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European Technical Assessment

ETA 12/0018
of 19/12/2016

General Part

Technical Assessment Body issuing the ETA	SP Sveriges Tekniska Forskningsinstitut
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	14 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, edition January 2002, used as European Assessment Document (EAD)
This version replaces	ETA 12/0018 issued on 30.06.2015

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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.
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).

Masonite beams and columns can be used in service classes 1 and 2 according to Eurocode 5, 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 0,18 W/(m·K) for OSB webs and 0,13 W/(m·K) for flange material according to EN ISO 10456. The natural density variation of the materials is taken into account 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 99/92/EC 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 SP Sveriges Tekniska Forskningsinstitut.

Issued in Borås on 19.12.2016
By SP Sveriges Tekniska Forskningsinstitut

Lennart Månsson
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 1-1.

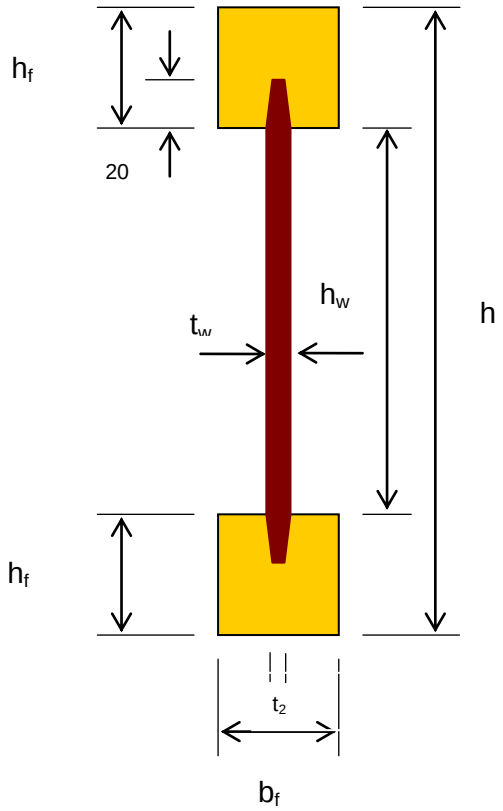

Figure 1-1 Cross section and notation.

Table 1-1 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 1-2 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	b_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.

2 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.

The machine settings are controlled based on the results from bending tests of full-sized beams.

Three flange material qualities are used, either C18, C24+ or C30+. The C24+ and C30+ classes have slightly higher strength and stiffness values than C24 and C30 according to EN338.

The web consists of a 10 mm oriented strand board of class OSB/3, according to EN 300 with 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 a 8-10 mm OSB/3 board according to EN300 with 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. Characteristic resistances and stiffness values for beams are given in Table 2-1 and Table 2-2. The basis of these values is as follows:

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

- $I_{eff} = I_f + \frac{E_w}{E_f} \cdot I_w$; 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.
- 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 2-1.
- $k_h = \left(\frac{300}{h}\right)^{0,25}$

Table 2-1 Characteristic bending strength (beam depth 300 mm) used to calculate characteristic moment resistance.

	C30+ flanges (H, HI, HM, and HB-beams)	C24+ flanges (H, HM and HB-beams)	C18 flanges (HL-Beams)
Bending strength, $f_{m,k}$ (MPa)	27	22	13,7

Moment resistance values for some preferred beam sizes are presented in Table 2-4.

1.2.2 Bending stiffness

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

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

where

E_f is the flange modulus of elasticity according to Table 2-2 and
I_{eff} is the second moment of inertia of the composite section

Table 2-2 E_f – values used to calculate bending stiffness. .

	C30+ flanges (H- HI, HM, and HB-beams)	C24+ flanges (H, HM and HB-beams)	C18 flanges (HL-Beams)
Flange MOE, E_f, (MPa) *(Mean value)*	13000	11000	9000

Bending stiffness values for some preferred beam sizes are presented in Table 2-3

1.2.3 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.

1.2.4 Shear resistance

The following expression should be used to calculate the shear resistance:

$V_k = 0.0674 \cdot h + 0{,}3$

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 2-4.

1.2.5 Regulations regarding holes in web

General design regulations regarding placement of holes in web can be viewed in figure below.

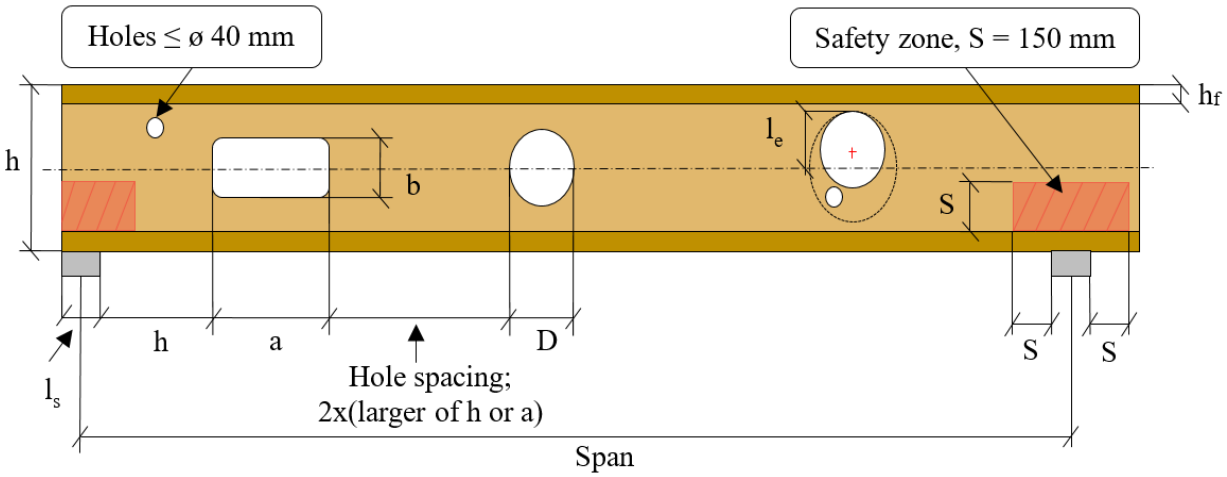

Figure 2-1. Hole regulations

- No holes are allowed in safety zones
- Support width, l_s, must be designed according to load conditions (min. 45 mm)
- Smaller diameter holes (≤20mm) can be placed anywhere in the web, although with a minimum distance of 40 mm between hole edges
- Holes ≤ 40 mm must be placed at least h/2 from the edge of the beam
- For holes with diameter ≤ 40 mm hole spacing must be at least 2 x (larger of D or a)
- One hole ≤ 40 mm will not affect the shear capacity of the beam; this also applies for two holes ≤ 40 mm as long as they are placed in the same horizontal plane and do not violate existing hole regulations
- Provided that all holes ≤ 40 mm, more than two holes will give a reduction of the shear capacity of 20%
- Holes with diameter > 40 mm must be placed with a minimum distance of h from adjacent hole, support, or point load
- For circular holes: D ≤ h – 2 x h_f
- Rectangular holes must be placed h from support or point load, with hole spacing at least 2 x (larger of h or a)
- For rectangular holes: a ≤ 320mm and b ≤ 200 mm and a/b = 0,5 to 2
- Groups of holes, or single holes, with centre point offset from centreline can be placed within the permitted area of circular or rectangular hole provided that the layout do not violate the existing hole regulations

- If hole(s) are placed with centre point outside centreline, holes must be checked for a diameter D = 2 x (distance between centreline and edge closest to flange, l_e) placed along centreline
- Under no circumstances may the flanges be cut

1.2.5.1 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:

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

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

$$k = \frac{h - h_f - 0{,}9D}{h - h_f}$$

Where:

$h =$ Beam depth

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

$h_f =$ Flange depth

1.2.5.2 Shear capacity rectangular holes

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

$$k = min\left\{0{,}3 * \left(\frac{h}{b}\right)^{0{,}1} * \left(\frac{h}{a}\right)^{0{,}18} * \left(\frac{b}{a}\right)^{0{,}2} * k_{depth}\,;0{,}9\right\},$$

where:

$h = beam\ depth$

$b = hole\ depth, b \le [H - 2{,}1 * h_f] \le 200\ mm$

$a = length\ of\ hole, a \le 320\ mm.$

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

$$k_{depth} = \left(\frac{255}{h}\right)^{1{,}1}.$$

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

$$k_{depth} = \left(\frac{h}{650}\right)^{0{,}9}.$$

1.2.6 Bearing resistance

For beams without reinforcement, with a beam depth h>250 mm and with concentrated load directly above the support, it is assumed that there is a risk of web buckling, and the following expression should be used to calculate the bearing resistance:

$$F_k = \min \begin{cases} \left(\frac{l}{45}\right)^{0.5} \cdot a_1 \\ \frac{F_0}{h} a_2 \end{cases}$$

For all other situations:

$$F_k = \left(\frac{l}{45}\right)^{0.5} \cdot a_1$$

where

$$l = \min \begin{cases} bearing\ length \\ 145\ mm \end{cases}$$

a_1 is a parameter depending on the flange width and the support conditions
h is the beam depth in mm
a_2 is a parameter depending on the support conditions (risk for buckling)

Table 2-3 Parameter values

Parameter	End bearing					Inner bearing/mid support				
	H	HL	HM	HI	HB	H	HL	HM	HI	HB
a_1	9	8,5	11,3	13	18	16	15,2	19,6	20	30
a_2	1	1	1	1	1	2l/45	2l/45	2l/45	2l/45	2l/45
F_0	4000	4000	4000	4000	5500	3000	3000	3000	3500	4000

Bearing resistance values for some preferred beam sizes are presented in Table 2-4.

Table 2-4 Characteristic mechanical resistance and stiffness data for beams with preferred sizes.
For bearing resistance, it is assumed that a point load is placed directly above the support (end- and inner bearing case).
Characteristic data for other sizes will be presented in design documentations in each individual case.

Beam depth		**Moment resistance** M_k	**Bending stiffness, EI**	**Shear resist-ance** V_k	**Shear stiffness GA**	**Bearing resistance (kN)**						
(mm)		(kNm)	(kNm^2)	(kN)	(kN)	End bearing				Inner bearing		Midspan
						Without reinf.		With reinf.		Without reinf.	With reinf.	With reinf
Beams with 47x47 mm flanges			(**Type H**)									
			Bearing length (mm) →			45	145	45	145	70	70	70
200	C30+	7.8	339	13.8	1488	9.0	16.2	9.0	16.2	20.0	20.0	20.0
220	C30+	8.8	431	15.1	1704	9.0	16.2	9.0	16.2	20.0	20.0	20.0
240	C30+	9.8	535	16.5	1920	9.0	16.2	9.0	16.2	20.0	20.0	20.0
250	C30+	10.3	592	17.2	2028	9.0	16.2	9.0	16.2	20.0	20.0	20.0
300	C30+	12.7	920	20.5	2568	9.0	13.3	9.0	16.2	20.0	20.0	20.0
350	C30+	15.1	1327	23.9	3108	9.0	11.4	9.0	16.2	20.0	20.0	20.0
400	C30+	17.7	1833	26.5	3648	9.0	10.0	9.0	16.2	20.0	20.0	20.0
450	C30+	20.1	2383	27.8	4188	8.9	8.9	9.0	16.2	20.0	20.0	20.0
500	C30+	22.2	3037	29.0	4728	8.0	8.0	9.0	16.2	18.7	20.0	20.0
Beams with 47x60 mm flanges			(**Type HM**)									
			Bearing length (mm) →			45	145	45	145	70	70	70
200	C30+	10.0	435	13.8	1488	11.3	20.3	11.3	20.0	24.4	24.4	24.4
220	C30+	11.3	553	15.1	1704	11.3	20.3	11.3	20.0	24.4	24.4	24.4
240	C30+	12.6	686	16.5	1920	11.3	20.3	11.3	20.0	24.4	24.4	24.4
250	C30+	13.2	759	17.2	2028	11.3	20.3	11.3	20.0	24.4	24.4	24.4
300	C30+	16.3	1178	20.5	2568	11.3	13.3	11.3	20.0	24.4	24.4	24.4
350	C30+	19.3	1445	23.9	3108	11.3	11.4	11.3	20.0	24.4	24.4	24.4
400	C30+	22.3	1975	26.5	3648	10.0	10.0	11.3	20.0	23.3	24.4	24.4
450	C30+	25.3	2593	27.8	4188	8.9	8.9	11.3	20.0	20.7	24.4	24.4
500	C30	28.2	3815	29.0	4728	8.0	8.0	11.3	20.0	18.7	24.4	24.4

Beam depth		**Moment resistance** M_k	**Bending stiffness, EI**	**Shear resist-ance** V_k	**Shear stiffness GA**	**Bearing resistance (kN)**						
(mm)		(kNm)	(kNm^2)	(kN)	(kN)	End bearing				Inner bearing		Midspan
						Without reinf.		With reinf.		Without reinf.	With reinf.	With reinf
Beams with 47x70 mm flanges			(**Type HI**)									
			Bearing length (mm) →			45	145	45	145	70	70	70
200	C30+	11.7	509	13.8	1488	13.0	23.3	13.0	23.3	24.9	24.9	24.9
220	C30+	13.2	647	15.1	1704	13.0	23.3	13.0	23.3	24.9	24.9	24.9
240	C30+	14.7	802	16.5	1920	13.0	23.3	13.0	23.3	24.9	24.9	24.9
250	C30+	15.4	887	17.2	2028	13.0	23.3	13.0	23.3	24.9	24.9	24.9
300	C30+	19.0	1375	20.5	2568	13.0	13.3	13.0	23.3	24.9	24.9	24.9
350	C30+	22.6	1977	23.9	3108	11.4	11.4	13.0	23.3	24.9	24.9	24.9
400	C30+	26.0	2694	26.5	3648	10.0	10.0	13.0	23.3	24.9	24.9	24.9
450	C30+	29.4	3529	27.8	4188	8.9	8.9	13.0	23.3	24.2	24.9	24.9
500	C30+	32.8	4484	29.0	4728	8.0	8.0	13.0	23.3	21.8	24.9	24.9
Beams with 47x97 mm flanges			(**Type HB**)									
			Bearing length (mm) →			45	145	45	145	70	70	70
200	C30+	16.3	708	13.8	1490	18.0	32.3	18.0	32.3	37.4	37.4	37.4
220	C30+	18.4	900	15.1	1706	18.0	32.3	18.0	32.3	37.4	37.4	37.4
240	C30+	20.4	1116	16.5	1922	18.0	32.3	18.0	32.3	37.4	37.4	37.4
250	C30+	21.4	1233	17.2	2030	18.0	32.3	18.0	32.3	37.4	37.4	37.4
300	C30+	26.4	1909	20.5	2570	18.0	18.3	18.0	32.3	37.4	37.4	37.4
350	C30+	31.3	2740	23.9	3110	15.7	15.7	18.0	32.3	35.6	37.4	37.4
400	C30+	36.0	3728	27.3	3650	13.8	13.8	18.0	32.3	31.1	37.4	37.4
450	C30+	40.7	4874	30.6	4190	12.2	12.2	18.0	32.3	27.7	37.4	37.4
500	C30+	45.2	6182	34.0	4730	11.0	11.0	18.0	32.3	24.9	37.4	37.4

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 tables 2-5, 2-6, 2–7 and 2–8.

Table 2-5 Values of k_{mod} for the Masonite beams type H, HL, HM, HI and HB-beams and columns type R.

Duration of load	**Bearing and axial strength**		**Shear resistance**		**Bearing resistance**			
					Beams with h<500mm		**Beams with h≥500mm**	
	Service class 1	Service class 2	Service class 1	Service class 2	Service class 1	Service class 2	Service class 1	Service class 2
Permanent	0.60	0.60	0.40	0.30	0.60	0.60	0.40	0.30
Long term	0.70	0.70	0.50	0.40	0.70	0.70	0.50	0.40
Medium term	0.80	0.80	0.70	0.55	0.80	0.80	0.70	0.55
Short term	0.90	0.90	0.90	0.70	0.90	0.90	0.90	0.70
Instantaneous	1.10	1.10	1.10	0.90	1.10	1.10	1.10	0.90

Table 2-6 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
0.60	0.80	1.50	2.25

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 taken into account that the characteristic values apply when the compression flanges are laterally supported according to table 5-1.

  Table 5-1

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. If the bearing length is more than 145 mm, the bearing resistance values given for 145 mm shall be used.
- 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.