



SINTEF Certification

No. 20154

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SINTEF Building and Infrastructure confirms that

Merwood AS timber frame building elements

meets the provisions regarding product documentation given in Norwegian building regulations, with properties, fields of application and conditions as stated in this document

1. Holder of the approval

Merwood AS Kaseküla 14 EE-61007 Elva Estonia www.merwood.eu

2. Manufacturer

Merwood AS, 61007 Elva, Estonia

3. Product description

3.1 General

Merwood AS timber frame building elements are prefabricated wall, floor and roof elements based on wood. The production is customized for each individual building project.

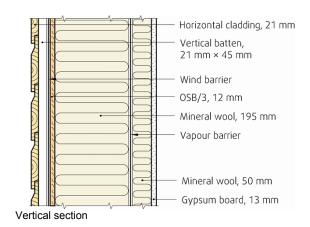
This approval covers the standard design of the structural components, i.e. walls, floors and roof, manufactured in the factory. Specifications of materials and components used in the building elements are shown in Table 1.

The approval does not cover surfaces, windows, doors or other supplementary building parts. Bathroom and wet room designs are neither covered by the approval.

All elements are based on studs, joists and rafters spaced c/c 600 mm.

3.2 External walls

Fig. 1 shows the principle design of load external walls. The wall elements are storey-high, and with lengths adapted to the individual house. External cladding may also be installed vertically on 36 mm x 45 mm horizontal battens.



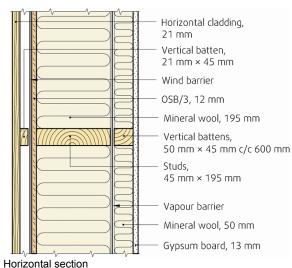


Fig. 1
Principle design of standard external wall with horizontal timber cladding. Vapour barrier and internal battens with gypsum lining are installed on site.

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Reference: Appr. 3D1238.01 Contr. 3B0748.01 Subject: Timber frame building elements

Table 1
Merwood AS timber frame building elements.
Material and component specifications

Material and component	specifications
Material / component	Specifications (None-specified material dimensions shall be in accordance with the specifications worked out separately for each delivery)
Timber members and sheat	thing
Timber members in walls, floors and roof	Untreated structural timber graded to strength class C24, C18, C16 according to EN 338 / EN 14081, or in accordance with specific calculations. Environmental properties shall be documented in accordance to Prodok matrice 017.
Glue laminated beams	Strenght class GL 28c according to EN 1194. Environmental properties shall be documented in accordance to Prodok matrice 017.
Subfloor	22 mm particleboard P5 with tongue and groove in accordance with EN 13986. Formaldehyde class E1. The boards shall be tested for floor application and fulfill the requirements according to EN 12871.
Roof sheathing	18 mm OSB/3 with tongue and groove in accordance with EN 13986. Formaldehyde class E1. Environmental properties shall be documented in accordance to Prodok matrice 024.
Floor sheathing towards foundation	8 mm OSB/3 with tongue and groove in accordance with EN 13986. Formaldehyde class E1. Environmental properties shall be documented in accordance to Prodok matrice 024.
Wall sheathing	12 mm OSB/3 with tongue and groove in accordance with EN 13986. Formaldehyde class E1. Environmental properties shall be documented in accordance to Prodok matrice 024.
Insulation materials	
Thermal insulation	Mineral wool insulation in accordance with EN 13162, with declared thermal conductivity $\lambda_D \leq 0.036$ W/mK. Density ≥ 13 kg/m³ for glass wool and ≥ 27 kg/m³ for rock wool. Mineral wool in floor elements over foundations shall have declared thermal conductivity $\lambda_D \leq 0.036$ W/mK Environmental properties shall be documented in accordance to Prodok matrice 001.
Impact sound floor insulation	30 mm Isover Flo mineral wool in accordance with EN 13162. Compression strength determined for each individual building project. Environmental properties shall be documented in accordance to Prodok matrice 001.
Membranes and barriers	
Vapour barrier (Water vapour control layer)	Min. 0.15 mm polyethylene film or similar product according to EN 13984 with water vapour resistance $s_d > 90$ m according to EN ISO 12572. Environmental properties shall be documented in accordance to Prodok matrice 008.
Wind barrier	Roll product wind barrier according to EN 13859-1 and 2 with water vapour resistance s _d < 0.1 m. Environmental properties shall be documented in accordance to Prodok matrice 004.
Combined wind barrier and roof underlay	Roof underlay according to EN 13859-1 and 2. Environmental properties shall be documented in accordance to Prodok matrice 004.
Roof underlay	Roof underlay according to EN 13956. Environmental properties shall be documented in accordance to Prodok matrice 010.
Fasteners	
Mechanical fasteners and connectors	Mechanical fasteners in conformity with CE marking according to EN 14592. Mechanical fasteners and connectors for external use shall be protected by hot dip galvanization or have equivalent protection against corrosion.
Glue for floor and wall sheathing	Class D3 PVAc glue according to EN 204
Acoustic profiles	Gyproc acoustic profiles, height 25 mm
Claddings and linings	
External cladding	Min 21 mm timber cladding with quality equivalent to EN 15146 or SN/TS 3186. Environmental properties shall be documented in accordance to Prodok matrice 019.
Internal lining	- 12,5 mm gypsum board type A according to EN 520, density > 600 kg/m³ - 15 mm gypsum board type DF according to EN 520, density > 600 kg/m³ Environmental properties shall be documented in accordance to Prodok matrice 014.
Windows/doors	
	Windows and doors installed in the elements are not part of this approval, but must comply with thermal insulation and tightness requirements as indicated in the Regulations on technical requirements for building works (TEK).
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3 3 Internal walls

Fig. 2 shows the principle design of internal walls. The wall elements are storey-high, and with lengths adapted to the individual house. Linings at corners and wall element connections are installed on site.



Fig. 2
Principle design of standard walls.
Non-loadbearing walls have 45 mm x 70 mm studs and load-bearing walls 45 mm x 145 mm studs.

3.4 Separating walls between housing units

Fig. 3 shows the principle design of walls between separate housing units. The wall consists of two timber frame constructions separated by a free distance of minimum 30 mm. Linings at corners and wall element connections are installed on site.

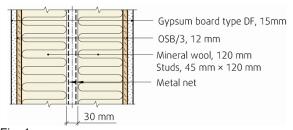


Fig. 1
Principle design of separating walls between housing units.

3.5 Floors inside the same housing unit

Fig. 4 shows the principle design of suspended floors within the same housing unit. Ceiling is installed on site.

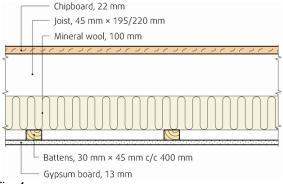


Fig. 4
Principle design of floors within a housing unit.

3.6 Suspended ground floors

Fig. 5 shows the principle design of floors above open foundations or foundations with crawl space.

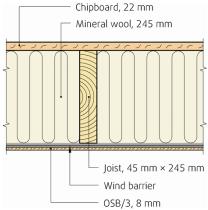


Fig. 2 Principle design of suspended ground floors over crawl space or open foundations.

3.7 Separating floors between housing units

Fig. 6 shows the principle design of suspended floors between separate housing units.

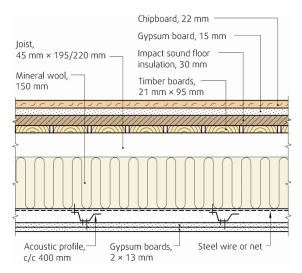


Fig. 6
Principle design of floors between separate housing

3.8 Roof elements

Fig. 7 shows the principle design of roof elements. Additional timber members are connected to the rafters in order to obtain a height of 340 mm, and a total thermal insulation thickness of 390 mm including the layer below the vapour barrier. The roofing material may be metal sheets or ceramic tiles. Roof elements are also produced with roof sheathing for roll formed roofing products.

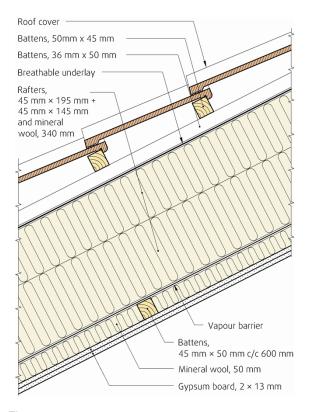


Fig. 7
Principle design of roof elements

3.9 Construction details in general

The detailed design of the element construction is described in the document "Standard Construction Details for Merwood AS timber frame building elementes belonging to SINTEF Technical Approval No. 20154". The version of the construction details which at any time is filed by SINTEF Building and Infrastructure is a formal part of the approval.

4. Fields of application

The intended use of Merwood AS timber frame building elements is primarily family houses and cabins with maximum two floors. The elements may also be used for other types of buildings, providing the performance requirements for the buildings are assessed in relation to the declared performance of the building elements. See also the special conditions for use and installation in chapter 7.

5. Properties

5.1 Load bearing capacity

The mechanical resistance and stability of all structural components is calculated and verified case by case for each individual building element and project according to EN 1995-1-1 with national appendix NA.

For low rise houses in one and two stories Merwood AS timber frame building elements the horizontal stability is considered sufficient for all normal house constructions.

In houses with particularly short external walls the wind bracing should nevertheless be controlled.

5.2 Fire resistance

External walls, load bearing internal walls and separating walls between house units, with principle design as shown in fig. 1-3, can be used where fire resistance REI30 is required in TEK. The condition is a vertical design wall load of maximum 15 kN/m, when no special structural design according to EN 1995-1-2 with national annex NA is done in each individual case.

Floors constructions shown in fig. 4 and 5 can be used where fire resistance R15 is required in TEK. Separating floors between housing units as shown in fig. 6 can be used where fire resistance REI30 is required in TEK.

Roof construction with principle design as shown in fig. 7 can be used where fire resistance REI30 is required. Load bearing capacity in the case of fire must then be determined in each individual case according to EN 1995-1-2.

5.3 Sound insulation

With elements for separation between housing units as described in chap. 3 and in "Standard Construction Details for Merwood AS timber frame building elementes belonging to SINTEF Technical Approval No. 20154", the expected sound insulation performance for assembled buildings according to EN ISO 140-4 and EN ISO 717-1 and -2 is given in Table 2. This meets the requirements for insulation class C in NS 8175. The sound insulation in completed house constructions does also depend on the installation of pipes, ducts and electrical cables.

Table 2
Expected sound insulation in completed houses

Structure	Estimated R` _w	Estimated L`w
Separating walls between housing units	≥ 55 dB	-
Separating floors between housing units	≥ 55 dB	≤ 53 dB

5.4 Thermal insulation

Table 3 shows the thermal transmittance values, U-values for Merwood AS timber frame building elements, calculated according to EN ISO 6946 and EN ISO 13370. The normalized thermal bridge value of 0.03 W/m²K can be applied for calculating the total heat loss of a house, providing no specific calculations are made in each individual case.

Table 3 Thermal transmittance, U-value

Structure	Mineral wool, λ_D W/(mK)	U-value W/(m² K)
External wall, total insulation thickness 245 mm	0,036	0,18
Ground floor, total insulation thickness 245 mm	0,034	0,15
Roof, total insulation thickness 390 mm	0,036	0,11

6. Environmental aspects

6.1 Effect on indoor environment

The elements are 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.

6.2 Environmental declaration

No environmental declaration according to the standard ISO 21930 have been worked out for Merwood AS timber frame building elements.

6.3 Substances hazardous to health and environment

The elements contain no hazardous substances with priority in quantities that pose any increased risk for human health and environment. Chemicals with priority include CMR, PBT and vPvB substances.

6.4 Effect on soil, surface water and ground water Leaching from the elements are assessed to have no negative effects on soil, ground water or drinking water.

6.5 Waste treatment/recycling

Wood, metals and other materials and mixed waste shall be sorted on the building site during demolition, and delivered to an authorized waste treatment plant for material and energy recovery.

7. Special conditions for use and installation

7.1 Design requirements in general

The production and delivery of each building element shall be based on a structural design, fire resistance, reaction to fire, sound insulation and thermal insulation determined for each individual building project. The design documents shall be available before production and deliverance of the building elements.

7.2 Structural design

The production of each building element shall be based on a full static calculation and structural

design according to EN 1995-1-1 and relevant loads according to EN 1991-1 with the national annexes NA for Norway. The mechanical resistant and stability must include vertical and horizontal load capacity, and wind anchoring between elements and to the foundations.

Suspended floors shall be designed according to the stiffness requirements given in SINTEF Building Research Design Guide No. 522.351.

7.3 Fire resistance design

The mechanical resistance and stability of load bearing elements in case of fire shall be checked for every building element delivery. When the fire resistance performance stated in cl. 5.2 is not sufficient, necessary action must be taken in order to fulfil the required fire resistance. This may be done by calculation according to EN 1995-1-2 or by testing, with accompanying documentation made availble.

7.4 Thermal insulation design

The required energy efficiency according to TEK shall be determined for each individual house delivery, and the thermal insulation performance of the elements shall be designed according to this.

7.5 Foundations

The timber frame building elements shall be installed on foundations according to the principles shown in SINTEF Building Research Design Guide No. 521.203. Moisture transport from the foundations to the building elements shall be prevented by a capillarity breaking layer, and the moisture content in the air space beneath suspended ground floors must be kept sufficiently low.

7.6 Installation in general

The building elements shall be installed and connected according to the details shown in "Standard Construction Details for Merwood AS timber frame building elements belonging to SINTEF Technical Approval No. 20154". Joints between wall elements shall be sealed with clamped overlap joints of the water vapour barrier inside and the wind barrier outside. The elements shall be anchored according to a specific description worked out for each individual project.

7.7 Roof construction

When the roof over the building elements is not delivered as prefabricated elements a roof construction assembled on site shall be designed according to the principles shown in the SINTEF Building Research Design Guides, and with roofing system adapted to the local climatic conditions.

7.8 Transport and storage

The building elements shall be protected against precipitation with a watertight cover under transport and storage, until they are covered by a permanent roofing. The elements must be placed on a dry and level base during transport and storage.

It is important for the element design to minimize the need for drying out excessive moisture from the timber components and OSB panels. The moisture content must be kept permanently low, and the elements must not be exposed to free water during production, transport, storage and installation.

8. Factory production control

Merwood AS timber framed building elements are subject to supervisory factory production and product control according to the contract between SINTEF Building and Infrastructure and Merwood AS concerning Technical Approval.

9. Basis for the approval

The approval is based on an assessment of the standard construction details and material and component specifications. The construction performances are based on reference to the following documents:

- SINTEF Building Research Design Guides No. 471.010 471.013 (thermal insulation)
- SINTEF Building Research Design Guides No. 520.321 and 520.322 (fire resistance)
- SINTEF Building Research Design Guides No. 522.511 and 524.325 (sound insulation)

10. Marking

Each delivery shall be accompanied by documents comprising at a minimum the manufacturer's name and address, project identification, and specific installation instructions for each delivery that comply with the "Standard construction details for Merwood AS timber frame building elements belonging to SINTEF Technical Approval TG 20154".

The approval mark for SINTEF Technical Approval No. 20154 may also be used.



Approval mark

11. Liability

The holder/manufacturer 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

12. Technical management

Project manager for this approval is Johan Gåsbakk, SINTEF Building and Infrastructure, dep. Buildings and installations, Oslo.

for SINTEF Building and Infrastructure

Ham Boye Shogston

Hans Boye Skogstad Approval Manager