

SINTEF Building and Infrastructure confirms that

Massive Wood Construction elements

have been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

UAB Massive Wood Construction
 Gamybos g. 6
 LT-76128 Siauliai
 Lithuania
 (Litauen)

2. Product description

2.1 General

Massive Wood Construction elements are factory produced timber frame elements for walls, floor and roof. The elements can be delivered in lengths of up to 6 m and a maximum height of 3 m.

The elements are produced using standardized construction detailing such as described in this approval and are customized and manufactured for each individual building project. The approval document include the standard design of the structural components; walls, floor constructions and roof including joints between elements and connection to the foundation. Material and component specifications, included in the approval, are listed in Table 1.

Table 2 show specifications of standard supplementary materials installed on site. These materials are not included in the approval but are assessed regarding health and environmental properties.

The approval does not cover windows, doors and other supplementary building parts such as roof turf including turf membrane, stairs and balconies. Nor does it include technical installations like electrical systems, ventilation systems, sanitary equipment and roof drainage, which is designed especially for each building project.

2.2 Walls

Fig. 1, 2 and 4 show the principle designs of external walls and internal walls.

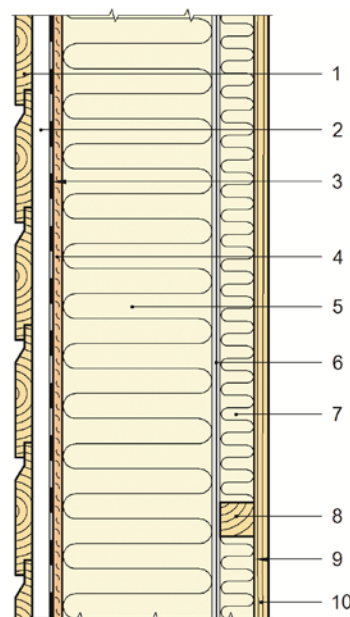


Fig. 1
 Vertical section exterior wall alt. 1 shows the principle design of standard external walls with horizontal wood cladding.

1	Outside horizontal wood cladding	6	Moisture barrier
2	Vertical battens 28x45 mm, c/c 600 mm	7	Mineral wool 45 mm
3	Wind barrier lining	8	Horizontal battens 45x45 mm c/c 600mm
4	Wind barrier board	9	Dust barrier
5	Mineral wool 195 mm, Studs 45x195/145 c/c 600 mm	10	Vertical inside wood panneling

2.3 Floors

Fig 3 shows the principle for floorconstruction between floors and figure 5 shows the principle design of the roof. The structures are based on floor joists spaced c/c 400, with dimensions and spans according to SINTEF Building Research Design Guide 522.351 *Trebjelkelag. Dimensjonering og utførelse.*

Table 1
Massive Wood Construction elements
Materials and component specifications

Material / component	Specification (Dimensions not specified in the table shall be as stated in the "Standard construction details" or according to design specifications worked out for each individual delivery or project)	CE-marked
Structural components		
Timber components	- Structural graded timber according to EN 14081, with strength class according to structural design Strength classes according to structural design - Glued laminated timber according to EN 14080, with strength class according to structural design Strength classes according to structural design - Moisture content $\leq 18\%$	X
Sheathing		
Floor sheathing	- 18 mm Swiss Krono or Kronospan Eco OSB/3 according to SINTEF Technical Approval 2575 and 20155	X
External wall sheathing	- 12 mm Kronoply or Kronospan Eco OSB/3 according to EN 13986, with $s_d < 1.0$ m	X
Roof sheathing	- 22 mm Swiss Krono or Kronospan Eco OSB/3 according to SINTEF Technical Approval 2575 and 20155	X
Thermal insulation materials		
Mineral wool	- Isover glass wool according to EN 13162. Declared thermal conductivity $\lambda_D \leq 0.037$ W/(mK) for use in external building parts. Min density 13 kg/m ³ - Knauf glass wool. Min density 13 kg/m ³ - Paroc stone wool according to EN 13162. Min density 27 kg/m ³	X
Membranes and barriers		
Water vapour control layers	- Min. 0.15 mm RaniMoBar polyethylene according to SINTEF Technical Approval 20201	X
Wind barriers	- Gyproc or Norgips gypsum boards, type A according to EN 520 - 4Pro120 - Supernova 120	X
Tape	- SIGA tape according to SINTEF Technical Approval 20134	
Claddings and linings		
External timber cladding	Min. 19 mm solid timber cladding according to EN 14519 / EN 15146 class A and SN/TS 3186	
Internal cladding	Min. 15 mm solid wood panelling according to EN 14519 class A	
Fastener products		
Nails and screws	Nails and screws according to EN 14592. Type and dimensions for load bearing applications in accordance with individual structural design. Corrosion protection shall be equivalent to hot dip zinc coating according to EN ISO 1461 for exterior applications, and equivalent to zinc coating according to ISO 2081 for interior applications.	X
Glue and sealings for sheathing	- Casco SuperFix SMP - Casco MultiSeal	

Table 2
Massive Wood Construction elements
Specifications of standard supplementary materials installed on site. These materials are not included in the approval but are assessed regarding health and environmental properties.

Material / component	Specification (Dimensions not specified in the table shall be as stated in the "Standard construction details" or according to design specifications worked out for each individual delivery or project)	CE-marked
Supplementary components installen on site		
Floor boards	- Solid wood plank - Solid wood (pine, oak, birch, alder, elm and ash) Södra Interiör AB	X
Reinforced Self Levelling Compound	- Mira 6700 cemplan - Mira X Plan	X
Liquid membrane	- Mira 4400 multicoat	
Tile adhesive	- Cementitious tile adhesive, Mira 3100 unifix	
Roof membrane	- Protan roof covering according to SINTEF Technical Approval 2010	X

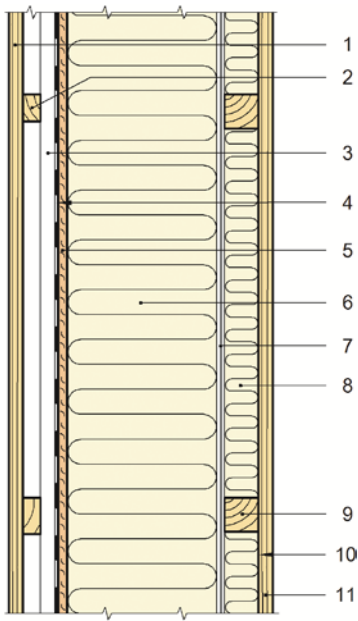


Fig.2. Shows the principle design of standard external wall with vertical wood cladding.

1	Outside vertical wood cladding	6	Studs 45x195/145 cc 600mm. Mineral wool 195/145mm
2	Horizontal battens 28x45 mm c/c 600 mm	7	Moisture barrier
3	Vertical battens 18/24x45 mm c/c 600mm	8	Mineral wool 45mm
4	Wind barrier lining	9	Horizontal battens 45x45 mm c/c 400mm
5	Wind barrier board	10	Dust barrier
		11	Vertical inside wood panelling

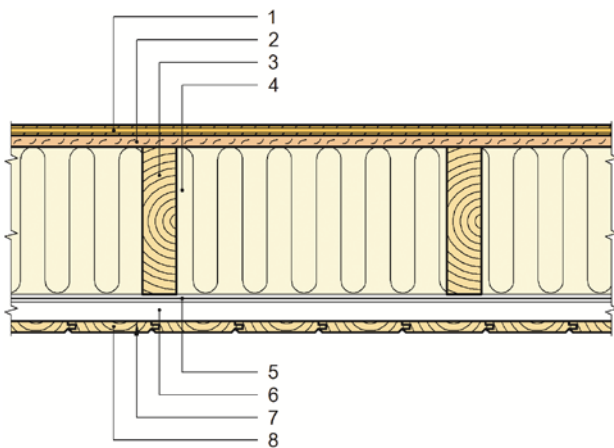


Fig.3. Shows the principle design of standard floor construction between stories.

1	Floor boards	5	Dust barrier
2	OSB 18mm	6	Battens 25/45x45 c/c 400mm
3	Wood beams 45x245/195/145 c/c 400mm	7	Surface treatment
4	Mineral wool 245/195/ 145	8	Ceiling panelling

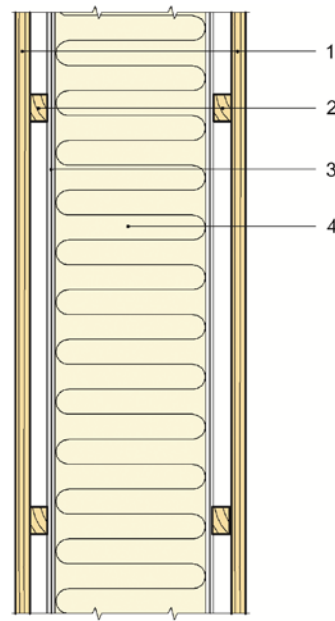


Fig.4. Shows the principle design of standard internal wall.

1	Vertical cladding	3	Studs 45x195/145/95 cc 600mm. Mineral wool 195/145/95 mm
2	Horizontal battens 25x45 mm c/c 400 mm	4	Vertical cladding

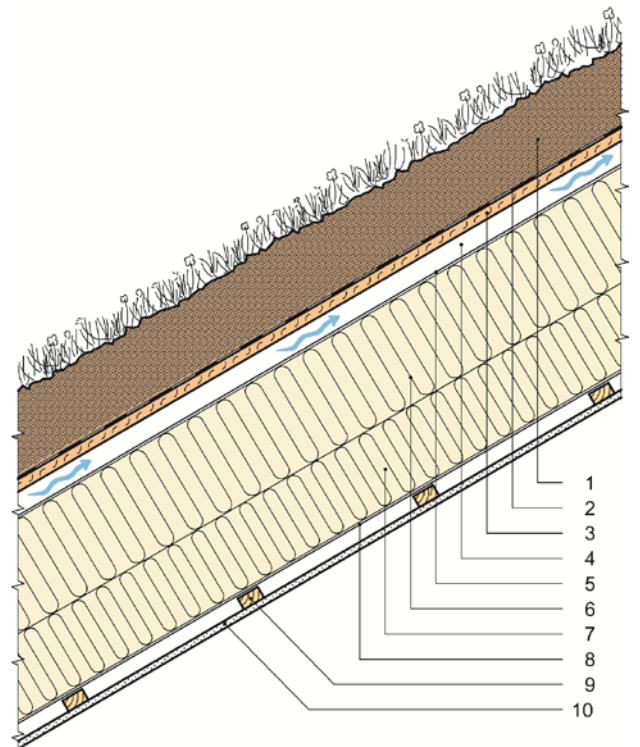


Fig. 5 shows the principle design of the roof.

1	Roof turf 150mm ¹⁾	6	Mineral wool 340mm
2	Bitumen membrane ¹⁾	7	Rafters 45x195mm + 45x145mm c/c 600mm
3	OSB 22mm	8	Vapor barrier
4	Air gap. Battens 70x45mm	9	Battens 25/45x45mm c/c 400mm
5	Diffusion membrane	10	Ceiling cladding

¹⁾ Fitted on site.

2.5 Construction details

Detailed element construction design and the principle design of connections between elements as described in "Standard Construction Details for Massive Wood Construction elements belonging to SINTEF Technical Approval No. 20481". The version of the construction details filed at SINTEF at any time is a formal part of the approval.

Table 3
Massive Wood Construction elements – Fire resistance

Buildingpart	Fire resistance equivalent to
External wall See fig. 1 and 2	EI 30 ¹⁾
Roof See fig. 5	EI 30 ¹⁾

¹⁾ One sided fire exposure from the inside

3. Fields of application

Massive Wood Construction elements can be used in assembling single occupancy houses in two stories, restricted to fire class of 1 according to the provisions of the regulation on technical requirements for building works (TEK).

The layout and building size is determined and designed for each individual project, in accordance with the case to case design of structural capacity and resistance to fire. The elements may also be used for other type of buildings, providing the performance requirements for the building are assessed in relation to the declared performance of the elements.

4. Properties

4.1 Load-carrying capacity

The mechanical resistance and stability of all structural components are calculated in full for each building project. Each element is dimensioned using NS-EN 1995-1-1 with national annex NA, and NS-EN 1991-1-1, 3 and 4 with national annexes NA for imposed loads, snow loads and wind loads.

For ordinary low rise houses with one or two stories the horizontal racking resistance may be regarded as acceptable without additional structural design calculations.

4.2 Fire resistance

Fire resistance as given in table 2 may be applied for the element constructions with minimum material, component dimensions and mechanical fasteners as specified in chap. 2 and in "Standard Construction Details".

4.3 Reaction to fire

Internal wood cladding is classified as D-s2, d0 according to EN 13501-1.

External wood cladding is classified as D-s2, d0 according to EN 13501-1.

Mineral wool shall be class A1 according to EN 13501-1.

4.4 Thermal insulation

Table 3 shows thermal transmittance values, U-values, for standard elements described in chapter 2. Thermal loss due to extra timber used around door- and window openings, are not included.

Table 4
U-values for Massive Wood Construction elements

Structure	Total thermal insulation thickness mm	U-value W/m ² K
External walls according to fig. 1 and 2	240mm	0,19
	190mm	0,23
Roof according to fig. 5	340	0,13

5. Environmental aspects

5.1 Substances hazardous to health and environment

The product is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health.

5.2 Effect on indoor environment

The product is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health.

5.3 Effect on soil, surface water and ground water

The leaching properties of the product are evaluated to have no negative effects on soil or ground water.

5.4 Handling of waste

The product shall be sorted as wood, metal, gypsum, residual waste or other appropriate waste fractions on the building/demolition site. The product shall be delivered to an authorized waste treatment plant for material recovery, energy recovery or disposal.

5.5 Environmental product declaration

No environmental declaration (EPD) has been worked out for the product.

6. Special conditions for use and installation

6.1 Design considerations in general

The production and delivery of elements is based on a structural design fulfilling requirements for fire resistance, and thermal insulation for each individual building. The requirements and necessary design calculations shall be available before production and delivery of the elements.

6.2 Structural design

The production of each building is based on a full structural design for floors construction, load-bearing walls and roof.

The structural design of the building includes vertical and horizontal load capacity, anchoring to the foundations, wind anchoring and the roof structure, beams over structural wall openings.

6.3 Fire resistance design

The production of each element shall be based on a full structural fire design applicable to the overall fire design requirements for the complete building. This includes all fire resistance performance not covered by the performance listed in chapter 4.2 and table 2.

6.4 Thermal insulation design

For each project using elements according to this approval the design and production shall be based on the required maximum thermal resistance and transmittance for the complete building.

6.5 Foundations

The elements shall be installed on foundations designed according to the principles shown in SINTEF Building Research Design Guide 521.203. Moisture transport from the foundation to the building elements shall be prevented by a capillary breaking layer. The elements shall be installed on a foundation which satisfies the manufacturer's requirements regarding dimensions and level tolerances.

6.6 Installation in general

The elements shall be installed and connected according to the details shown in "*Standard Construction Details for Massive Wood Construction elements belonging to SINTEF Technical Approval No. 20481*" as long as no specific installation details have been worked out for each individual project.

Installation of ducts, pipes and cables for technical services, including special installation shafts, shall be sealed at every penetration of building structures according to specifications worked out for each particular project. The sealing shall provide necessary fire resistance performance if required.

6.7 Roof construction

The roof construction shall be specified individually for each specific project in accordance with the principles in SINTEF Building Research Design Guide No. 544.803.

6.8 Transport and storage

The elements shall be protected from precipitation during transportation and storage using watertight materials. Before and during assembly of elements to a building, the elements must be stored in a dry environment and protected from precipitation.

7. Factory production control

The product is produced by

UAB Massive Wood Construction
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LT-76128 Siauliai
Lithuania
(Litauen)

The holder of the approval is responsible for the factory production control in order to ensure that the product is produced in accordance with the preconditions applying to this approval.

The manufacturing of the product is subject to continuous surveillance of the factory production control in accordance with the contract regarding SINTEF Technical Approval.

8. Basis for the approval

The approval is based on an assessment of the standard construction details, and the verification of construction performances according to the following documents:

- SINTEF Building Research Design Guide No. 471.011/471.013/471.401 (thermal insulation)
- SINTEF Building Research Design Guide No. 522.351 (joists, dimensions)
- SINTEF Building Research Design Guide No. 544.803 (roof)
- SINTEF Building Research Design Guide No. 523.701 (Inserting window in timber frame walls)
- Obtainment of health and environmental data – Evaluation report dated 11.05.2016.

9. Marking

Each delivery must be accompanied by documents comprising as a minimum the manufacturer's name and address, project identification, time and date of manufacture, assembly instructions, as well as specific construction details and assembly instructions that comply with the "*Standard construction details for Massive Wood Construction Building System belonging to SINTEF Technical Approval TG 20481*". The approval mark for SINTEF Technical Approval No. 20481 may also be used.



Approval mark

10. Liability

The holder/manufacture has sole product responsibility according to existing law. Claims resulting from the use of

the product cannot be brought against SINTEF beyond the provisions of Norwegian Standard NS 8402.

for SINTEF Building and Infrastructure



Marius Kvalvik
Approval Manager