Austrian Institute of Construction Engineering
Schenkenstrasse 4 | T +43 1 533 65 50
1010 Vienna | Austria | F +43 1 533 64 23
www.oib.or.at | mail@oib.or.at

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
www.eota.eu

European Technical Assessment

ETA-15/0760 of 25.05.2022

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	MHM – wall element MHM – Wandelement
Product family to which the construction product belongs	Solid wood slab element – Element of mechanically jointed timber boards to be used as a structural element in buildings
Manufacturer	Massiv-Holz-Mauer (MHM) Entwicklungs GmbH Auf der Geigerhalde 41 87459 Pfronten-Weißbach Germany
Manufacturing plants	See Annex 1
This European Technical Assessment contains	27 pages including 8 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	European Assessment Document (EAD) 130002-00-0304 “Solid wood slab element - element of dowel jointed timber boards to be used as a structural element in buildings”
This European Technical Assessment replaces	European Technical Assessment ETA-15/0760 of 30.07.2021

Remarks

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

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may be made with the written consent of Austrian Institute of Construction Engineering. Any partial reproduction has to be identified as such.

Specific Parts

1 Technical description of the product

1.1 General

This European Technical Assessment (ETA)[1] applies to the element of mechanically jointed timber boards "MHM – wall element". The MHM – wall element is made of softwood boards which are bonded together with fluted aluminium nails in order to form cross laminated timber (solid wood slab elements). Generally adjacent layers of the softwood boards are arranged perpendicular (angle of 90 °) to each other, see Annex 2, Figure 1.

The principle structure of the MHM – wall element is shown in Annex 2, Figure 1 and Figure 2. Surfaces can be rough. The boards may be grooved in longitudinal direction on one side and provided with rabbet joins at the edges, see Annex 2, Figure 4. Outer surface of cover layers may be planed.

The solid wood slab element consists of at least five adjacent layers and up to fifteen adjacent layers which are arranged perpendicular to each other. With regard to the thickness of the solid wood slab element, thicknesses and orientations of individual layers are symmetrically assembled. In case of serious deviations from symmetry potential effects should be investigated.

The MHM – wall element and the boards for its manufacturing correspond to the specifications given in the Annexes 2 and 4. The material characteristics, dimensions and tolerances of the MHM – wall element, not indicated in these Annexes, are given in the technical file[2] of the European Technical Assessment.

The application of wood preservatives and flame retardants is not subject of the European Technical Assessment.

1.2 Components

1.2.1 Boards

The specification of the boards is given in Annex 4, Table 3. Boards are visually or machine strength graded. Only technically dried wood shall be used. The boards may be grooved in longitudinal direction on one side and provided with rabbet joins at the edges, see Annex 2, Figure 4.

Wood species is European spruce or equivalent softwood.

1.2.2 Fluted aluminium nails

For mechanically jointing the single boards, fluted aluminium nails according to Annex 3 shall be used. The dimension of the fluted aluminium nails is 2.5 x 50 mm. They are made of aluminium. The fluted aluminium nails may be CE-marked according to a European Technical Assessment.

---

[1] In 2016 ETA-15/0760 was firstly issued as European Technical Assessment ETA-15/0760 of 24.05.2016, amended in 2017 to ETA-15/0760 of 30.06.2017, amended in 2018 to ETA-15/0760 of 27.04.2018, amended in 2019 to ETA-15/0760 of 16.09.2019, 2020 amended to ETA-15/0760 of 20.04.2020, 2021 amended to ETA-15/0760 of 15.02.2021, 2021 amended to ETA-15/0760 of 30.07.2021 and 2022 amended to ETA-15/0760 of 25.05.2022.

[2] The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik and, in so far as is relevant to the tasks of the notified product certification body involved in the assessment and verification of constancy of performance procedure, is handed over to the notified product certification body.

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

2.1 Intended use

The MHM – wall element is intended to be used as a structural or non-structural wall element in buildings and timber structures.

The MHM – wall element is subjected to static and quasi static actions.

The MHM – wall element is intended to be used in service classes 1 and 2 according to EN 1995-1-1[3] at low and moderate exposure to corrosion (corrosive categories C1, C2 and C3 according to EN 12944-2). Members which are directly exposed to the weather shall be provided with an effective protection for the MHM – wall element in service.

2.2 General assumptions

The MHM – wall element is manufactured in accordance with the provisions of the European Technical Assessment using the manufacturing process as identified in the inspection of the manufacturing plant by Österreichisches Institut für Bautechnik and laid down in the technical file.

The manufacturer shall ensure that the requirements in accordance with the Clauses 1, 2 and 3 as well as with the Annexes of the European Technical Assessment are made known to those who are concerned with design and execution of the works.

Layers of rough boards shall be jointed together to the required thickness of the element of mechanically jointed timber boards. The individual boards may be jointed in longitudinal direction by means of finger joints according to EN 14080, there shall be no butt joints.

Nailing of the single boards must be performed by an automatic nail device type “Wandmaster” of company Hans Hundegger AG.

Edge distance between nailed boards is 30 ± 5 mm according to Annex 3, Figure 6. This excludes the nailing between the first and the second layer of boards where a fixed nailing pattern according to Annex 3, Figure 7, with $e_{fix} \leq 0.8 \times b_{min}$ for elements with two nails per crossing point and $e_{fix} \leq 0.4 \times b_{min}$ for elements with four nails per crossing point is kept.

The edges of the boards need not to be jointed. The boards may be provided with a rabbet joint, see Annex 2, Figure 4.

Design

The European Technical Assessment only applies to the manufacture and use of the MHM – wall element. Verification of stability of the works including application of loads on the product is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of the MHM – wall element is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the MHM – wall element.
- The MHM – wall element is installed correctly.

Design of the element of mechanically jointed timber boards may be according to EN 1995-1-1 and EN 1995-1-2, taking into account the Annexes 4 and 7 of the European Technical Assessment.

Standards and regulations in force at the place of use shall be considered.

Packaging, transport, storage, maintenance, replacement and repair

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients

3 Reference documents are listed in Annex 8.

on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

Installation

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Fixing of objects

All fixed objects that are subject to tensile forces shall in any case be anchored in MHM – wall element with an anchoring depth of at least 3 layers. For heavy weight objects a deeper anchorage has to be provided. This refers in particular to kitchen cabinets, hot water boilers, handrails, etc..

The specifications of the installation instructions shall be observed.

2.3 Working life/Durability

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of the MHM – wall element of 50 years, when installed in the works, provided that the element is subject to appropriate installation, use and maintenance (see Clause 2.2). These provisions are based upon the current state of the art and the available knowledge and experience[4].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

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

3.1 Essential characteristics of the product

Table 1: Essential characteristics and product performance

№	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability [1)]		
1	Load-bearing capacity and stiffness regarding mechanical actions perpendicular to the solid wood slab element	Annex 4
2	Load-bearing capacity and stiffness regarding mechanical actions in plane of the solid wood slab element	Annex 4
3	Embedding strength / Withdrawal strength	Annex 4
4	Creep and duration of the load	Annex 4
5	Dimensional stability	Annex 4
6	Aspects of durability	Annex 4
Basic requirement for construction works 2: Safety in case of fire		
7	Reaction to fire	Annex 4
8	Resistance to fire	Annex 4

[4] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

Basic requirement for construction works 3: Hygiene, health and the environment		
9	Content, emission and/or release of dangerous substances	3.1.1
10	Water vapour permeability	Annex 4
Basic requirement for construction works 4: Safety and accessibility in use		
11	Same as BWR 1	Annex 4
Basic requirement for construction works 5: Protection against noise		
12	Airborne sound insulation	Annex 4
13	Impact sound insulation	No performance assessed.
14	Sound absorption	No performance assessed.
Basic requirement for construction works 6: Energy economy and heat retention		
15	Thermal resistance	Annex 4
16	Air permeability	Annex 4
17	Thermal inertia	Annex 4
1)	These characteristics also relate to BWR 4.	

3.1.1 Hygiene, health and the environment

The release of dangerous substances is determined according to EAD 130002-00-0304, “Solid wood slab element – Element of dowel jointed timber boards to be used as a structural element in buildings”, Edition July 2015. No dangerous substances is the performance of the MHM – wall element in this respect.

NOTE In addition to the specific clauses relating to dangerous substances contained in the European Technical Assessment, there may be other 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.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of the MHM – wall element for the intended use, and in relation to the requirements for mechanical resistance and stability, for safety in case of fire, for hygiene, health and the environment, for safety and accessibility in use, for protection against noise and for energy economy and heat retention in use in the sense of the basic requirements for construction works № 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with the European Assessment Document EAD 130002-00-0304, Solid wood slab element – Element of dowel jointed timber boards to be used as a structural element in buildings, edition July 2015.

3.2.2 Identification

The European Technical Assessment for the MHM – wall element is issued on the basis of agreed data that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are implemented, as an amendment of the European Technical Assessment is possibly necessary.

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

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/176/EC the system of assessment and verification of constancy of performance to be applied to the MHM – wall element is System 1. System 1 is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, 1.2., and provides for the following items

(a) The manufacturer shall carry out

(i) factory production control;

(ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with a prescribed test plan[5];

(b) The notified product certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body:

(i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product;

(iii) initial inspection of the manufacturing plant and of factory production control;

(iv) continuous surveillance, assessment and evaluation of factory production control.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 1 shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in point 4.1 (b)(i).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer shall establish and continuously maintain a factory production control. All procedures and specification adopted by the manufacturer shall be documented in a systematic manner. The factory production control shall ensure the constancy of performances of the element of mechanically jointed timber boards with regard to the essential characteristics.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials shall be subject to controls by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents presented by the manufacturer of the raw materials.

The frequencies of controls and tests conducted during manufacturing and on the assembled product are defined by taking account of the manufacturing process of the product and are laid down in the control plan.

[5] The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components
- Type of control or test
- Date of manufacture of the product and date of testing of the product or basic materials or components
- Results of controls and tests and, if appropriate, comparison with requirements
- Name and signature of person responsible for factory production control

The records shall be kept at least for ten years time after the construction product has been placed on the market and shall be presented to the notified product certification body involved in continuous surveillance. On request they shall be presented to Österreichisches Institut für Bautechnik.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of conformity issued by the notified product certification body, the manufacturer shall draw up a declaration of performance.

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the MHM – wall element according to the European Technical Assessment. In particular the following items shall be appropriately considered

- Personnel and equipment
- The suitability of the factory production control established by the manufacturer
- Full implementation of the control plan

5.2.2 Continuous surveillance, assessment and evaluation of factory production control

The notified product certification body shall visit the factory at least once a year for routine inspection. In particular the following items shall be appropriately considered

- The manufacturing process including personnel and equipment
- The factory production control
- The implementation of the control plan

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the control plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

Issued in Vienna on 25.05.2022
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits

Managing Director

Manufacturing plants in Germany

Abbundzentrum Dahlen GmbH & Co. KG
Gewerbestraße 3
04774 Dahlen

Herrmann Abbundtechik GmbH
Industriestr. 2
36419 Geisa/Rhön

Holz in Form GmbH
Alte Stützengrüner Str. 5
08237 Rothenkirchen

das Naturholzhaus ZHLS GmbH & Co. KG
Röthendorf 4
91550 Dinkelsbühl

Mayr & Sonntag GmbH
Schlossergasse 7
87764 Legau

inholz GmbH
Max-Born-Straße 16 - 18
68169 Mannheim

Hoch4 Holzbau GmbH & Co. KG
Von-Büren-Alle 43
59302 Oelde

Holzbau Binz GmbH & Co. KG
Am Limes 40
73479 Ellwangen-Pfahlheim

Teredo Vollholzhaus GmbH
Chamer Straße 58
93473 Arnschwang

Thumann Holzbau GmbH
Im Spital 9a
92348 Berg bei Neumarkt i.d.Opf

V+F Massivholzwand GmbH
Goldener Steig 42
94116 Hutthurm

Zimmerei Karrer
Untere Einöde 28
87789 Woringen

R3 Massivholzbau GmbH
Energiestraße 4a
86925 Asch-Fuchstal

Penzkofer Bau GmbH
Oleumhütte 23
94209 Regen

STERK Abbundzentrum
Birkenstraße 21
88285 Bodnegg

Zimmerei Helmut Bauerschmitt e.K.
Mühlbach 21
97483 Eltmann OT Dippach

Reichart Holzbautechnik GmbH
Wengen
87534 Oberstaufen

Zimmerei Diestelmeir GmbH
Graubergenstraße
21218 Seevetal

Manufacturing plants in Austria

Holz Meissnitzer GmbH
Niedernsiller Str. 2
5722 Niedernsill

GT – Holzbau GmbH
Geißelbacher
Hart 1
9473 Lavamünd

Manufacturing plants in Italy

FBE snc.
di Fongaro Enrico & C.
Via dell'Industria, 1
36070 Castelgomberto

MHM – wall element	Annex 1
Manufacturing plants	of European Technical Assessment ETA-15/0760 of 25.05.2022

Manufacturing plants in France

Tanguy sa
BP 6
11, rue de la Roche
29870 Lannilis

Manufacturing plants in Belgium

Stabilame
Zone industrielle
5660 Mariembourg

Manufacturing plants in Switzerland

GAUYE & DAYER Charpente
route de la Drague
1950 Sion

MHM Schweiz AG c/o
Haudenschild AG
Gässli 10
4704 Niederbipp

Manufacturing plants in Poland

dream art home SP. z o.o.
ul. Sarni Stok 1
43-300 Bielsko-Biala

Manufacturing plants in Estonia

EstHus Production OÜ
Metsa 11
60536 Tartu maakond

Manufacturing plants in Finland

Timberpoint Oy
Valkolammentie 2
07910 Loviisa

Manufacturing plants in Slovakia

Forest progress s.r.o.- MHM Slovakia
Štefánikova 217
01401 Bytča

Maruna s.r.o
Vyšné Kamence 1551
01356 Terchová

Manufacturing plants in Czech Republic

NEMA spol. s.r.o.
Byňov 106
37401 Nové Hrady

MHM – wall element	Annex 1
Manufacturing plants	of European Technical Assessment ETA-15/0760 of 25.05.2022

Figure 1: Principle structure of the solid wood slab

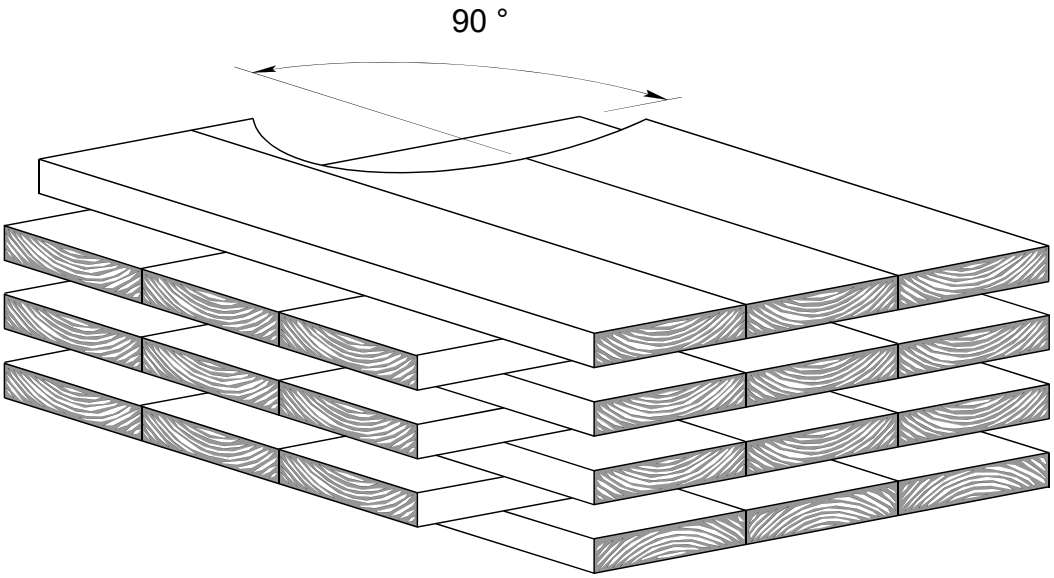
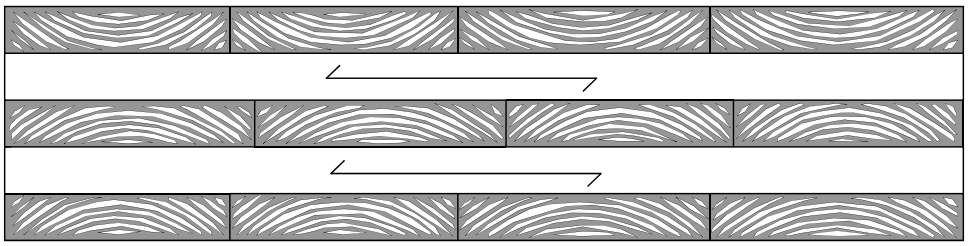
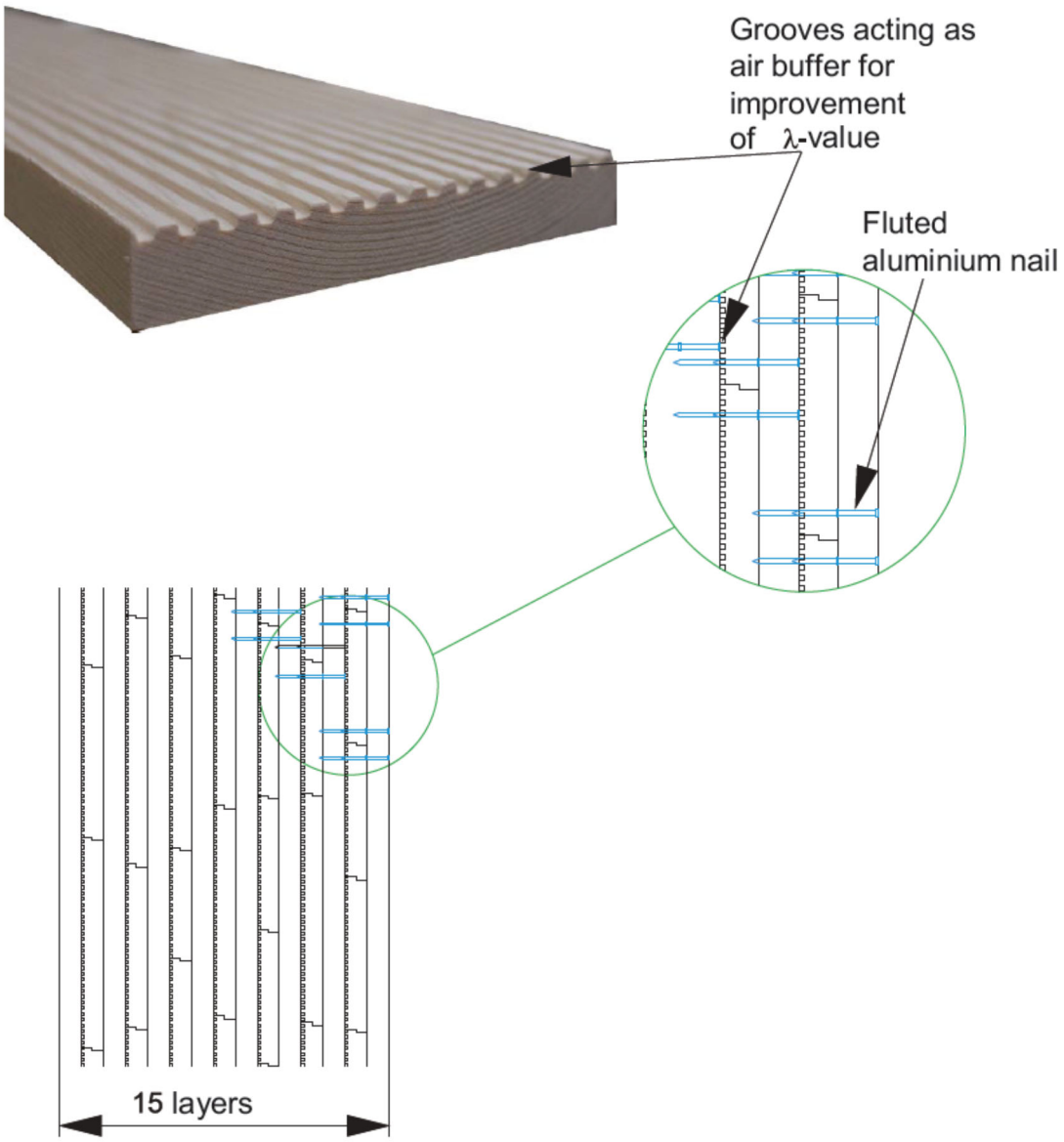


Figure 2: Principle structure of MHM – wall element with 5 layers



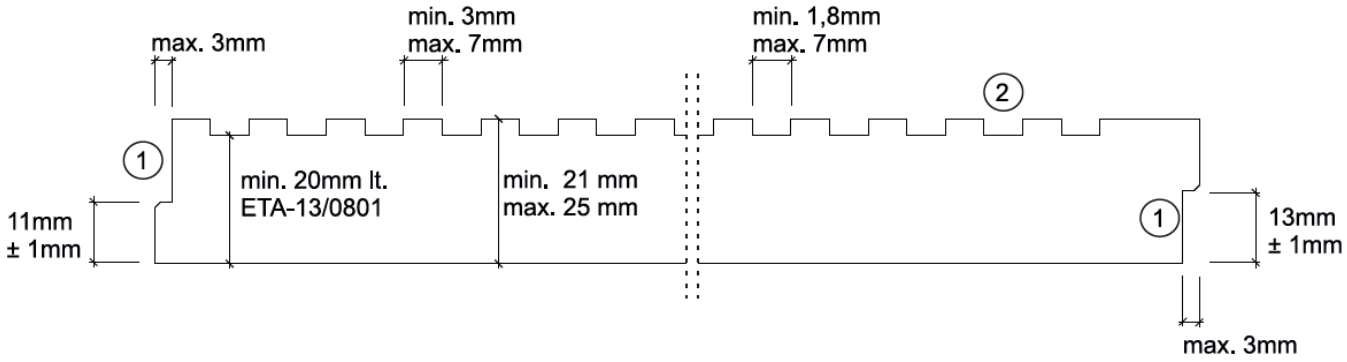
MHM – wall element	Annex 2
Structure of the MHM– wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

Figure 3: Principle structure of the MHM – wall element with grooved board layers



MHM – wall element	Annex 2
Structure of the MHM– wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

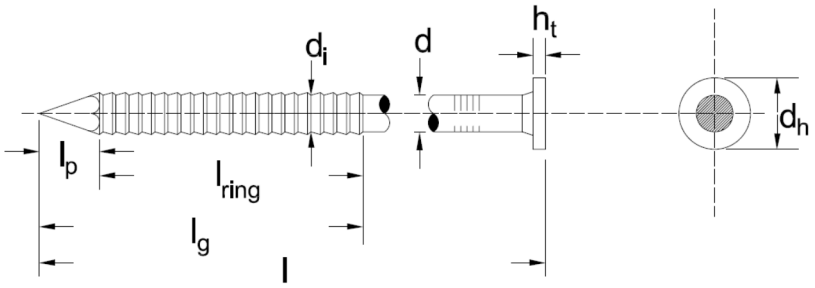
Figure 4: Dimensions of boards with grooves and rabbet joints



(1) Rabbet joints (face of the board)
(2) Grooves arranged in longitudinal direction (edges of the board)

MHM – wall element	Annex 2
Structure of the MHM– wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

Figure 5: Geometry of fluted aluminium nail



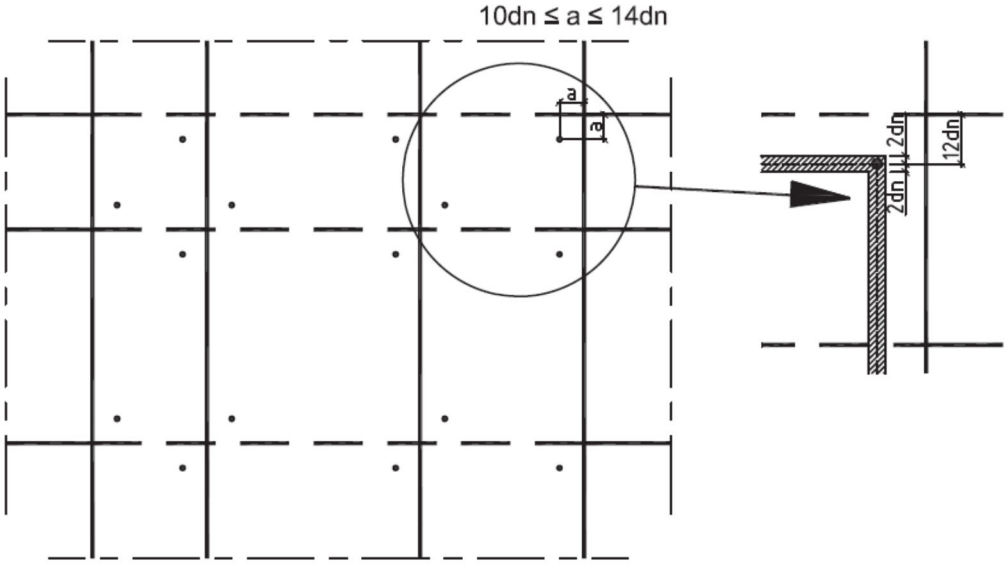
l	length
l_{ring}	threaded length
l_p	length of the tip
l_g	length of tip and thread
d_i	inner thread diameter
d	diameter
d_h	head diameter
h_t	thickness of the head

Table 2: Specification of fluted aluminium nail

Nail characteristics		Unit	Value
Nominal diameter	d	mm	2.5
Nominal length	l	mm	50
Characteristic tensile strength	$F_{tens,k}$	N	1400
Characteristic yield moment	$M_{y,k}$	Nmm	800
Characteristic withdrawal capacity of the shaft	$F_{ax,k,Shaft}$	N	610
Characteristic withdrawal capacity of the nail	$F_{ax,k}$	N	485
Slip modulus (serviceability limit state)	K_{ser}	N/mm	300
Slip modulus (ultimate limit state)	K_u	N/mm	200

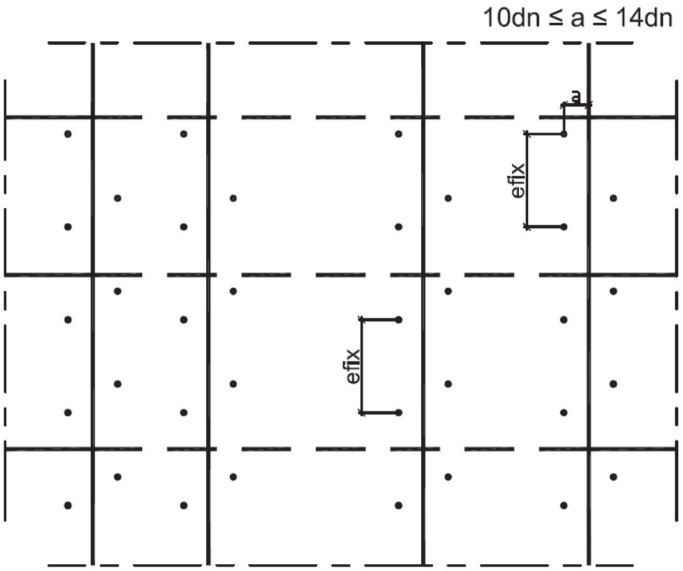
MHM – wall element	Annex 3
Fluted aluminium nail	of European Technical Assessment ETA-15/0760 of 25.05.2022

Figure 6: General nailing patterns for the MHM – wall element



d_n	diameter of the nail: 2.5 mm
grey shaded	admissible area for nailing

Figure 7: Fixed nailing pattern for first layer of the MHM – wall element



b_{min}	minimum board width
e_{fix}	fixed distance between nails
$e_{fix} \leq 0.8 \times b_{min}$	for elements with two nails per crossing point
$e_{fix} \leq 0.4 \times b_{min}$	for elements with four nails per crossing point

MHM – wall element	Annex 3
Fluted aluminium nail	of European Technical Assessment ETA-15/0760 of 25.05.2022

Table 3: Dimensions and specifications

Item		Dimension / Specification
MHM – wall element		
Thickness	mm	115 to 345
Width	m	≤ 4.0
Length	m	≤ 6.0
Number of layers	—	5 to 15 symmetric assembly
Maximum width of joints between boards within one layer: Regions with applied fasteners Other regions	mm	 3 6
Board		
Surface	—	rough
Thickness (planed dimension)	mm	23 ± 2
Width	mm	140 to 260
Ratio width to thickness	—	≥ 4 : 1
Boards shall be graded with suitable visual and/or machine procedures to be able to assign them to a strength class according to EN 338. Cover layer and inner layer	—	 C16 or better With additional requirements of C24 regarding bow
Moisture of wood according to EN 13183-2	%	15 ± 3
Finger joints	—	EN 14080

MHM – wall element	Annex 4
Characteristic data of MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

Table 4: Product characteristics of the MHM – wall element

BWR	Essential characteristic	Method of verification	Level / Class / Description
1	**Mechanical resistance and stability**		
	1. Load bearing capacity and stiffness regarding mechanical actions perpendicular to the solid wood slab element		
	Strength class of boards	EN 338	C16 or better With additional requirements of C24 regarding bow
	Modulus of elasticity – parallel to the grain of the boards $E_{0,\,mean}$ – perpendicular to the grain of the boards $E_{90,\,mean}$	Annex 7 EN 338	See Annex 7 370 MPa [1)]
	Shear modulus – parallel to the grain of the boards $G_{090,\,mean}$	EN 338	690 MPa
	Bending strength – parallel to the grain of the boards $f_{m,\,k}$	Annex 7	See Annex 7
	Tensile strength		
	In general mechanically jointed solid wood slab element elements are unsuitable for tension perpendicular to the plane of the slab. Fasteners shall be applied to overcome such design situations.		
	Compressive strength – perpendicular to the grain of the boards $f_{c,\,90,\,k}$	EN 338	2.5 MPa
	Shear strength – parallel to the grain of the boards $f_{v,\,090,\,k}$	Annex 7	See Annex 7

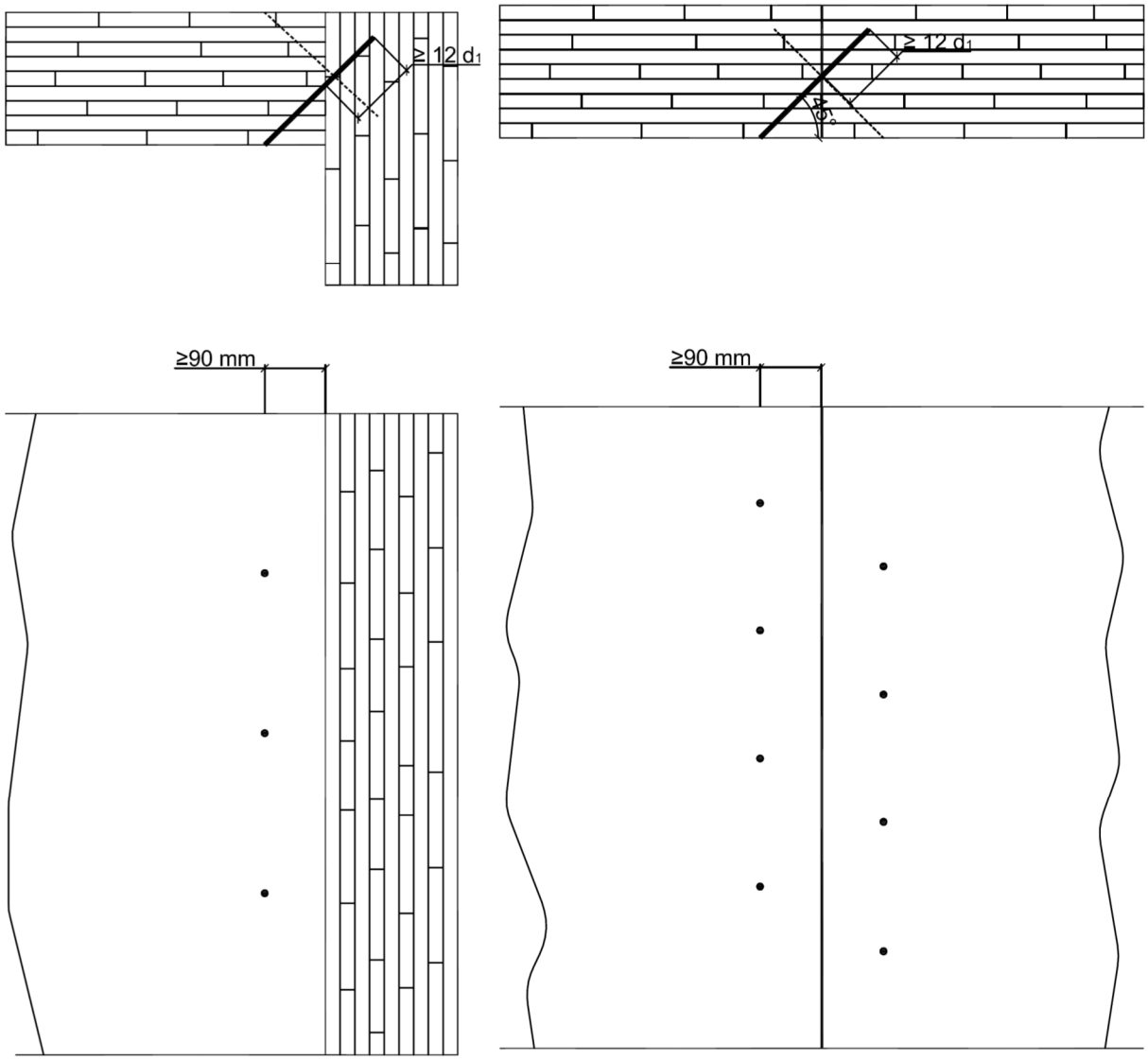
[1)] 1 MPa = 1 N/mm²

BWR	Essential characteristic	Method of verification	Level / Class / Description
1	**Mechanical resistance and stability**		
	2. Load bearing capacity and stiffness regarding mechanical actions in plane of the solid wood slab element		
	Strength class of boards	EN 338	C16 or better With additional requirements of C24 regarding bow
	Modulus of elasticity – parallel to the grain of the boards $E_{0,\,mean}$	Annex 7	See Annex 7
	Bending strength – parallel to the grain of the boards $f_{m,\,k}$	Annex 7	See Annex 7
	Tensile strength – parallel to the grain of the boards $f_{t,\,0,\,k}$	EN 338	14 MPa
	Compressive strength – parallel to the grain of the boards $f_{c,\,0,\,k}$	EN 338	21 MPa
	Shear strength – parallel to the grain of the boards $f_{v,\,090,\,k}$	Annex 7	See Annex 7
	3. Other mechanical actions		
	Fasteners: Embedding strength and withdrawal strength	EN 1995-1-1 and Annex 7	
	Creep and duration of load	EN 1995-1-1	
	Dimensional stability Moisture content during service shall not change to such an extend that adverse deformation will occur.		
	Aspects of durability – Service classes	EN 1995-1-1	1 and 2

MHM – wall element	Annex 4
Characteristic data of MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

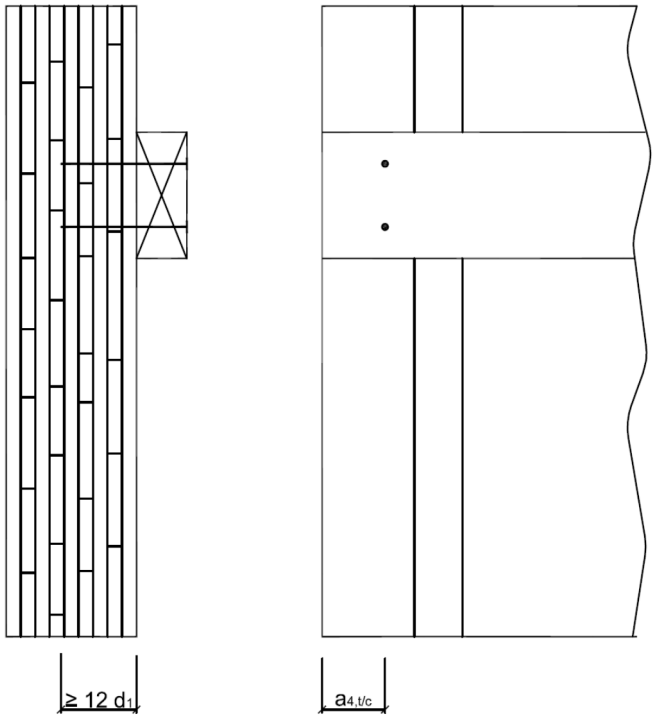
BWR	Essential characteristic	Method of verification	Level / Class / Description
2	**Reaction to fire**		
	Solid wood panels excluding floorings (ρ_{min}=400kg/m³)	Commission Decision 2003/43/EC as amended	Euroclass D-s2, d0
	Floorings of solid wood panels (ρ_{min}=400kg/m³)		Euroclass D_{fl}-s1
	Resistance to fire		
	Charring rate – Charring of more layers than the cover layer	EN 1365-1	1.15 mm/min
3	**Hygiene, health and environment**		
	Vapour permeability, μ, for the timber	EN ISO 10456	50 (dry) to 20 (wet)
	The elements are open for water vapour diffusion. Harmful condensation within the element shall be avoided in intended use conditions. This can be proven case by case by a calculation according to EN ISO 13788, when needed.		
4	**Safety and accessibility in use**		
	Same as BWR 1.		
5	**Protection against noise**		
	Airborne sound insulation	EN ISO 10140-2, EN ISO 717-1	For R_w (C; C_{tr}), see Annex 6
6	**Energy economy and heat retention**		
	Thermal resistance λ_D	EAD 130002-00-0304	0.11 W/(m·K)
	Air tightness	Wind tightness is required in particular if dry lining is used. Adequate air tightness has to be provided by the manufacturer.	
	Thermal inertia, specific heat capacity c_p	EN ISO 10456	1 600 J/(kg·K)

Figure 8: Perpendicular and parallel connection of MHM – wall elements



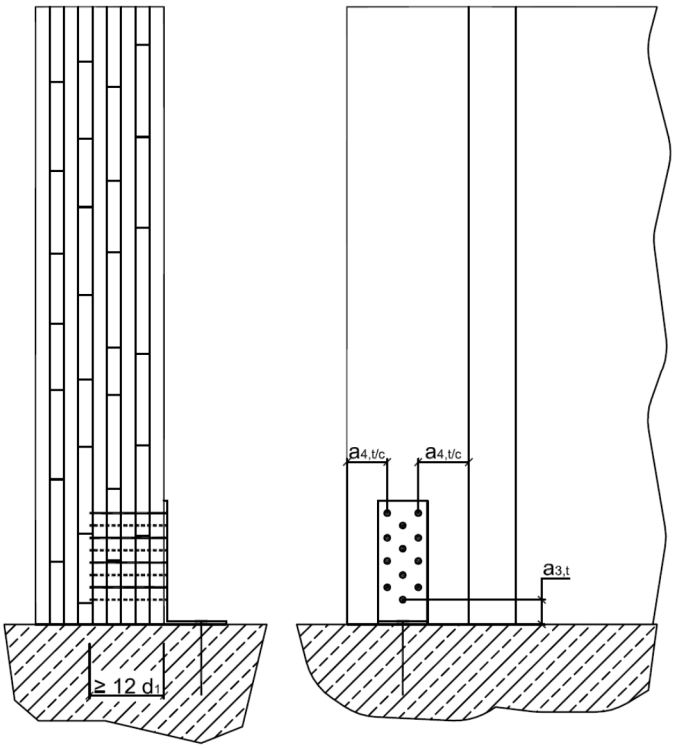
MHM – wall element	Annex 5
Connection of MHM – wall elements	of European Technical Assessment ETA-15/0760 of 25.05.2022

Figure 9: Connection of MHM – wall element and solid wood



Edge distances according to EN 1995-1-1

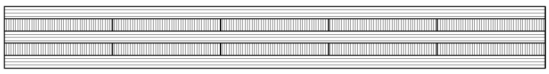
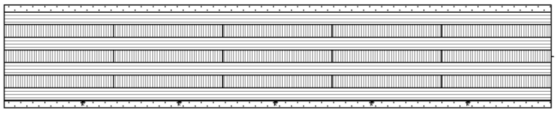
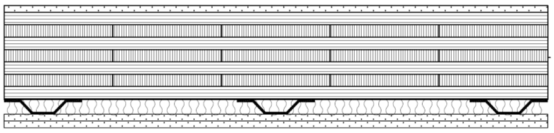
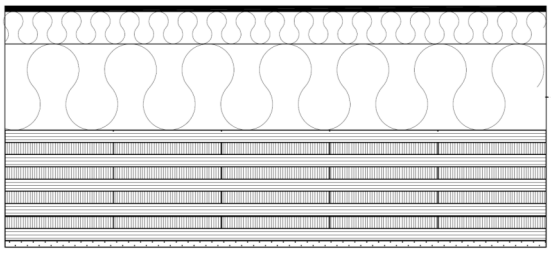
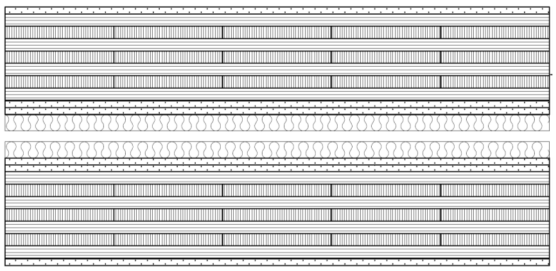
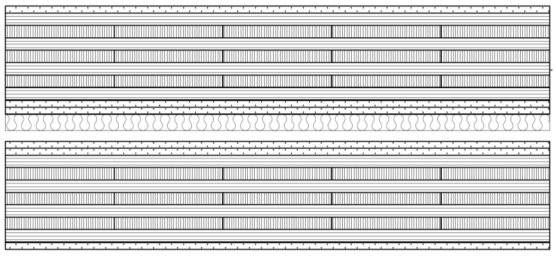
Figure 10: Connection of MHM – wall element and steel plate



Edge distances according to EN 1995-1-1

MHM – wall element	Annex 5
Connection of MHM – wall elements	of European Technical Assessment ETA-15/0760 of 25.05.2022

Examples for airborne sound insulation

№	Wall elements		
W 1	115 mm	MHM – wall element, m' = 45.7 kg/m²	**$R_w(C; C_{tr})$ = 32 (-1; -3) dB** 
W 2	12.5 mm 160 mm 12.5 mm	Gypsum fibre board, m' = 15.3 kg/m² MHM – wall element, m' = 63.4 kg/m² Gypsum fibre board, m' = 15.3 kg/m²	**$R_w(C; C_{tr})$ = 42 (-1; -4) dB** 
W 3	12.5 mm 12.5 mm 27 mm 20 mm 160 mm 12.5 mm	Gypsum fibre board, m' = 15.3 kg/m² Gypsum fibre board, m' = 15.3 kg/m² Hat-shaped spring strip, e = 690 mm Stone wool insulation board, ρ = 40.2 kg/m³ MHM – wall element, m' = 63.7 kg/m² Gypsum fibre board, m' = 15.3 kg/m²	**$R_w(C; C_{tr})$ = 61 (-4; -11) dB** 
W 4	6 mm 60 mm 160 mm 0.45 mm 205 mm 12.5 mm	Plaster, m' = 9.6 kg/m² Wood fiber insulation board, m' = 15 kg/m² Structural timber, e = 625 mm, and blow-in insulation of wood fiber, ρ = 38.9 kg/m³ Facing sheet, m' = 0.145 kg/m² MHM – wall element, m' = 81.6 kg/m² Gypsum fibre board, m' = 15.3 kg/m²	**$R_w(C; C_{tr})$ = 46 (-2; -7) dB** 
W 5	12.5 mm 160 mm 2 x 12.5 mm 30 mm 20 mm 30 mm 2 x 12.5 mm 160 mm 12.5 mm	Gypsum fibre board, m' = 15.3 kg/m² MHM – wall element, m' = 64.9 kg/m² Gypsum fibre board, m' = 15.3 kg/m² Stone wool insulation board, ρ = 40.9 kg/m³ Joint/air Stone wool insulation board, ρ = 40.9 kg/m³ Gypsum fibre board, m' = 15.3 kg/m² MHM – wall element, m' = 64.9 kg/m² Gypsum fibre board, m' = 15.3 kg/m²	**$R_w(C; C_{tr})$ = 78 (-2; -7) dB** 
W 6	12.5 mm 160 mm 2 x 12.5 mm 20 mm 30 mm 2 x 12.5 mm 160 mm 12.5 mm	Gypsum fibre board, m' = 15.3 kg/m² MHM – wall element, m' = 64.9 kg/m² Gypsum fibre board, m' = 15.3 kg/m² Air Stone wool insulation board, ρ = 40.9 kg/m³ Gypsum fibre board, m' = 15.3 kg/m² MHM – wall element, m' = 64.9 kg/m² Gypsum fibre board, m' = 15.3 kg/m²	**$R_w(C; C_{tr})$ = 74 (-2; -8) dB** 

MHM – wall element	Annex 6
Airborne sound insulation	of European Technical Assessment ETA-15/0760 of 25.05.2022

Mechanical actions perpendicular to plane and in plane of the MHM – wall element

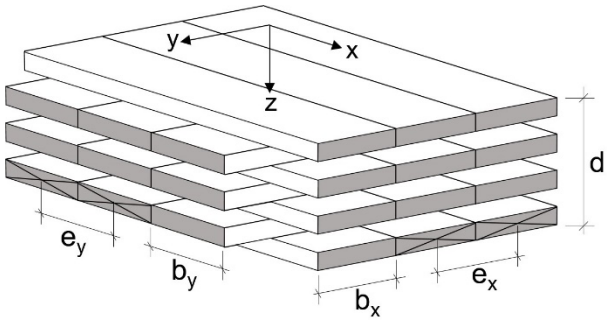
General

Due to the perpendicular orientation of the boards, the MHM – wall element is able to transfer loads in all directions according to its condition of support. For mechanically jointed cross laminated timber multi-axle stressed in both principal directions, different stiffness for the two principal directions shall be considered.

For calculation of the effective bending stiffness, boards which are oriented perpendicular to the direction of the mechanical action shall be considered.

For design of mechanically jointed cross laminated timber according to shear analogy method (TR019, C.1.2) and EN 1995-1-1, characteristic strength and stiffness of solid wood according to Annex 4 shall be taken.

Figure 11: Definition of direction of layers for the calculation of stiffness



With

x ..... direction of cover layers
y ..... direction of cross layers

$$B_x^A = \frac{E \cdot d^3}{12} \cdot \frac{(n+1)}{2} \qquad B_y^A = \frac{E \cdot d^3}{12} \cdot \frac{(n-1)}{2} \qquad \left[\frac{Nmm^2}{mm}\right]$$

Sum of own bending stiffnesses in x – and y – direction

$$B_x^B = \frac{E \cdot d^3}{12} \cdot f_x^B \qquad B_y^B = \frac{E \cdot d^3}{12} \cdot f_y^B \qquad \left[\frac{Nmm^2}{mm}\right]$$

Sum of Steiner parts in x – and y – direction

With

Number of layers	f_x^B	f_y^B
5	96	24
7	240	96
9	480	240
11	840	480
13	1344	840
15	2016	1344

MHM – wall element	Annex 7
Design considerations for the MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

$\frac{1}{S_{xz}^{B}} = \frac{1}{f} \cdot \left[\frac{(n-1)}{[(n-1) \cdot d]^2 \cdot m \cdot \left(\frac{K}{b_x \cdot b_y} \right)} \right]$	$\left[\frac{mm}{N}\right]$	Equivalent shear stiffness in x – and y – direction
$\frac{1}{S_{yz}^{B}} = \frac{1}{f} \cdot \left[\frac{(n-3)}{[(n-3) \cdot d]^2 \cdot m \cdot \left(\frac{K}{b_x \cdot b_y} \right)} \right]$		
$D_x^A = \frac{E \cdot d}{2} \cdot (n+1)$ $D_y^A = \frac{E \cdot d}{2} \cdot (n-1)$	$\left[\frac{N}{mm}\right]$	Sum of axial stiffnesses in x –and y – direction
$D_{xy}^A = \frac{K_\varphi}{b_x \cdot b_y}$	$\left[\frac{N}{mm}\right]$	Stiffness in xy – plane
$K_\varphi = \left[\left(\frac{b_x}{2} - 30mm \right)^2 + \left(\frac{b_y}{2} - 30mm \right)^2 \right] \cdot K \cdot m \cdot (n-1)$		
n	$[-]$	Number of layers
d	$[mm]$	Thickness of one layer
m	$[-]$	Number of nails per cross point
b_x	$[mm]$	Width of boards in x – direction
b_y	$[mm]$	Width of boards in y – direction
K mit K_{ser} in serviceacility limit state K_u in ultimate limit state	$[N/mm]$	Slip modulus of single nail
f	$[-]$	Factor considering rise in stiffness $f = 1.5$ for $m = 2$ and $f = 1.25$ for $m = 4$
E	$[N/mm^2]$	Modulus of elasticity $E_{0,mean}$ according to EN 338

MHM – wall element	Annex 7
Design considerations for the MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

The effective bending stiffnesses in x – and y – direction for the simple case of a single span beam (considered as static uniaxial acting component) under uniformly distributed load may be calculated as follows:

$$EI_{eff,x} = B_x^A + B_x^B \cdot \frac{1}{1 + \frac{B_x^B \cdot \pi^2}{S_{xz}^B \cdot l_x^2}}$$

$$EI_{eff,y} = B_y^A + B_y^B \cdot \frac{1}{1 + \frac{B_y^B \cdot \pi^2}{S_{yz}^B \cdot l_y^2}}$$

$\left[\frac{Nmm^2}{mm}\right]$ Effective bending stiffnesses in x – and y – direction

$l_{x,y}$ $[mm]$ Length of element in x – and y – direction

Note: In the ultimate limit state, all stiffnesses must be divided by the material safety factor γ_M.

Mechanical actions perpendicular to the MHM – wall element

Design with maximum board width b_{max} = 260 mm in both directions. If the board width is defined and marked accordingly, the marked board width may be used.

If the maximum deformation in the serviceability limit state does not exceed h / 300, design for wall elements with two nails per crossing point is carried out with 2/3 of the calculated shear flow and design for wall elements with four nails per crossing point is carried out with 4/5 of the calculated shear flow.

For design of mechanically jointed cross laminated timber according to shear analogy method (TR019, C.1.2) and EN 1995-1-1, characteristic strength and stiffness of solid wood according to Annex 4 shall be taken.

The stiffness properties may be determined as given above.

The effective bending stiffnesses in x – and y – direction for the simple case of a single span beam (considered as static uniaxial acting component) under uniformly distributed load may be calculated using $EI_{eff,x}$ or $EI_{eff,y}$.

Verification in the ultimate limit state shall be performed for the combination of stresses in the center of gravity in layer B and bending stresses in layer A for the individual lamellas.

Mechanical actions in plane of the MHM – wall element

For assessment of wall elements loaded in tension or compression the net cross section (without transverse layers) in direction of loading has to be considered.

For compressive stress in plane of the MHM – wall element verification according to second order theory with equivalent imperfections according to EN 1995-1-1 under consideration of shear deformations or shear buckling, respectively. Assessment of stability with maximum board width b_{max} = 260 mm in both directions. If the board width is defined and marked accordingly, the marked board width may be used.

For horizontal stress in plane of MHM – wall elements verification according to second order theory with equivalent imperfections according to EN 1995-1-1 under consideration of shear deformations or shear buckling, respectively. Hereby, serviceability will be decisive. For shear stress in plane of the MHM – wall element assessment with minimum board width b_{min} = 140 mm in both directions. If the board width is defined and marked accordingly, the marked board width may be used.

The stiffness properties may be determined as given above.

The effective bending stiffnesses in x – and y – direction for the simple case of a single span beam (considered as static uniaxial acting component) may be calculated using $EI_{eff,x}$ or $EI_{eff,y}$.

For elements above openings the number of horizontal, statically active, board layers is restricted to five boards lying upon each other.

Without further verification, the racking strength for an element with minimum 9 layers may be taken by $R_{v,k} = 2.75\ kN/m$.

Verification by calculation in ultimate limit state shall follow the shear analogy method, with

$M_\varphi = \frac{n_{xy} \cdot e_x \cdot e_y}{n-1}$	$[Nmm]$	Moment for design of connection in joint
$r = \sqrt{\left(\frac{b_x}{2} - 30mm\right)^2 + \left(\frac{b_y}{2} - 30mm\right)^2}$	$[mm]$	Distance of nails to the centre of rotation
$F_N = \frac{M_\varphi}{r \cdot m}$	$[N]$	Stress of a nail in the joint
n_{xy}	$[N/mm]$	Shear force
e_x	$[mm]$	Distance between centre of boards in x-direction
e_y	$[mm]$	Distance between centre of boards in y-direction

MHM – wall element	Annex 7
Design considerations for the MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

Fasteners

Load transfer through fluted aluminium nails shall be verified.

Design of fasteners for connection of two MHM – wall elements or MHM – wall elements and solid timber, glued laminated timber or steel sheets with a minimum penetration depth of 12 x d, may follow EN 1995-1-1 under consideration of:

- For connections between MHM – wall elements and solid timber or glued laminated timber loaded in shear with the screw head on solid timber or glued laminated timber side reduction of load bearing capacity $F_{v,Rk}$ by factor $\delta_1 = 0.95$.
- For connections between two MHM – wall elements and MHM – wall elements and solid timber or glued laminated timber loaded in shear with the screw head on MHM – wall element side reduction of load bearing capacity $F_{v,Rk}$ by factor $\delta_2 = 0.75$.

No reduction for nail-connections loaded in shear as well as axially loaded screw connections.

MHM – wall element	Annex 7
Design considerations for the MHM – wall element	of European Technical Assessment ETA-15/0760 of 25.05.2022

EAD 130002-00-0304, European Assessment Document for “Solid wood slab element – Element of dowel jointed timber boards to be used as a structural element in buildings”

TR019, Technical Report for “Calculation models for prefabricated wood-based load-bearing stressed skin panels for use in roofs”; Edition February 2005:

EN 338 (04.2016), Structural timber – Strength classes

EN 1365 (10.2012), +AC (04.2013), Fire resistance tests for loadbearing elements – Part 1: Walls

EN 1995-1-1 (11.2004), +AC (06.2006), +A1 (06.2008), +A2 (05.2014), Eurocode 5 – Design of timber structures – Part 1-1: General – Common rules and rules for buildings

EN 1995-1-2 (11.2004), +AC (06.2006), +AC (03.2009), Eurocode 5 – Design of timber structures – Part 1-2: General – Structural fire design

EN 13183-2 (04.2002), Moisture content of a piece of sawn timber – Part 2: Estimation by electrical resistance method

EN 14080 (06.2013), Timber structures – Glued laminated timber and glued solid timber – Requirements

EN ISO 717-1 (03.2013), Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation

EN ISO 10140-2 (09.2010), Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation

EN ISO 10456 (12.2007), +AC (12.2009), Building materials and products - Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values

EN ISO 12944-2 (05.1998), Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments

EN ISO 13788 (12.2012), Hygrothermal performance of building components and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods

MHM – wall element	Annex 8
Reference documents	of European Technical Assessment ETA-15/0760 of 25.05.2022