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European Technical Assessment

ETA 12/0018
of 26/10/2023

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 Swelite® Beams and Columns Nordex® Beams and Columns
Product family to which the construction product belongs	Composite wood-based beams and columns for structural purposes
Manufacturer	Masonite Beams AB Strandvägen 36 SE–914 41 Rundvik, Sweden www.masonitebeams.se
Manufacturing plant(s)	Masonite Beams AB Strandvägen 36 SE-914 41 Rundvik, Sweden
This European Technical Assessment contains	22 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	EAD 130367-00-0304, Composite wood-based beams and columns
This version replaces	ETA 12/0018, issued on 11/05/2023

Specific parts

1 Technical description of the product

Masonite Beams AB's products are wood-based composite beams and columns with an 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 (for 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 to 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 use classes 1 and 2 as specified in EN 335. The products may be exposed to the weather for a short time during installation.

In seismic areas the behaviour factor of the composite wood-based beams and columns used for the design is limited to non-dissipative or low-dissipative structures ($q \leq 1,5$), defined according to Eurocode 8 (EN 1998-1:2004 clauses 1.5.2 and 8.1.3 b). Products intended for higher class of dissipative structures need further assessment and are not covered by this ETA. For use in these areas please contact manufacturer for further assistance.

The provisions made in this European Technical Approval are based on an assumed working life of the products 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 guideline for choosing the right products in relation to the expected economically reasonable working life of the application.

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

3.1 Essential characteristics and their performance

Basic requirement and essential characteristics	**Performance**
BWR 1: Mechanical resistance and stability	
Bending strength and/or bending moment capacity (edgewise and flatwise) and size effect parameter (edgewise and flatwise)	See Annex 2
Tension strength and/or tension capacity parallel to the product and size effect parameter	See Annex 2
Tension strength and/or capacity perpendicular to the product	No performance assessed
Compression strength and/or capacity parallel to the product	See Annex 2
Compression strength perpendicular to the product (edgewise and flatwise) and/or bearing capacity	See Annex 2
Shear strength and/or capacity (edgewise and flatwise) and size effect parameter (flatwise)	See Annex 2
Modulus of elasticity parallel to the grain	See Annex 2
Shear modulus (edgewise and flatwise)	See Annex 2
Torsional shear capacity and rigidity	No performance assessed
Density	No performance assessed
Creep and duration of the load	See Annex 2
Dimensional stability	See Annex 1
Corrosion resistance of metal fasteners and other connectors	No performance assessed
Bonding quality and durability of bonding strength	No performance assessed
BWR 2: Safety in case of fire	
Reaction to fire	Flanges and webs: D-s2, d0
Resistance to fire	No performance assessed
BWR 3: Hygiene, health and the environment	
Content, emission and/or release of dangerous substances	Clause 3.1.1
BWR 6: Energy economy and heat retention	
Thermal conductivity	Clause 3.1.2
Thermal inertia	No performance assessed
Aspects of durability	
Natural Durability	Clause 3.1.3

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.

3.1.3 Natural durability

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 use 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.

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 26.10.2023
By RISE Research Institutes of Sweden AB

Martin Tillander
Director, Product certification

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, together with dimensions in Table 1 and tolerances in Table 2 .

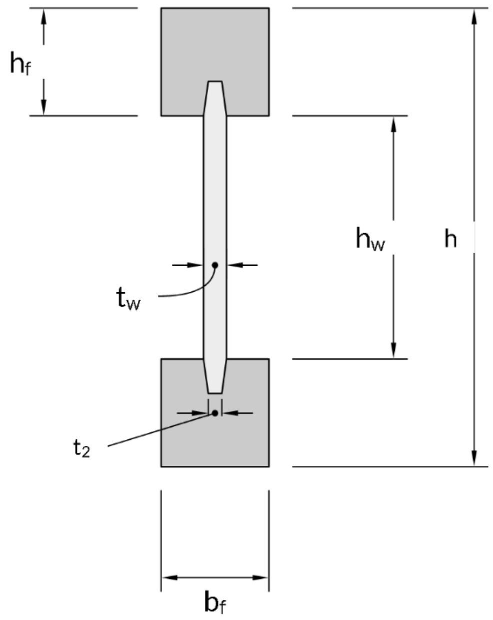


Figure 1. Cross section and notation.

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

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	≥0,5 t_w
Column Type R	150-400	45-55	45-70	8-10	≥0,5 t_w

Table 2. Tolerances in millimeter

Overall depth	h	± 1,5
Length	l	-/+10
Flange width	b_f	± 1,5
Flange depth	h_f	± 2
Web thickness	t_w	± 0,8

2 Specification of components

2.1 Beams

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

- Flanges graded in their final dimension.
- Original plank dimension graded and split into final flange dimension and planed. In addition to this a visual override according to special rules is required, where particularly 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 EN 338. The machine settings are controlled based on the results from bending tests of full-sized beams.

The web consists of OSB/3 board or particleboard of quality P5 or P7, produced according to EN 300 for OSB/3 board and EN 312 for particleboard. Characteristic values for structural design according to EN 12369.

2.2 Columns

The flanges consist of machine strength graded Norway spruce or pine timber.

The strength class is C18 or C24 according to EN 338.

The web consists of OSB/3 board or P5 particleboard. Produced according to EN 300 for OSB/3 board and EN 312 for the P5 particleboard. Characteristic values for structural design according to EN 12369.

2.3 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

Characteristic resistances and stiffness values for beams are given in Table 4 and Table 5. 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	Based on 30 test specimens
Axial force resistance:	Calculation	
Shear resistance:	Calculation assisted by testing	Based on 30 test specimens
Shear stiffness:	Calculation	
Bearing resistance:	Calculation assisted by testing	Based on 30 test specimens
Holes in web	Calculation assisted by testing	Based on 10 test specimens
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:

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

where:

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

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 and Table 12.

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 loads 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 <u>**without**</u> reinforcement and <u>**with**</u> 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 7and Table 9.

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

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

Parameter values are shown in Table 6, Table 8 and Table 9.

[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, $F_d \leq 2\ x\ V_d$

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

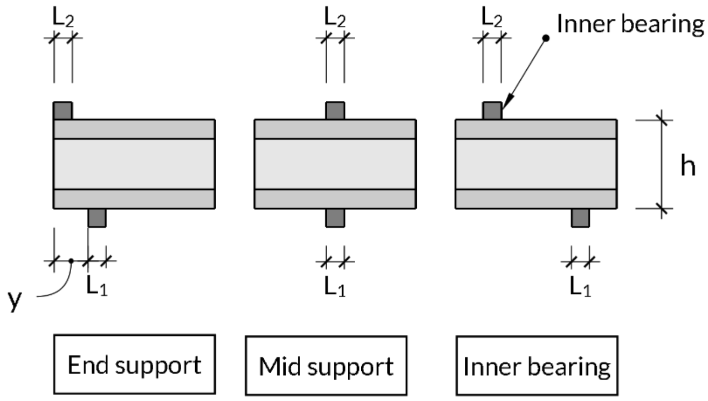


Figure 2. Support types

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)]. For mid support and inner bearing: $L_1 = \min(L_1 \; and \; 200 \; mm)$ [2),3)]

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:

$$\Delta a = 4 \cdot \frac{y}{(^h/_2)}, \quad (5)$$

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

[3)] For situations when h ≤ 220 mm, bearing capacity shall be calculated for L_1= 150 mm.

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	1,43	1,31

For cases with 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.

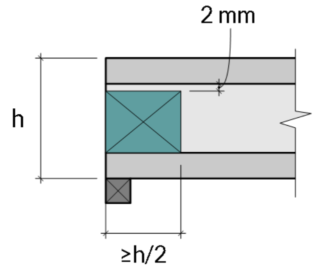


Figure 3. Reinforcement

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 EN 338.

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:

<u>For OSB/3 web</u>

$$V_k = 0{,}0674 \cdot h + 0{,}3 \qquad (6)$$

<u>For particleboard P5 or P7 web</u>

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

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 and Table 12.

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 the support edges, for supports with point load from above the safety zones covers 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.

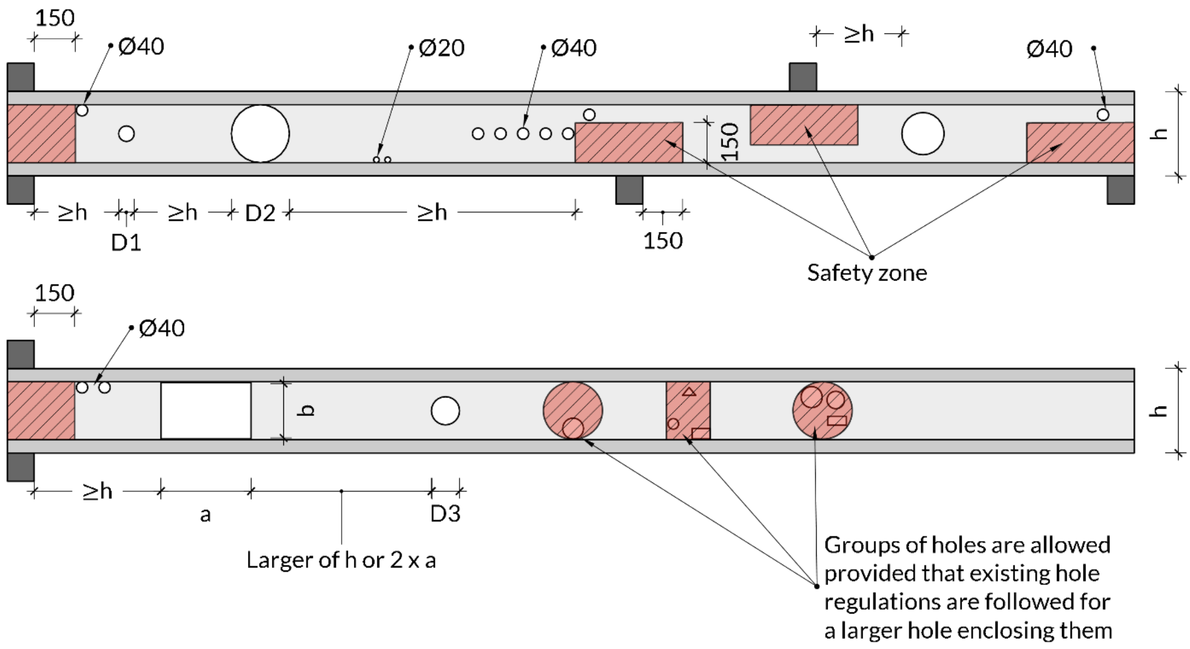


Figure 4. Hole regulations

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 Edge Distance from Bearing or Point Load		≥h[1)]								
Minimum Edge Distance Between Circular Holes	**≤40mm**	2 x larger of (D_1 or D_2)								
	>40mm	≥h[1)]								
Minimum Edge 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:

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

and

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

where:

$h = beam\ depth$

$D = hole\ diameter, D \leq h - 2 \cdot h_f$

$h_f = \ Flange\ depth$

1.2.6.2 Shear capacity rectangular holes

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

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

where:

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

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 or P7 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 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 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]	[kNm^2]	[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

OSB web									
Beam depth and quality 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]	[kNm^2]	[kN]	[kN]	[m]		[kN]	
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 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]	[kNm^2]	[kN]	[kN]	[m]		[kN]	
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	2499	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 47x97 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(Mk)	(EI)	(Vk)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm^2]	[kN]	[kN]	[m]		[kN]	
HB200	C30	16,3	711	13,8	1419	0,077	0,028	222,0	16,3
HB220	C30	18,4	904	15,1	1635	0,086	0,028	223,4	18,4
HB240	C30	20,5	1121	16,5	1851	0,096	0,028	224,8	20,5
HB250	C30	21,5	1238	17,2	1959	0,101	0,028	225,5	21,5
HB300	C30	26,6	1918	20,5	2499	0,124	0,027	229,0	26,6
HB350	C30	31,4	2753	23,9	3039	0,148	0,027	232,5	31,4
HB400	C30	36,2	3745	27,3	3579	0,171	0,027	236,0	36,2
HB450	C30	40,9	4898	30,6	4119	0,194	0,027	239,5	40,9
HB500	C30	45,4	6212	34,0	4659	0,217	0,027	243,0	45,4

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 web									
Beam depth and quality 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]	[kNm^2]	[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

Particleboard web									
Beam depth and quality 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]	[kNm^2]	[kN]	[kN]	[m]		[kN]	
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

Particleboard web									
Beam depth and quality 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]	[kNm^2]	[kN]	[kN]	m]		[kN]	
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	32,1	4429	36,1	4141	0,218	0,019	172,1	136,3

Particleboard web									
Beam depth and quality 47x97 mm flanges		Moment resistance	Bending stiffness	Shear resistance	Shear stiffness	Radius of gyration		Axial capacity	
		(Mk)	(EI)	(Vk)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm^2]	[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

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

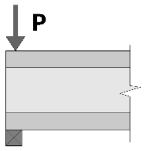
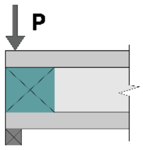
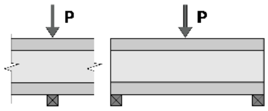
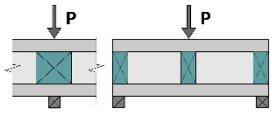
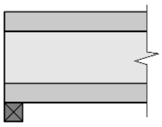
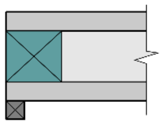
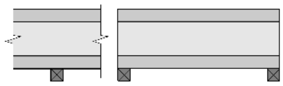
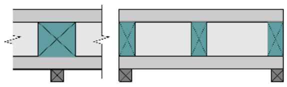
Beam depth [mm]	End bearing [kN]								Inner bearing/mid span [kN]							
	Without reinforcement				With reinforcement				Without reinforcement				With reinforcement			
																
	Bearing length [mm]				Bearing length [mm]				Bearing length [mm]				Bearing length [mm]			
	45	70	95	145	45	70	95	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	19,7					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 or C24 in EN 338 should be used. For the web material, strength and stiffness values as given in EN 12369 should be used.

1.3.1 Characteristic mechanical resistance and stiffness data

Table 15. 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 47x47 mm flanges		**Moment resistance**	**Bending stiffness**	**Shear resistance**	**Shear stiffness**	**Radius of gyration**		**Axial capacity**	
		(Mk)	(EI)	(Vk)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm^2]	[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 16. 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 web									
Beam depth and quality 47x47 mm flanges		**Moment resistance**	**Bending stiffness**	**Shear resistance**	**Shear stiffness**	**Radius of gyration**		**Axial capacity**	
		(Mk)	(EI)	(Vk)	(GA)	i_x	i_y	N_{ck}	N_{tk}
		[kNm]	[kNm^2]	[kN]	[kN]	[m]		[kN]	
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

2 Modification factors

The modification factors for the joists, k_{mod} and k_{def} as defined in Eurocode 5, are given in Table 17 and Table 18.

Table 17. Values of k_{mod} for the Masonite beams type H, HL, HM, HI and HB-beams and columns type R

	Bending, bearing and axial strength		**Shear resistance** [1)]			
Duration of load	**Service class 1**	**Service class 2**	**Service class 1**		**Service class 2**	
			OSB/P7	**P5**	**OSB/P7**	**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 18. Values of k_{def} 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/P7	**P5**	**OSB/P7**	**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 19,

Table 19. 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 $\geq$ 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 use class 3 during a short time before immediate protection against rain.