,Rd})$	0,25	<= 1,0

Proof of distance perpendicular/parallel and loaded/unloaded end

Screw diameter	d	8	mm

According to ETA 15/0667

Miniumum distance for screws (ETA-15/0667)			
a1	5·d	40	mm
a2	5·d	40	mm
$a1_{CG}$	5·d	40	mm
$a2_{CG}$	4·d	32	mm

Literature

ETA - 15/0667	European Technical Assessment MEGANT®	
EC 5	EN 1995-1-1 : 2010-12	Design of timber structures
EC 5 NA	EN 1995-1-1 NA 2013-08	National document of timber structures
EC 9	EN 1999-1-1 : 2010-05	Measurement and construction of aluminum structures
EC 3	EN 1993-1 : 2010-10	Measurement and construction of steal structures

MEGANT®

Selected reference projects

Object: CMML, commercial building, Brunnthal (D); Year of construction: 2014/2015, Completion: 2015; Architect: M13 Architekten GmbH, www.m13-architekten.de; Project team: Florian Uhl, Lothar Hennig, Timber constuction: Gumpp and Maier GmbH; Client: Remo Stilhof, www.remo-fliesen.de; Construction: Wood construction; Connector: MEGANT®

Object: Expo "Pavillon France", Milan (I); Completion May 2015; Builder: France Agri Mer; Architect: x-tu, Paris (FR);
Timber constuction: Simonin, Montlebon (FR); Parametric designtoproduction (CH); Connectors: MEGANT® and RICON®S

Object: Eurospar Attnang-Puchheim; Year of construction: 2013; Architect: Dworschak + Mühlbachler Architects ZT GmbH; Planners: Dworschak + Mühlbachler Architects ZT GmbH; Statics: engineering office Meinhart und Partner Ziviltechniker GmbH; Timber construction: Schmid Baugruppe Holding AG www.schmid-baugruppe.at, Timber construction Prefabrication: Buchacher Holzleimbau GmbH; Developer: GNIGL Projektentwicklung und Errichtungs GmbH Client: Spar Österreichische Warenhandels AG; Construction: solid construction with aluminum glass façade [poor energy balance]; Connector: MEGANT® Connector sizes / loads: MEGANT® 990/100/40 with 292 kN; MEGANT® 1000/150/50 with 369 kN; Converted space: 1,400 m2; Usable area: 6,700 m^2; Total area; 2,150 m^2; 310 m^2 Post-facade; 2.497 m^2 roof

Contact

Tel.: +43 (0)7474 / 799 10
Tel.: +49 (0)8106 / 99 55 99 0
info@knapp-connectors.com

knapp-connectors.com/contact

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Calculation tables approved by:

Blaß & Eberhart
Ingenieurbüro für Baukonstruktionen

Consulting engineers for building constructions

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Knapp GmbH I Wassergasse 31 I A-3324 Euratsfeld I Tel.: +43 (0)7474 / 799 10 I Fax: +43 (0)7474 / 799 10 99
E-Mail: info@knapp-connectors.com

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