

SINTEF Building and Infrastructure confirms that

Unihouse timber frame building elements

has 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

Unihouse S.A.
 ul. Rejonowa 5
 17-100 Bielsk Podlaski, Poland
www.unihouse.pl

2. Product description

2.1 General

Unihouse timber frame building elements are pre-designed building kits containing walls, floors and roof structure. The kits are prepared in the factory for each individual building, delivered as a package, and assembled on site.

The approval covers the standard design of the structural components; 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 internal surface materials, windows and doors and other supplementary building parts. Constructions to bathroom and wet room design is not a part of the approval.

2.2 External walls

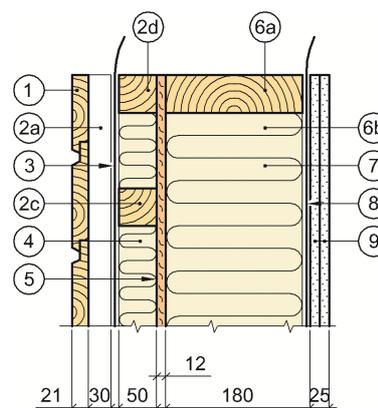
Figures 1 – 4 show the principle designs of external walls. The wall height is normally adapted to 2.5 m room height. Maximum height of the wall elements are 3.0 m. Maximum length is 16.0 m.

2.3 Internal walls

Figures 5 and 6 show the principle designs of internal walls and separating walls between housing units. The wall height is normally adapted to 2.5 m room height.

2.4 Floors

Figures 7 – 10 show the principle designs of suspended ground floors and separating floors. The structures are based on floor joists spaced c/c 600 mm, with dimensions and spans according to SINTEF Building research guide 522.351 or SINTEF Technical Approval for the relevant



Vertical section

1	Timber cladding	5	12 mm OSB/3 board
2a	30x50 mm battens	6a	50x180 mm top plate
2c	50x50 mm battens	6b	50x180 mm studs c/c 600 mm
2d	50x50 mm battens	7	Rock wool 180 mm
3	Wind barrier	8	Vapour barrier
4	Rock wool 50 mm	9	12.5 mm gypsum board type A or DF

Fig. 1
 Principle design of standard external walls with horizontal timber cladding.

type of joists.

Floor coverings and ceilings are installed on site.

In bathroom floors, slopes to a drain are built on site.

2.5 Roof

Fig. 11 shows the principle design of roof structure. Rafters are structural grade timber with dimensions 60 mm x 240 mm, glued laminated timber or I-beams.

2.6 Construction details

The detailed element construction design is described in "Standard Construction Details for Unihouse belonging to SINTEF Technical Approval No. 20014". The version of the construction details filed at SINTEF at any time is a formal part of the approval.

SINTEF is the Norwegian member of European Organisation for Technical Assessment, EOTA, and European Union of Agrément, UEAtc

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3. Fields of application

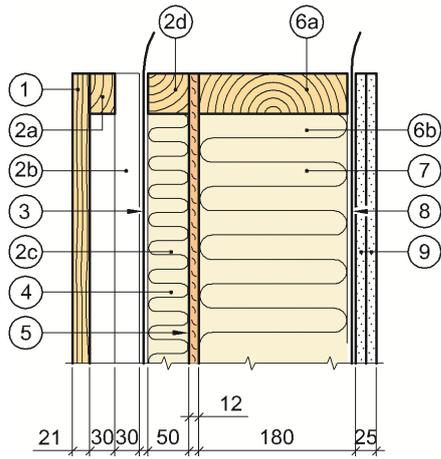
Unihouse timber frame building elements can be used for low- and multi-storey housing in fire class 1 and 2 according to the provisions of the Regulation on technical requirements for building works (TEK). For use in fire class 3 a comprehensive fire design analysis must be performed.

The building elements may also be used for other type of buildings, providing the performance requirements for the buildings are assessed in relation to the declared performance of the building elements.

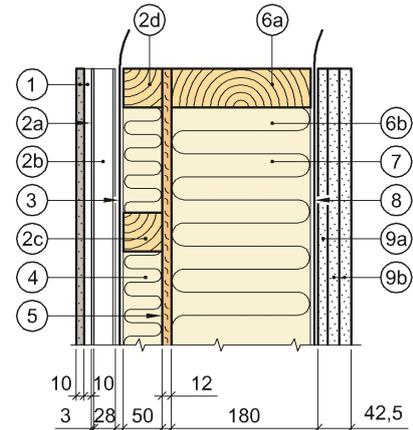
Table 1

Unihouse building elements – Material and component specifications

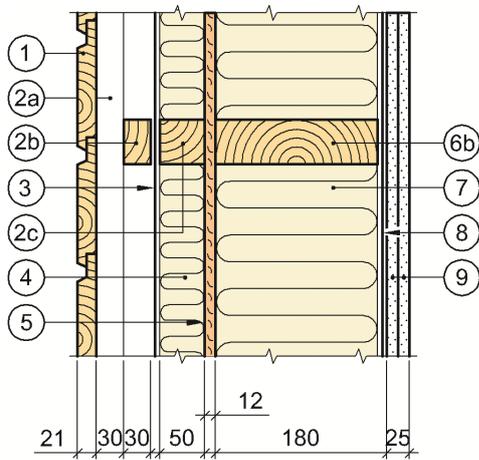
Material / component	Specification (Dimensions not specified in the table shall be as stated in the "Standard construction details" or according to design specifications worked out for each individual delivery or project)	CE -marking
Structural components		
Timber components in floors, walls and roof	Structural grade timber class C 16 according to NS-EN 338 / NS-EN 14081 in general Structural grade timber class C 24 according to NS-EN 338 / NS-EN 14081 or glued laminated timber according to NS-EN 14080 in studs, joists, beams and other applications as specified in the structural design calculations Moisture content $\leq 18\%$	x
	Steico I-joists SJ 60, according to ETA 06/0238	
	Steico LVL R and Steico wall, according to NS-EN 14374	
Sheathing		
Floor sheathing and underlay	22 mm t&g OSB boards class OSB/3 floor according to NS-EN 13986, formaldehyde class E1 12 mm boards class OSB/3 floor according to NS-EN 13986, formaldehyde class E1 4 mm - 12 mm soft fibreboard class SB E1 according to NS-EN 13986 / EN 622-4 Fermacell gypsum fibreboard, according to ETA 03/0006 and ETA 03/0050	x
Internal wall sheathing	12 mm OSB boards class OSB/3 according to NS-EN 13986, formaldehyde class E1	x
External wall sheathing	12 mm OSB boards class OSB/3 according to NS-EN 13986, formaldehyde class E1	x
Plywood - various applications	Plywood according to NS-EN 13896, formaldehyde class E1	x
Thermal insulation materials		
Mineral wool between studs, joists and trusses	Rockwool according to EN 13162 with declared thermal conductivity $\lambda_D \leq 0.037$ W/(mK)	x
Membranes and barriers		
Water vapour control layers	0.2 mm polyethylene film with verified resistance to thermal aging according to EN 13984 RaniMoBar according to SINTEF Technical Approval 20201	x
Windbarrier	Dörken Delta Vent according to NS-EN 13859-1 or NS-EN 13859-2	x
Combined roofing underlay	Dörken Delta Vent N, resistance to water penetration class W1, vapour resistance $S_d < 0,02$ m, according to NS-EN 13859-1	x
Claddings and linings		
External timber cladding	Min. 19 mm solid timber cladding according to NS-EN 14519 and quality equivalent SN/TS 3186 class 1	x
External fibre cement boards	Cembrit fibre-cement flat boards type NT according to NS-EN 12467 and SINTEF Technical Approval 20085	x
Internal lining	Gyproc, Rigips or Siniat gypsum boards, 12.5 mm type A and 12.5/15 mm type DF, according to NS-EN 520	x
Fastener products		
Nails and screws	Nails and screws according to NS-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 NS-EN ISO 1461 for exterior applications, and equivalent to zinc coating according to ISO 2081 for interior applications.	x
Three-dimensional nailing plates (joist hangers)	Simpson Strong-Tie joist hangers, CE-marked according to ETA 04/0042, ETA 06/0034 and ETA 07/0043.	x
Glue for floor sheathing installation	Kestopur 200/40 Polyurethane adhesive	
Tape	SIGA tape according to SINTEF Technical Approval 20134 Tyvek tape according to SINTEF Technical Approval 2601	



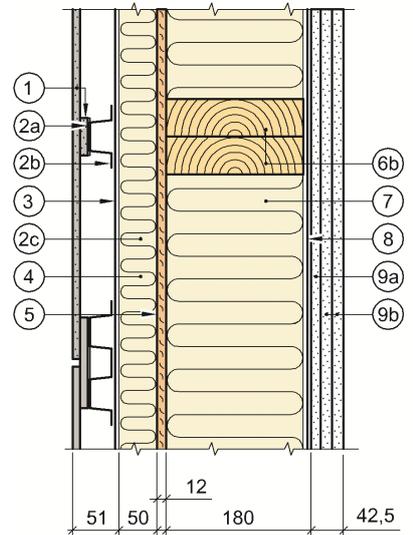
Vertical section



Vertical section



Horizontal section



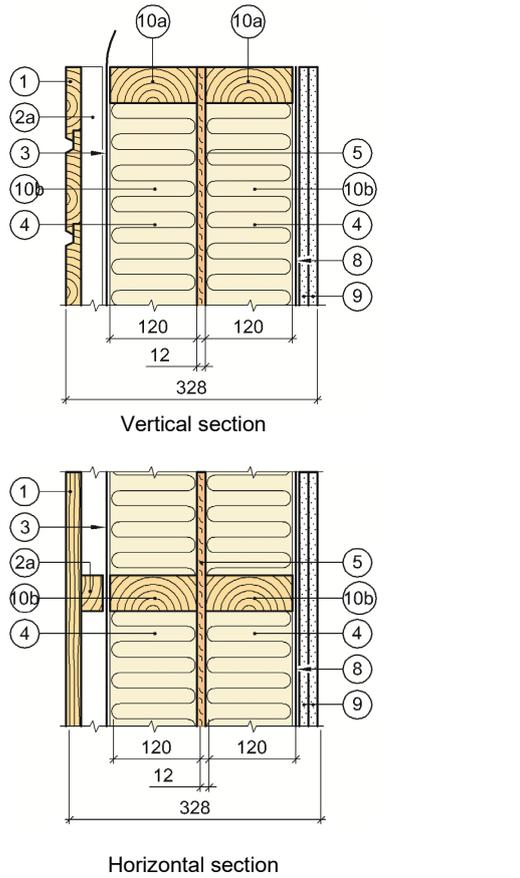
Horizontal section

1	Timber cladding	5	12 mm OSB/3 board
2a	30x50 mm battens	6a	50x180 mm top plate
2b	30x50 mm battens	6b	50x180 mm studs c/c 600 mm
2c	50x50 mm battens	7	Rock wool 180 mm
2d	50x50 mm battens	8	Water vapour control layer
3	Wind barrier	9	12.5 mm gypsum board type DF
4	Rock wool 50 mm		

1	Fibre-cement board	5	12 mm OSB/3 board
2a	EPDM washer	6a	50x180 mm top plate
2b	Steel battens	6b	50x180 mm studs c/c 600 mm
2c	Battens 50x50 mm	7	Rock wool 180 mm
2d	Battens 50x50 mm	8	Water vapour control layer
3	Wind barrier	9a	12.5 mm Gypsum board DF
4	Rock wool 50 mm	9b	15 mm Gypsum board DF

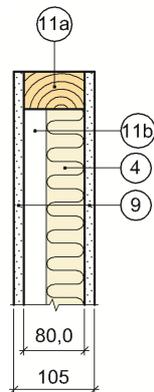
Fig. 2
Principle design of standard external walls with vertical timber cladding.
Extra vertical 50 mm x 50 mm battens may be added on the inside or 50 mm x 50 mm horizontal battens may be added on the outside of the studs to increase thermal insulation thickness.

Fig. 3
Principle design of external walls with fibre-cement boards and improved fire resistance.



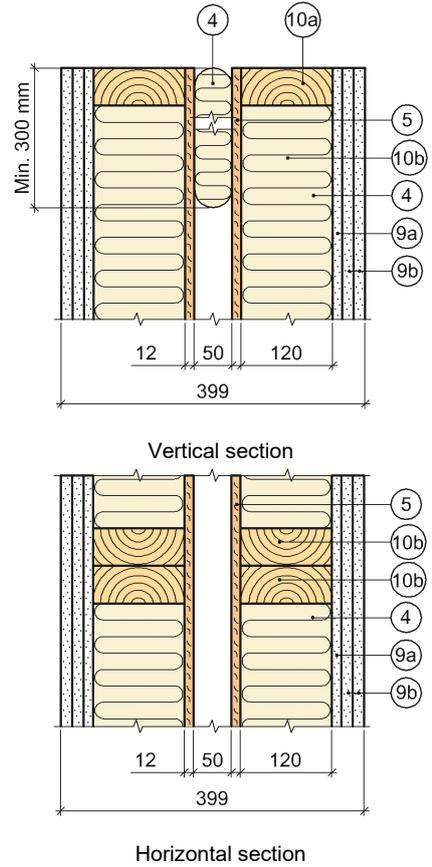
1	Timber cladding	8	Vapour barrier
2a	30x50 mm battens	9	12.5 mm gypsum board type DF
3	Wind barrier	10a	50 x 120 mm top plate
4	Rock wool 120 mm	10b	50 x 120mm studs c/c 600 mm
5	12 mm OSB/3 board		

Fig. 4
Principle design of standard external walls with horizontal timber cladding.
Extra horizontal 50 mm x 50 mm battens may be added on the inside or the outside of the studs to increase thermal insulation thickness.



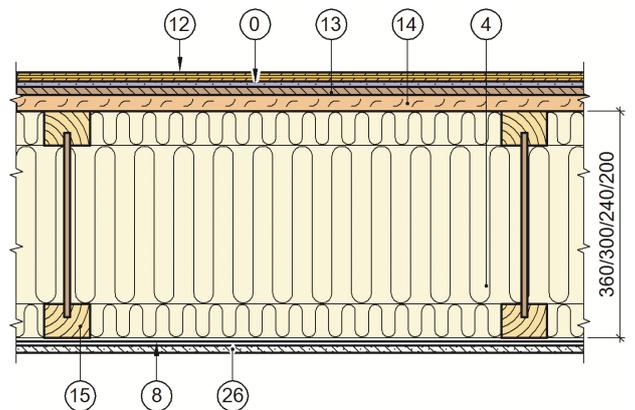
4	Rock wool 50 mm	11a	50 x 80 mm top plate
9	12.5 mm gypsum board type A	11b	50 x 80 mm studs c/c 600 mm

Fig. 5
Principle design of internal walls



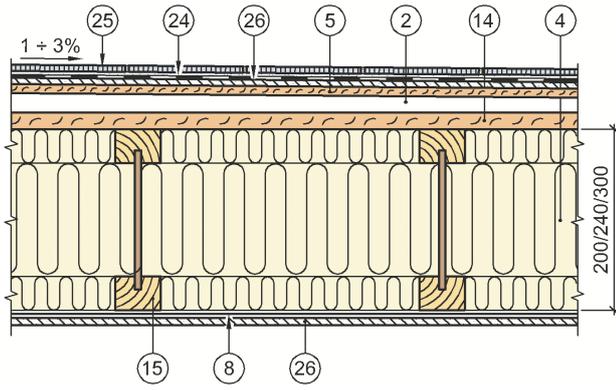
4	Rock wool	9b	15 mm gypsum board type DF
5	12 mm OSB/3 board	10a	50 x 120 mm top plate
9a	12.5 mm gypsum board type DF	10b	50 x 120 mm studs c/c 600 mm

Fig. 6
Principle design of separating walls between housing units with improved fire resistance.
The number and type of gypsum boards and double studs are applied according to table 2 in order to meet fire resistance requirements.



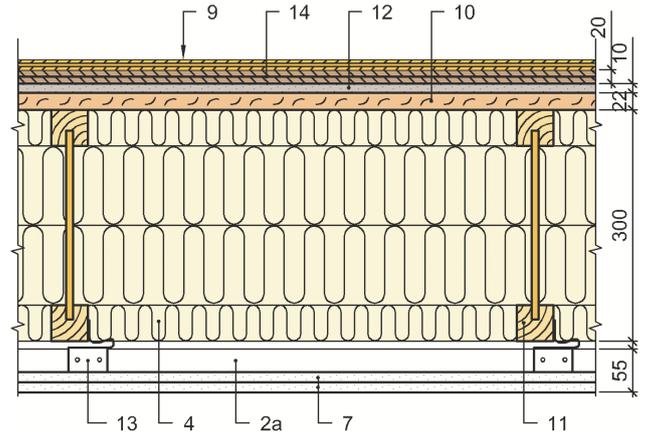
0	7 mm underlay fibreboard	13	11 mm soft fibreboard
4	Rock wool	14	22 mm OSB/3 board
8	Wind barrier	15	Steico I-joists
12	Parquet or stiff flooring material	26	10 mm Fermacell board

Fig. 7
Principle design of suspended ground floor.



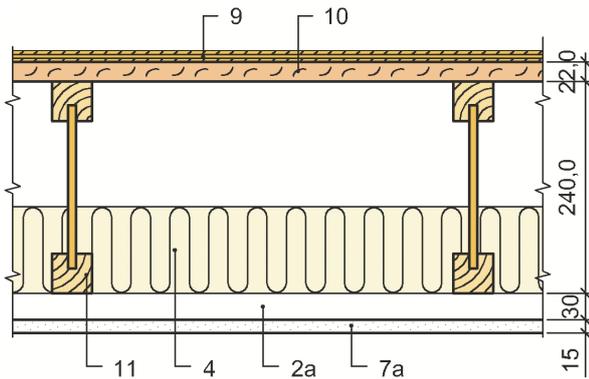
2	Sloped timber battens	15	Steico I-joists c/c max. 400 mm
4	Rock wool	24	Waterproofing membrane
5	12 mm OSB/3 board	25	Floor tiles
8	Wind barrier	26	10 mm Fermacell board
14	22 mm OSB/3 board		

Fig. 8
Principle design of bathroom floor.



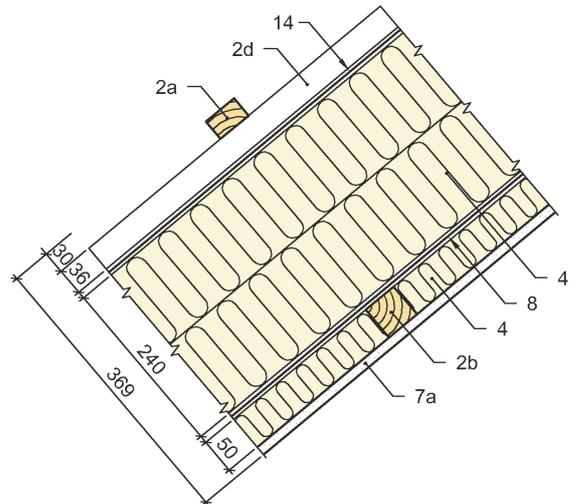
2a	30x50 mm battens c/c 600 mm	11	Steico I-joists c/c max 400 mm
4	Rock wool 300mm	12	10 mm soft fibreboard
7	12,5 mm gypsum board type A or DF	13	Glava Hanger type B or D
9	Parquet or stiff flooring material	14	10 mm Fermacell board
10	22 mm OSB/3 board - flooring		

Fig. 10
Principle design of separating floors between housing units



2a	30x50 mm battens c/c 600 mm	9	Parquet or stiff flooring material
4	Rock wool 100 mm	10	22 mm OSB/3 board - flooring
7a	15 mm gypsum board type DF	11	Steico I-joists

Fig. 9
Principle design of floors inside the same housing unit



2a	30x50 mm battens	7a	12.5 mm gypsum board type F
2b	50x50 mm battens c/c 600 mm	8	Vapour barrier
2d	36x50 mm battens c/c 600 mm	14	Combined roofing underlay
4	Rock wool		

Fig. 11
Principle design of roofs

4. Properties

4.1 Load bearing capacity

The mechanical resistance and stability of all structural components are calculated case by case in full for each building project according to EN 1995-1-1 and EN 1991 with the national annex NA for Norway.

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

4.2 Fire resistance

The maximum load-bearing capacity during fire is calculated case by case according to EN 1995-1-2 with national annex NA.

Fire resistance and load-bearing capacity after fire exposure as given in table 2 may be applied for the building elements constructions with minimum material, component dimensions and mechanical fasteners as specified in chap. 3 and in "Standard Construction Details".

4.3 Reaction to fire

Internal gypsum boards linings and external fibre cement board linings are classified as A2-s1,d0 according to EN 13501-1. External timber claddings are classified as D-s2, d0 according to EN 13501-1.

4.4 Sound insulation

With standard separating constructions between housing units as described in chap. 3 and in "Standard Construction Details", the expected sound insulation performance for assembled buildings according to EN ISO 16283-1 and EN ISO 717-1 and -2 are as follows:

- Estimated weighted apparent airborne sound reduction index $R'_w \geq 55$ dB
- Estimated weighted normalized impact sound pressure level $L'_{n,w} \leq 53$ dB

These performances meet the requirements for residential houses class C in NS 8175. The sound insulation performance for assembled buildings also depends on the installation of pipes, ducts etc., and must be assessed case by case for each building project.

4.5 Thermal insulation

Table 3 shows thermal transmittance values, U-value, for standard building element designs described in chap. 3. Thermal loss due to extra timber around door and window openings etc. is not included.

5. Environmental aspects

5.1 Chemicals 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 or vPvB substances.

Table 2

Unihouse building elements - Fire resistance and design load capacity at accidental limit state fire

Structure	Fire resistance	Design load capacity ¹⁾
External walls according to fig. 1 and 2		
Single studs c/c 600 mm	EI 90	-
	REI 30	No reduction
	REI 60	128 kN/m
Double studs c/c 600 mm	EI 90	-
	REI 30	No reduction
	REI 60	256 kN/m
External walls according to fig. 3		
Single studs c/c 600 mm	REI 90	70 kN/m
Double studs c/c 600 mm	REI 90	140 kN/m
External walls according to fig. 4		
Studs c/c 600 mm	REI 30	No reduction
Double separating walls between housing unites according to fig. 6		
2 layers of gypsum board and single studs	EI 90	-
	REI 30	No reduction
	REI 60	42 kN/m ²⁾
2 layers of gypsum board and double studs	EI 90	-
	REI 30	No reduction
	REI 60	84 kN/m ²⁾
3 layers of gypsum board and single studs	EI 120	-
	REI 90	11 kN/m ²⁾
2 layers of gypsum board and double studs	EI 120	-
	REI 90	22 kN/m ²⁾
Separating floors between housing units according to fig. 10		
Two layers of 12,5 mm type A or DF gypsum board in the ceiling	REI 30	No reduction

¹⁾ Vertical design load capacity at accidental limit state in case of fire. "No reduction" means no reduction in capacities determined at ordinary ultimate limit state. Values are given for the wall height $\leq 2,5$ m.

²⁾ Design load capacity for one individual wall leaf.

Table 3

Thermal transmittance, U-values, for standard designs, calculated according to EN ISO 6946, based on mineral wool with declared thermal conductivity $\lambda_D = 0.037$ W/(mK)

Structure	Total thermal insulation thickness mm	U-value W/m ² K
External walls according to fig. 1 and fig. 2	230	0,20
External walls according to fig. 3	230	0,21
External walls according to fig. 4	240	0,18
Floors according to fig. 7.	300	0,13
Floors according to fig. 10.	300	0,14
Roof according to fig. 11	290	0.15

5.2 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.

5.3 Waste treatment/recycling

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

5.4 Environmental declaration

No environmental declaration (EPD) has been worked out for Unihouse timber frame building elements.

6. Special conditions for use and installation

6.1 Design requirements in general

The production and delivery of each building element shall be based on a structural design, fire resistance, sound insulation and thermal insulation required for the relevant building. The calculations shall be available before production and deliverance of the building elements.

6.2 Structural design

The production of each building element shall be based on full static calculations and structural design of floors, load-bearing walls and roofs of the building according to the relevant design loads given in EN 1991.

The structural design of the building elements shall include vertical and horizontal capacity, anchoring to the foundations, wind anchoring of the roof structure, capacity of beams over door and window openings and structural connections between building elements.

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

6.3 Fire resistance design

For every building element delivery, the required fire resistance of each part of the building shall be determined, and the load capacity in addition to what is given in cl. 5.5 must be assessed.

Buildings according to fire class 3 require a special, comprehensive fire design analysis according to TEK for the complete building structure.

6.4 Thermal insulation design

For each building element delivery, the required maximum thermal resistance and transmittance for the external building parts shall be determined, and the thermal performance of the building elements designed in order to fulfil these requirements.

In cases where U-values for building elements are higher than required in TEK, the calculations of heat loss and buildings energy needs shall be performed for the complete building structure.

6.5 Foundations

The building elements shall be installed on foundations designed according to the principles shown in SINTEF Building Research Design Guide 521.203.

Moisture content in the air space beneath suspended ground floors shall be sufficiently low to prevent moisture-related damage. Moisture transport from the foundations to the building elements shall be prevented by a capillarity-breaking layer. The building elements shall be installed on a foundation that satisfies the manufacturer's requirements regarding dimensions and level tolerances.

6.6 Installation in general

The building elements shall be installed and connected according to the details shown in "Standard Construction Details for Unihouse building elements belonging to SINTEF Technical Approval No. 20014" 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 the necessary fire resistance and sound insulation performance.

6.7 External fibre-cement boards

The external fibre-cement boards shall be installed according to the principles shown in SINTEF Building Research Design Guides 542.502.

6.8 Roof construction

The roof construction over the building elements shall be specified individually for each individual building project. Roofing and roof slope shall be adapted to the local climatic conditions.

6.9 Transport and storage

The building elements shall be protected against precipitation under transport and storage with a watertight cover. The building elements shall be protected against precipitation during assembly, until covered by a watertight roof.

7. Factory production control

The product is produced in Poland for Unihouse S.A., Bielsk Podlaski, Poland.

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 based on the following documents:

- SINTEF Building Research Design Guides No. 471.011 – 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)
- Rambøll AS. Report project number 1350000909 Kapasitetsberegninger – Vegger, tak og etasjeskiller, 27.03.2014
- SP Technical Research Institute of Sweden. Brandsäkra trähus version 3, October 2012

9. Marking

For each delivery, a set of delivery documents shall be available. The documents shall as a minimum include name of the manufacturer, project identification, specific installation specifications for the individual project, and construction details with all relevant details in “Standard Construction Details for Unihouse belonging to SINTEF Technical Approval No. 20014”. The approval mark for SINTEF Technical Approval No. 20014 may also be used.



Approval mark

10. 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.

for SINTEF Building and Infrastructure

Marius Kvalvik
Approval Manager