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European Technical Assessment

ETA 12/0018
of 14/08/2018

General Part

Technical Assessment Body issuing the European Technical Assessment:	RISE Research Institutes of Sweden AB
Trade name of the construction product	Masonite® Beams and Columns
Product family to which the construction product belongs	Light composite wood-based beams and columns for structural purposes
Manufacturer	Masonite Beams AB Box 5, SE – 914 29 Rundvik www. masonitebeams.se
Manufacturing plant(s)	Masonite Beams AB Rundvik
This European Technical Assessment contains	21 pages including 3 Annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	ETAG 011 used as EAD, 2002, Light composite wood-based beams and columns
This version replaces	ETA 12/0018, issued on 19/12/2016

Specific parts

1 Technical description of the product

Masonite Beams AB products are wood-based composite beams and columns with I-shaped cross section. The flanges are made of structural timber and the web of oriented strand board OSB or particleboard.
The web is adhesively bonded to the flanges.
The standard cross sections, materials, dimensions and tolerances are given in Annex 1 (H, HL, HM, HI and HB-beams and columns type R).

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

Masonite beams and columns are intended for use as load-bearing parts of building constructions. With regard to the effect moisture has on the product, the use is limited in service classes 1 and 2 as defined in Eurocode 5 (EN 1995-1-1:2004. Eurocode 5. Design of timber structures. Part 1-1: General – Common rules and rules for buildings), and in hazard classes 1 and 2 as specified in EN 335. The products may be exposed to the weather for a short time during installation.

Durability may be reduced by attack from insects such as long horn beetle, dry wood termites and anobium in regions where these may be found.

The provisions made in this European Technical Approval are based on an assumed working life of Masonite beams of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Essential characteristics and their performance

		Characteristic	**Performance**
BWR 1	Mechanical resistance and stability	Load bearing capacities	See Annex 2
BWR 2	Safety in case of fire	Reaction to fire	Flanges and webs: D-s2, d0
BWR 3	Hygiene, health and the environment	Content and/or release of dangerous substances	Clause 3.1.1
BWR 6	Energy economy and heat retention	Thermal conductivity	Clause 3.1.2

3.1.1 Content and/or release of dangerous substances

All wood based boards in the webs satisfy formaldehyde class E1 in EN 13986.
The beams and columns do not contain pentachlorophenol.

Regarding dangerous substances contained in this European technical assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.1.2 Thermal conductivity

The thermal conductivity λ is 0,13 W/(m·K) for OSB webs, 0,16 W/(m·K) for particleboard webs and 0,13 W/(m·K) for flange material according to EN ISO 10456.The natural density variation of the materials is considered in this value.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 1999/92/EC - Commission decision of date 21 January 1999, published in the Official Journal of the European Union (OJEU) L29 of 3/2/1999, of the European Commission the system of assessment and verification of constancy of performance (see Annex V to the regulation (EU) No 305/2011) given in the following table apply:

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Light composite wood-based beams and columns	In buildings	-	1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at RISE.

Issued in Borås on 14.08.2018
By RISE Research Institutes of Sweden AB

Johan Åkesson
Certification Manager

ANNEX 1

DESCRIPTION OF THE BEAMS AND COLUMNS, TYPE H, HL, HI, HM, HB and R

1 Cross sections and sizes

The shape of the beams and columns is shown in Figure 1.

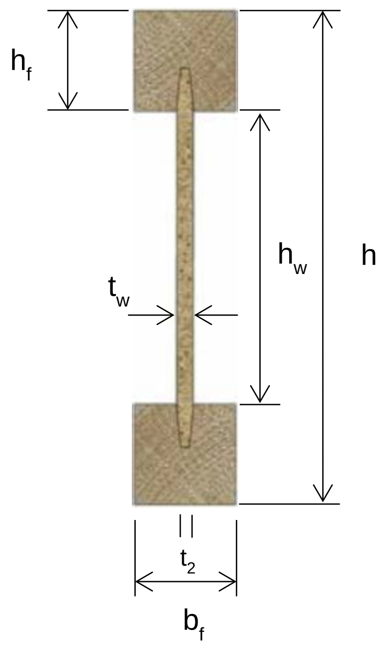


Figure 1. Cross section and notation.

Table 1 Cross section sizes of Masonite beams and columns in millimetres.

Product type	h	h_f	b_f	t_w	t_2
Beams H, HL, HM, HI and HB	150- 500	45-60	45-98	10	5,9
Column Type R	150-400	45-55	45-70	8-10	0,5 t_w

Table 2 Tolerances in millimetre

Overall depth	h	± 1.5
Length	l	-/+10 mm
Flange width	b_f	± 1.5
Flange depth	h_f	± 2
Web thickness	t_w	± 0.8

The joints of the web are made as a V-shaped adhesive bonded joint deliberately spaced. The root depth of the joint is approximately 18 mm.

Specification of components

2.1 Beams

The flanges consist of machine strength graded Norway spruce timber. Grading is carried out in either of the following ways:

- Flanges graded in their final dimension.
- Original dimension graded and after that splitting into flange dimension and planed. In addition to this a visual override according to special rules is required. In particular the size of knots is checked.

Three flange material qualities are used, either C18, C24+ or C30+. The C24+ and C30+ classes can have slightly higher strength and stiffness values than C24 and C30 according to EN338. The machine settings are controlled based on the results from bending tests of full-sized beams.

The web consists of a 10 mm OSB/3 board or P5 particleboard, produced according to EN300 for OSB/3 board and EN 312 for the P5 particleboard. Characteristic values for structural design according to EN 12369.

2.2 Columns

The flanges consist of machine strength graded Norway spruce timber.
The strength class is C18 according to EN338.

The web consists of an 8-10 mm OSB/3 board or P5 particleboard. Produced according to EN300 for OSB/3 board and EN312 for the P5 particleboard. Characteristic values for structural design according to EN12369.

3. Moisture content

When the beams are manufactured, the moisture content of the flanges is between 12 and 18 %, which is above the equilibrium value in normal use conditions. The moisture content of the web is approximately 8 %, which corresponds to the value in normal use conditions. Due to changing temperature and relative humidity of the surrounding air the moisture content will continuously change.

ANNEX 2
MECHANICAL PROPERTIES OF THE BEAMS AND COLUMNS, TYPE H, HL, HM, HI, HB and R

1. Resistance and stiffness

1.1 General

The products are intended for use in service classes 1 and 2 as defined in Eurocode 5 (EN 1995-1-1:2004. Eurocode 5. Design of timber structures. Part 1-1: General – Common rules and rules for buildings), and in hazard classes 1 and 2 as specified in EN 335. The products may be exposed to the weather for a short time during installation.
Characteristic resistances and stiffness values for beams are given in Table 4. The basis of these values is presented in Table 3.

Table 3 Basis for values

Beams	
Moment resistance and bending stiffness:	Calculation assisted by testing
Axial force resistance:	Calculation
Shear resistance:	Calculation assisted by testing
Shear stiffness:	Calculation
Bearing resistance:	Calculation assisted by testing
Columns	
Mechanical resistance and stiffness:	Calculation

The structural performance of the product relies on adequate restraint to the compression flange.

1.2 Beams

1.2.1 Moment resistance

The moment resistance can be calculated as follows:

$$M_k = f_{m,k} \cdot I_{eff} / \left(\frac{h}{2}\right) \cdot k_h \qquad (1)$$

where

- o $I_{eff} = I_f + \frac{E_w}{E_f} \cdot I_w$; E_w and I_w are the modulus of elasticity and moment of inertia of the web material and E_f and I_f are the modulus of elasticity and the moment of inertia of the flanges.
- o *h* is the depth of the beam
- o $f_{m,k}$ is the characteristic bending strength (corresponding to the stress in the outermost fibre in the flanges) according to Table 4.
- o $k_h = \left(\frac{300}{h}\right)^{0,25}$

Table 4 Characteristic bending strength (beam depth 300 mm) used to calculate characteristic moment resistance.

	C30+ flanges (H, HI, HM, and HB)	C24+ flanges (H, HM and HB)	C18 flanges (HL)	Columns (R)
Bending strength, $f_{m,k}$ (MPa)	27	22	13,7	11,0

Moment resistance values for some preferred beam sizes are presented in Table 11.

1.2.2 Bending stiffness

The following expression should be used to calculate the bending stiffness:

$$EI = E_f \cdot I_{eff} \qquad (2)$$

where

E_f is the flange modulus of elasticity according to Table 5 and
I_{eff} is the second moment of inertia of the composite section.

Table 5 E_f – values used to calculate bending stiffness.

	C30+ flanges (H- HI, HM, and HB)	C24+ flanges (H, HM and HB)	C18 flanges (HL and R)
Flange MOE, E_f, (MPa) *(Mean value)*	13 000	11 000	9 000

Bending stiffness values for some preferred beam sizes are presented in Table 11.

1.2.3 Bearing resistance

In this paragraph, the calculation methods for bearing resistance for all beam heights and qualities are presented. Both evenly distributed and point loads are considered. Correction factors are used to correct for the impact of different bearing lengths, and to account for the risk of web buckling due to increase of beam height and the use of reinforcement.

The following expression (3) should be used to calculate the bearing resistance for beams **without** reinforcement and **with** point load over support[1].

$$F_k = \left(\frac{L_1}{45}\right)^{0,5} \cdot a \cdot k_A \cdot k_6, \qquad (3)$$

Parameter values are shown in Table 6, Table 7 and Table 9.

The following expression (4) should be used to calculate the bearing resistance for beams **with** reinforcement **without** point load over support and reinforcement [1].

$$F_k = \left(\frac{L_1}{45}\right)^{0,5} \cdot a \cdot k_B * k_7, \qquad (4)$$

Parameter values Table 6, Table 8 and Table 9.

Different types of supports are explained in Figure 2, for later reference.

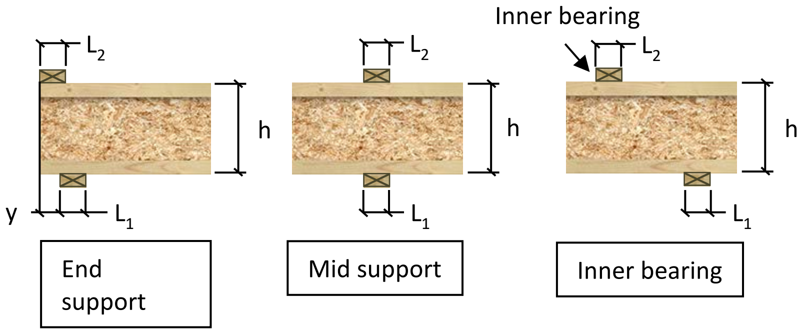


Figure 2 Support types

In cases for end support, where y > h, the bearing resistance should be calculated as mid-support. In cases of end support with **overhang**, y, increased capacity can be used according to Table 6. For end support: $L_1 = \min(L_1 \; and \; 150 \; mm)$[2][3]. For mid support and inner bearing: $L_1 = \min(L_1 \; and \; 200 \; mm)$[3][4]

[1] The results by this formula must be checked against the design shear capacity (close to the support) of the beam, for the specific loading situation. Shear capacity shall not be exceeded according to:

- For end support, $F_d \leq V_d$
- For mid support, $F_d \leq 2 \; x \; V_d$

[2] For situations when L_1 > 150 mm and h > 220 mm, bearing capacity shall be calculated for L_1= 150 mm.

[3] For situations when L_1 > 200 mm and h ≤ 220 mm, bearing capacity shall be calculated for L_1= 200 mm.

[4] For $L_2 < L_1$, L_2 shall be used as bearing length.

Table 6 parameter value, $\boldsymbol{a}$

$\boldsymbol{a}$		
Beam type	**End support**	**Mid-/inner support**
H	$9{,}0 + \Delta a$	14
HL	$8{,}5 + \Delta a$	13
HM	$9{,}5 + \Delta a$	15
HI	$10{,}5 + \Delta a$	17
HB	$12{,}0 + \Delta a$	21

The additional term, Δa, is calculated according to:

$$\Delta a = a_1 \cdot \frac{y}{(^h/_2)}, \tag{5}$$

Where $a_1 = 4{,}0$.

Table 7 Parameter value, k_A

k_A							
Beam depth	**End support**				**Mid-support/ Inner bearing**		
	L_1				**L_1**		
	45	**70**	**100**	**150**	**70**	**100**	**150**
250	1,00	1,00	1,00	1,00	1,00	1,00	1,00
300	1,00	0,99	0,98	0,95	1,00	1,00	1,00
350	1,00	0,98	0,95	0,90	0,98	0,92	0,92
400	1,00	0,96	0,92	0,85	0,96	0,88	0,88
450	0,98	0,94	0,89	0,80	0,95	0,84	0,84
500	0,97	0,92	0,85	0,75	0,93	0,80	0,80

For bearing lengths, L_1, other than the above presented, interpolation can be used to calculate k_A. For situations without point load over support, k_A = 1,0.

Table 8 Parameter value, k_B

k_B							
Beam depth	**End support**				**Mid-support/ Inner bearing**		
	L_1				**L_1**		
	45	**70**	**100**	**150**	**70**	**100**	**150**
200	1,30	1,23	1,14	1,00	1,25	1,19	1,09
220	1,32	1,24	1,16	1,01	1,27	1,21	1,10
240	1,33	1,26	1,17	1,02	1,28	1,22	1,12
250	1,34	1,27	1,18	1,03	1,29	1,23	1,13
300	1,39	1,31	1,22	1,06	1,33	1,27	1,16
350	1,43	1,35	1,26	1,10	1,38	1,31	1,20
400	1,47	1,39	1,29	1,13	1,42	1,35	1,24
450	1,52	1,43	1,33	1,16	1,46	1,39	1,27
500	1,56	1,47	1,37	1,20	1,50	1,430	1,31

For cases <u>with</u> point load over support k_B = 1,0 for all beam depths and qualities. For bearing lengths, L_1, other than the above presented, interpolation can be used to calculate k_B. In cases where the support length, L_1, is larger than 150 mm, L_1 should be set to 150 mm.

Table 9 Parameter value, k_6 and k_7

Beam depth	k_6	k_7
< 400	1,00	1,00
400	1,00	1,03
450	0,96	1,10
500	0,84	1,17

The factor k_6 is to be used for End support and for all beam types. For mid support, and end bearing with reinforcement, k_6 = 1,0 for all beam heights and qualities.

k_7 is to be used for reinforced HB type beams without point load over support, for all other situations k_7 = 1,0. For bearing lengths, L_1, other than the above presented.

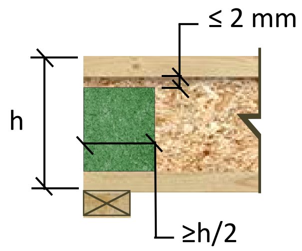


Figure 3 Reinforcement

When reinforcement is to be used they must be mounted on both sides of the web. The width of the reinforcements must be at least half the beam depth, i.e. h / 2, with a depth of 2 mm smaller than the distance between the beam flanges, see Figure 3.

The prevailing conditions may require reinforcements with width larger than h / 2, this is to be assessed by the structural designer.

1.2.4 Axial force resistance

To be calculated according to EC5 using strength and stiffness values in EN338.
For C30+ use the values for C30 and for C24+ use the values for C24.

1.2.5 Shear resistance

For beams the following expression should be used to calculate the shear resistance:

For OSB/3 web

$$V_k = 0.0674 \cdot h + 0{,}3 \qquad (5)$$

and

For particleboard P5 web

$$V_k = 0{,}0647 \cdot \ h + 3{,}7, \qquad (7)$$

where

h is the beam depth in mm and V_k is given in kN.

Shear resistance values for some preferred beam sizes are presented in Table 11.

For columns EC5 should be used for calculations of shear resistance.

1.2.6 Regulations regarding holes in web

Unless otherwise stated:

· All holes must be placed on the centre of the web

· No holes are allowed in the safety zones (S)

· Holes must not extend into the flange material

- Safety zones (S) are measure 150 mm horizontally and vertically from support edges, support with point load from above the safety zones the full depth of the web.
- Holes with diameter less than 21 mm can be placed anywhere in the web, *even in the safety zone*, with a minimum distance of 2 x D between holes.
- One hole with diameter less than 41 mm can be placed anywhere in the web, if the general rules for hole spacing are followed. No reduction of the shear capacity is necessary.
- More than two holes, with diameter less than 41 mm, spaced with 2 x D and placed in the same horizontal plane, gives a reduction of 80% of the shear capacity for a solid beam.
- The maximum dimensions for rectangular holes are: a = 320 mm and b = 200 mm.
- The reduction of shear capacity caused by a hole must be checked according to 1.2.6.1 and 1.2.6.2.
- Placement restrictions and the maximum sizes of holes are shown in Figure 4 and Table 10 below.

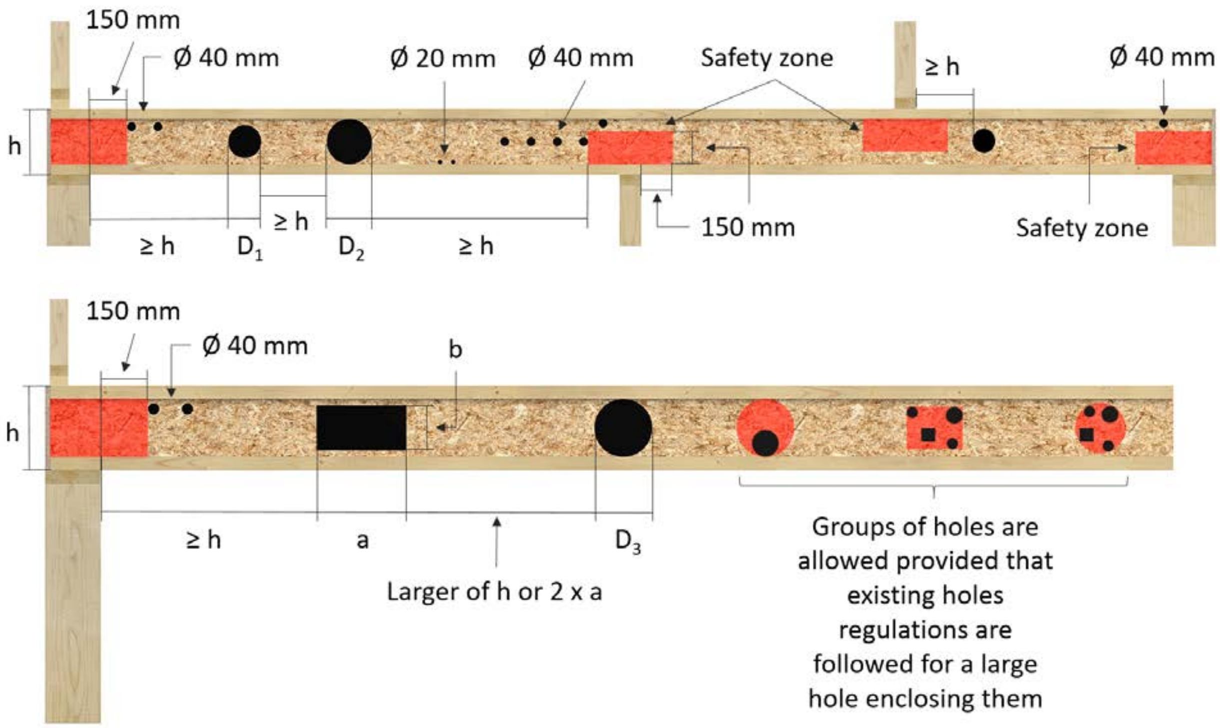


Figure 4 Hole regulations

Table 10 Hole regulations for standard depth

Product depth [mm]		**200**	**220**	**240**	**250**	**300**	**350**	**400**	**450**	**500**
Maximum Hole Depth [mm]		106	126	146	156	206	256	306	356	406
Minimum Distance from Bearing or Point Load		≥h[1)]								
Minimum Distance Between Circular Holes	**≤40mm**	2 x larger of (D_1 or D_2)								
	>40mm	≥h[1)]								
Minimum Distance Between rectangular and other holes		Larger of h or 2 x a								

[1)] **Note:** All values above are valid for uniformly distributed loads. Information regarding the calculation of the reduction of shear capacity caused by a hole can be found in Masonite Beams European Technical approval; ETA 12/0018. Any holes falling outside of these rules must be checked by our engineering support service.

1.2.6.1 Shear capacity circular holes

The design shear capacity, $V_{d,hole}$, in a beam cross section containing a circular hole in the web can be calculated according to:

$$V_{d,hole} = V_d \cdot k \tag{8}$$

Where V_d is the design shear capacity of the beam without a hole, and with k being a reduction factor determined by:

$$k = \frac{h - h_f - 0{,}9D}{h - h_f} \; for\ OSB/3\ web \tag{9}$$

and

$$k = \frac{h - h_f - 0{,}80 \cdot D}{h - h_f} * \left(1 - \log\left(\frac{h}{115}\right)\right), \; for\ particleboard\ P5\ web \tag{10}$$

Where:

$h =$ beam depth

$D =$ Hole diameter, $D \leq h - 2h_f$

$h_f =$ Flange depth

1.2.6.2 Shear capacity rectangular holes

For rectangular holes, shear capacity can be calculated according to:

$$k = min\left\{q * \left(\frac{h}{b}\right)^{0{,}1} * \left(\frac{h}{a}\right)^{0{,}18} * \left(\frac{b}{a}\right)^{0{,}2} * k_{depth}\ ; 0{,}9\right\}, \tag{11}$$

where:

$h = beam\ depth$
$b = hole\ depth, b \leq \left[H - 2 * h_f\right] \leq 200\ mm$
$a = length\ of\ hole, a \leq 320\ mm.$
$q = material\ dependant\ factor, 0{,}3\ for\ OSB\ and\ 0{,}21\ for\ particleboard\ P5\ web\ material$.

For beams $200\ mm\ \leq h \leq 400\ mm$:

$$k_{depth} = \left(\frac{255}{h}\right)^{1{,}1} \cdot kp \tag{12}$$

For beams $400\ mm\ \leq H_{beam} \leq 500\ mm$:

$$k_{depth} = \left(\frac{h}{650}\right)^{0{,}9} \cdot kp \tag{13}$$

For beam larger than 250 mm with particleboard P5 web, the following expression should be multiplied to the reduction factor:

$$kp = 1 - \log\left(\frac{h}{220}\right) \tag{14}$$

For all other situations $kp = 1{,}0$.

1.2.7 Regulations Characteristic mechanical resistance and stiffness data

Table 11 Characteristic mechanical resistance and stiffness data for beams with preferred sizes with OSB web. Characteristic data for other sizes will be presented in design documentations in each individual case.

OSB web									
Beam depth and quality Beams with 47x47 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(M_k)	(EI)	(V_k)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm²]	[kN]	[kN]	[m]		[kN]	
H200	C30+	7.8	342	13.8	1419	0,076	0,013	109,2	86,4
H220	C30+	8.8	435	15.1	1635	0,085	0,013	110,6	87,5
H240	C30+	9.8	540	16.5	1851	0,094	0,013	112,0	88,6
H250	C30+	10.3	597	17.2	1959	0,099	0,013	112,7	89,2
H300	C30+	12.7	929	20.5	2499	0,122	0,013	116,2	92,0
H350	C30+	15.1	1339	23.9	3039	0,144	0,013	119,7	94,8
H400	C30+	17.7	1831	27,3	3579	0,166	0,013	123,2	97,5
H450	C30+	20.1	2405	30,6	4119	0,187	0,012	126,7	100,3
H500	C30+	22.2	3037	34,0	4659	0,208	0,012	130,2	103,1
Beam depth and quality Beams with 47x60 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(M_k)	(EI)	(V_k)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm²]	[kN]	[kN]	[mm]		[mm]	
HM200	C30+	10.0	438	13.8	1419	0,076	0,017	138,5	109,6
HM220	C30+	11.3	557	15.1	1635	0,086	0,017	139,9	110,7
HM240	C30+	12.6	691	16.5	1851	0,095	0,017	141,3	111,9
HM250	C30+	13.2	764	17.2	1959	0,100	0,017	142,0	112,4
HM300	C30+	16.3	1186	20.5	2499	0,123	0,017	145,5	115,2
HM350	C30+	19.3	1707	23.9	3039	0,145	0,017	149,0	118,0
HM400	C30+	22.3	2329	27,3	3579	0,168	0,016	152,5	120,7
HM450	C30+	25.3	3053	30,6	4119	0,190	0,016	156,0	123,5
HM500	C30+	28.2	3884	34,0	4659	0,212	0,016	159,5	126,3

OSB web									
Beam depth and quality Beams with 47x70 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(M_k)	(EI)	(V_k)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm²]	[kN]	[kN]	[mm]		[mm]	
HI200	C30+	11.8	512	13.8	1419	0,077	0,020	161,1	127,5
HI220	C30+	13.3	651	15.1	1635	0,086	0,020	162,5	128,6
HI240	C30+	14.8	807	16.5	1851	0,095	0,020	163,9	129,7
HI250	C30+	15.5	892	17.2	1959	0,100	0,020	164,6	130,3
HI300	C30+	19.2	1384	20.5	1499	0,123	0,020	168,1	133,1
HI350	C30+	22.7	1990	23.9	3039	0,146	0,019	171,6	135,8
HI400	C30+	26.2	2711	27,3	3579	0,169	0,019	175,1	138,6
HI450	C30+	29.6	3552	30,6	4119	0,192	0,019	178,6	141,4
HI500	C30+	33.0	4513	34,0	4659	0,214	0,019	182,1	144,2

OSB web									
Beam depth and quality Beams with 47x97 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(M_k)	(EI)	(V_k)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm^2]	[kN]	[kN]	[mm]		[mm]	
HB200	**C30+**	16.3	711	13.8	1419	0,077	0,028	222,0	175,7
HB220	**C30+**	18.4	904	15.1	1635	0,086	0,028	223,4	176,8
HB240	**C30+**	20.5	1121	16.5	1851	0,096	0,028	224,8	177,9
HB250	**C30+**	21.5	1238	17.2	1959	0,101	0,028	225,5	178,5
HB300	**C30+**	26.6	1918	20.5	2499	0,124	0,027	229,0	181,3
HB350	**C30+**	31.4	2753	23.9	3039	0,148	0,027	232,5	184,1
HB400	**C30+**	36.2	3745	27.3	3579	0,171	0,027	236,0	186,8
HB450	**C30+**	40.9	4898	30.6	4119	0,194	0,027	239,5	189,6
HB500	**C30+**	45.4	6212	34.0	4659	0,217	0,027	243,0	192,4

OSB web									
Beam depth and quality		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(Mk)	(EI)	(Vk)	(GA)	ix	iy	Nck	Ntk
		[kNm]	[kNm2]	[kN]	[kN]	[m]		[kN]	
R200	C18	3,2	239	10,4	1419	0,075	0,013	84,9	47,2
R220	C18	3,7	305	11,8	1635	0,084	0,013	86,5	48,0
R240	C18	4,1	379	13,1	1851	0,093	0,013	88,0	48,9
R250	C18	4,3	419	13,8	1959	0,097	0,013	88,7	49,3
R300	C18	5,3	655	17,2	2499	0,119	0,013	92,5	51,4
R350	C18	6,4	949	20,6	3039	0,140	0,012	96,3	53,5
R400	C18	7,4	1303	24,0	3579	0,161	0,012	100,1	55,6

Table 12 Characteristic mechanical resistance and stiffness data for beams with preferred sizes with particleboard web. Characteristic data for other sizes will be presented in design documentations in each individual case.

Particleboard P5 web									
Beam depth and quality		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(Mk)	(EI)	(Vk)	(GA)	ix	iy	Nck	Ntk
		[kNm]	[kNm2]	[kN]	[kN]	[m]		[kN]	
H200s	C30+	7,8	340	16,6	1261	0,077	0,014	106,1	84,0
H220s	C30+	8,8	432	17,9	1453	0,086	0,014	107,1	84,8
H240s	C30+	9,8	535	19,2	1645	0,096	0,013	108,0	85,5
H250s	C30+	10,3	591	19,9	1741	0,100	0,013	108,5	85,9
H300s	C30+	12,7	916	23,1	2221	0,124	0,013	110,8	87,7
H350s	C30+	15,0	1316	26,3	2701	0,147	0,013	113,2	89,6
H400s	C30+	17,3	1793	29,6	3181	0,169	0,013	115,5	91,5
H450s	C30+	19,6	2348	32,8	3661	0,192	0,013	117,9	93,3
H500s	C30+	21,8	2982	36,1	4141	0,214	0,013	120,3	95,2
HM200s	C30+	10,0	436	16,6	1261	0,077	0,017	135,5	107,2
HM220s	C30+	11,3	553	17,9	1453	0,087	0,017	136,4	108,0
HM240s	C30+	12,6	686	19,2	1645	0,096	0,017	137,3	108,7
HM250s	C30+	13,2	758	19,9	1741	0,101	0,017	137,8	109,1
HM300s	C30+	16,2	1173	23,1	2221	0,124	0,017	140,2	111,0
HM350s	C30+	19,2	1684	26,3	2701	0,148	0,017	142,5	112,8
HM400s	C30+	22,1	2291	29,6	3181	0,171	0,017	144,9	114,7
HM450s	C30+	25,0	2996	32,8	3661	0,194	0,017	147,2	116,6
HM500s	C30+	27,8	3800	36,1	4141	0,217	0,016	149,6	118,4
HI200s	C30+	11,7	509	16,6	1261	0,077	0,020	158,0	125,1
HI220s	C30+	13,2	647	17,9	1453	0,087	0,020	159,0	125,8
HI240s	C30+	14,7	802	19,2	1645	0,096	0,020	159,9	126,6
HI250s	C30+	15,4	886	19,9	1741	0,101	0,020	160,4	127,0
HI300s	C30+	19,0	1371	23,1	2221	0,125	0,020	162,7	128,8
HI350s	C30+	22,5	1966	26,3	2701	0,148	0,020	165,1	130,7
HI400s	C30+	25,8	2673	29,6	3181	0,172	0,020	167,4	132,6
HI450s	C30+	29,1	3494	32,8	3661	0,195	0,019	169,8	134,4
HI500s	C30+	32,4	4429	36,1	4141	0,218	0,019	172,1	136,3

Particleboard P5 web									
Beam depth and quality		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(Mk)	(EI)	(Vk)	(GA)	ix	iy	Nck	Ntk
		[kNm]	[kNm2]	[kN]	[kN]	[m]		[kN]	
HB200s	C30+	16,3	708	16,6	1261	0,077	0,028	218,9	173,3
HB220s	C30+	18,4	900	17,9	1453	0,087	0,028	219,9	174,1
HB240s	C30+	20,4	1115	19,2	1645	0,097	0,028	220,8	174,8
HB250s	C30+	21,4	1232	19,9	1741	0,101	0,028	221,3	175,2
HB300s	C30+	26,4	1905	23,1	2221	0,125	0,028	223,6	177,0
HB350s	C30+	31,2	2730	26,3	2701	0,149	0,028	226,0	178,9
HB400s	C30+	35,8	3707	29,6	3181	0,173	0,027	228,3	180,8
HB450s	C30+	40,4	4840	32,8	3661	0,197	0,027	230,7	182,6
HB500s	C30+	44,8	6128	36,1	4141	0,220	0,027	233,1	184,5
R200s	C18	3,2	237	10,7	1261	0,076	0,013	81,7	45,4
R220s	C18	3,6	301	12,1	1453	0,085	0,013	82,7	45,9
R240s	C18	4,0	374	13,5	1645	0,094	0,013	83,7	46,5
R250s	C18	4,2	413	14,2	1741	0,099	0,013	84,2	46,8
R300s	C18	5,2	642	17,7	2221	0,122	0,013	86,8	48,2
R350s	C18	6,2	926	21,2	2701	0,144	0,013	89,3	49,6
R400s	C18	7,2	1265	24,7	3181	0,166	0,013	91,9	51,0

Table 13 Bearing resistance, evenly distributed load ***with*** point load. For both OSB and particleboard web.

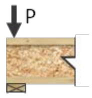
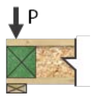
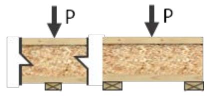
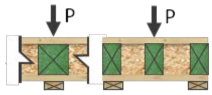
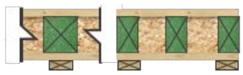
Beam depth [mm]	End bearing [kN]								Inner bearing/mid span [kN]							
	Without reinforcement				With reinforcement				Without reinforcement				With reinforcement			
																
	Bearing length [mm]				Bearing length [mm]				Bearing length [mm]				Bearing length [mm]			
	45	70	95	145	45	70	95	145	45	70	95	145	45	70	95	145
≤H250	9,0	11,2	13,1	16,2	9,0	11,2	13,1	16,2	14,0	17,5	20,3	25,1	14,0	17,5	20,3	25,1
H300		11,1	12,8	15,4												
H350		11,0	12,5	14,6						17,1	18,9	23,1				
H400		10,8	12,1	13,8						16,8	18,2	22,1				
H450	8,5	10,1	11,3	12,5						16,5	17,4	21,1				
H500	7,3	8,6	9,5	10,3						16,2	16,7	20,1				
≤HM250	9,5	11,8	13,8	17,1	9,5	11,8	13,8	17,1	15,0	18,7	21,8	26,9	15,0	18,7	21,8	26,9
HM300		11,8	13,5	16,2												
HM350		11,6	13,2	15,4						18,3	20,3	24,8				
HM400		11,4	12,8	14,6						18,0	19,5	23,7				
HM450	9,0	10,7	11,9	13,2						17,7	18,7	22,6				
HM500	7,7	9,1	10,0	10,9						17,3	17,9	21,5				
≤HI250	10,5	13,1	15,3	18,8	10,5	13,1	15,3	18,8	17,0	21,2	24,7	30,5	17,0	21,2	24,7	30,5
HI300		13,0	14,9	18,0												
HI350		12,8	14,6	17,1						20,7	23,0	28,1				
HI400		12,6	14,1	16,2						20,4	22,1	26,9				
HI450	9,9	11,8	13,1	14,6						20,1	21,2	25,6				
HI500	8,5	10,1	11,1	12,0						19,6	20,3	24,4				
≤HB250	12,0	15,0	17,4	21,5	12,0	15,0	17,4	21,5	21,0	26,2	30,5	37,7	21,0	26,2	30,5	37,7
HB300		14,8	17,1	20,5												
HB350		14,7	16,6	19,5						25,6	28,4	34,7				
HB400		14,4	16,2	18,5						25,2	27,3	33,2				
HB450	11,3	13,5	15,0	16,7						24,8	26,2	31,7				
HB500	9,7	11,5	12,6	13,8						24,3	25,1	30,2				

Table 14 Bearing resistance, evenly distributed load ***without*** point load. For both OSB and particleboard web.

Beam depth [mm]	End bearing [kN]								Inner bearing/mid span [kN]							
	Without reinforcement				With reinforcement				Without reinforcement				With reinforcement			
																
	Bearing length [mm]				Bearing length [mm]				Bearing length [mm]				Bearing length [mm]			
	45	70	95	145	45	70	95	145	45	70	95	145	45	70	95	145
H200					11,7	13,8	15,1	16,3					18,2	21,8	24,4	27,6
H220					11,9	14,0	15,3	16,5					18,4	22,1	24,7	28,0
H240					12,0	14,1	15,5	16,8					18,7	22,4	25,1	28,4
H250	9,0	11,2	13,1	16,2	12,1	14,2	15,6	16,9					18,8	22,6	25,2	28,6
H300					12,5	14,7	16,1	17,4	14,0	17,5	20,3	25,1	19,4	23,3	26,0	29,5
H350					12,9	15,2	16,6	18,0					20,0	24,0	26,9	30,4
H400					13,3	15,6	17,1	18,5					20,6	24,8	27,7	31,3
H450	8,6	10,8	12,6	15,5	13,7	16,1	17,6	19,1					21,2	25,5	28,5	32,3
H500	7,6	9,4	11,0	13,6	14,1	16,5	18,1	19,6					21,9	26,2	29,3	33,2
HM200					12,4	14,5	15,9	17,2					19,5	23,4	26,2	29,6
HM220					12,5	14,7	16,2	17,5					19,8	23,7	26,5	30,0
HM240					12,7	14,9	16,4	17,7					20,0	24,0	26,9	30,4
HM250	9,5	11,8	13,8	17,1	12,8	15,0	16,5	17,8					20,2	24,2	27,0	30,6
HM300					13,2	15,5	17,0	18,4	15,0	18,7	21,8	26,9	20,8	25,0	27,9	31,6
HM350					13,6	16,0	17,5	19,0					21,5	25,7	28,8	32,6
HM400					14,0	16,5	18,1	19,5					22,1	26,5	29,7	33,6
HM450	9,1	11,4	13,3	16,4	14,4	17,0	18,6	20,1					22,8	27,3	30,5	34,6
HM500	8,0	10,0	11,6	14,3	14,8	17,5	19,1	20,7					23,4	28,1	31,4	35,6
HI200					13,7	16,1	17,6	19,0					22,1	26,5	29,6	33,6
HI220					13,8	16,3	17,9	19,3					22,4	26,9	30,0	34,0
HI240					14,0	16,5	18,1	19,5					22,7	27,2	30,4	34,5
HI250	10,5	13,1	15,3	18,8	14,1	16,6	18,2						22,8	27,4	30,6	34,7
HI300					14,6	17,2	18,8	20,3	17,0	21,2	24,7	30,5	23,6	28,3	31,6	35,8
HI350					15,0	17,7	19,4	20,9					24,3	29,2	32,6	36,9
HI400					15,5	18,2	20,0	21,6					25,1	30,1	33,6	38,1
HI450	10,1	12,6	14,6	18,1	15,9	18,8	20,6	22,2					25,8	30,9	34,6	39,2
HI500	8,8	11,0	12,8	15,8	16,4	19,3	21,2	22,9					26,5	31,8	35,6	40,3
HB200					15,6	18,4	20,1	21,8					27,3	32,7	36,6	41,5
HB220					15,8	18,6	20,4	22,0					27,7	33,2	37,1	42,0
HB240					16,0	18,9	20,7	22,3					28,0	33,6	37,6	42,6
HB250	12,0	15,0	17,4	21,5	16,1	19,0	20,8	22,5					28,2	33,8	37,8	42,9
HB300					16,6	19,6	21,5	23,2	21,0	26,2	30,5	37,7	29,1	34,9	39,1	44,2
HB350					17,2	20,2	22,2	23,9					30,0	36,0	40,3	45,6
HB400					18,2	21,5	23,5	25,4					31,9	38,2	42,8	48,4
HB450	11,5	14,4	16,7	20,7	20,0	23,6	25,9	27,9					35,1	42,0	47,0	53,3
HB500	10,1	12,6	14,6	18,1	21,9	25,8	28,3	30,6					38,4	46,0	51,4	58,3

1.3 Columns

Axial force resistance and other resistances are calculated according to EC5.
Flange strength and stiffness values for C18 in EN338 should be used.
For the web material, strength and stiffness values as given in EN12369 should be used.

2. Modification factors

The modification factors for the joists, k_{mod} and k_{def} as defined in Eurocode 5, are given in Table 15 and Table 16.

Table 15 Values of k_{mod} for the Masonite beams type H, HL, HM, HI and HB-beams and columns type R

Duration of load	**Bending, bearing and axial strength**		**Shear resistance [1)]**			
Service class	Service class 1	Service class 2	Service class 1		Service class 2	
			OSB	P5	OSB	P5
Permanent	0.60	0.60	0.40	0,30	0.30	0,20
Long term	0.70	0.70	0.50	0,45	0.40	0,30
Medium term	0.80	0.80	0.70	0,65	0.55	0,45
Short term	0.90	0.90	0.90	0,85	0.70	0,60
Instantaneous	1.10	1.10	1.10	1,10	0.90	0,80

[1)] And for bearing resistance, as shown in Figure 2, _with_ point load from above _without_ reinforcement for h≥250 for end support, and h≥300 for inner bearing/mid span.

Table 16 Values of kdef for the Masonite beams type H, HL, HM, HI and HB-beams and columns type R

Bending and axial deformation		**Shear deformation**			
Service class 1	Service class 2	Service class 1		Service class 2	
		OSB	P5	OSB	P5
0.60	0.80	1.50	2,25	2.25	3,0

ANNEX 3
INSTALLATION GUIDE FOR THE BEAMS AND COLUMNS

The installation guide of the manufacturer shall be followed. Especially the following points shall be noticed:

- The instructions of the manufacturer regarding the restraint of the compression flange and temporary bracing shall be followed. For moment resistance, it should be considered that the characteristic values apply when the compression flanges are laterally supported according to Table 17.

  Table 17 Maximum distance for laterally support

Beam Type	Max distance for laterally support
H	350 mm
HM	500 mm
HI	600 mm
HB	1000 mm

- The bearing length to be used shall be ≥ 45 mm. With effective bearing length, as described in 1.2.3.

- Web stiffeners may be used according to the instructions of the manufacturer.

- During installation, the finished product may be exposed for conditions corresponding to hazard class 3 during a short time before immediate protection against rain.