SINTEF Technical Approval

TG 20563

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Amended: 21.12.2023
Valid until 01.12.2025
Provided listed on
www.sintefcertification.no

SINTEF confirms that

Byggnor building modules

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

Solås AS
Elgtråkket 5C
2014 Blystadlia
www.byggnormodul.com

2. Product description

2.1 General

Byggnor building modules are prefabricated building modules which are assembled on site for e.g. residential, office and school buildings, see fig. 1. Fields of application are further described in chap. 3. The modules are based on timber structures in floors, walls and roof.

Standard module dimensions are 5,3 m width and 4,5 m height. The length is customized to each building project. Maximum length is 14,5 m.

The modules are normally delivered from the factory with cladding and windows and doors installed in external walls. Finished roofing may also be included. The modules are normally delivered with finished internal linings and surfaces, and partly with fixed internal furnishing and technical installations installed in the factory. Modules may have open sides for connection to other modules. The modules may include wet rooms.

2.2 Scope

The approval covers the standard module constructions produced in the factory, with materials and components as specified in chap. 2.3. This includes wall, floor and roof structures with associated construction details, and details for module assembly and connections.

The approval does not cover internal surface materials, windows and doors in the modules. These components are specified specifically and must be documented individually for each building project. The approval does neither cover technical installations like ventilation, heating and electrical systems, nor control of module assembly or any other work performed on the building site.

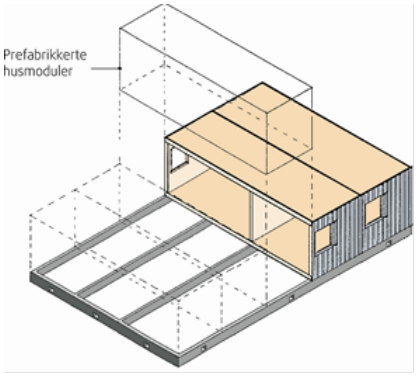


Fig. 1
Principle use of Byggnor building modules

2.3 Construction details

Specifications of materials and components used in the modules are shown in table 1. Properties for these products shall be proven by the respective manufacturers.

The principle design of floors, walls and roof is shown in fig. 2 – 7. The detailed design of module construction and connection details are described in *"Standard Construction Details for Byggnor building modules belonging to SINTEF Technical Approval no. 20563"*. The version of the construction details filed at SINTEF at any time is a formal part of the approval.

3. Fields of application

The application of Byggnor building modules in a building project must always be checked by the responsible project consultants and building company. Byggnor building modules are assessed to be in conformity with the pre accepted performance requirements for buildings in risk class 4 and fire class 1 and 2 according to the TEK guideline.

Applications of Byggnor building modules for buildings with other fire classes must be separately documented by the responsible consultants/builders for each individual building project. A check concerning possible fire requirements different from pre accepted performances in a building project must also be done before the application of Byggnor building modules.

Table 1
Byggnor building modules. Material specifications

Material / component	Spesification [1]	TG/PS [2]	Fire classification [3]	CE-marking [4]
Structural components				
Timber	Strength graded structural timber with class C24 or according to specific structural calculations. Moisture content max. 18 %	-	D-s2,d0	EN 14081-1
Glued laminated timber	Palmako glulam with class GL 28c and GL32, or according to specific structural calculations. Formaldehyde class E1	-	D-s2,d0	EN 14080
	Products with SINTEF Technical Approval for current application	-	-	-
I-beams	Masonite I-Bjelke	-	D-s2,d0	ETA 04/0012
	Products with SINTEF Technical Approval for current application	-	-	-
Board materials				
Floor sheathing	Products with SINTEF Technical Approval for current application	-	-	-
Roof sheathing	Products with SINTEF Technical Approval for current application	-	-	-
Flooring underlay	Hunton Silencio 36	TG 2330	E_{fl}	EN 13986
	12,5 mm Gyproc Normal Ergo	-	A2-s1,d0	EN 520
Wind barrier boards	Products with SINTEF Technical Approval for current application	-	-	-
Claddings and linings				
External cladding	21 x 95/120/145 mm double rebated wood panel, class A according to EN 15146	-	D-s2, d0	EN 14915
	Products with SINTEF Technical Approval for current application	-	-	-
Internal lining	12 mm Forestia Ferdigvegg	-	D-s2,d0	EN 13986
	12 mm Forestia walls4you	-	D-s2,d0	EN 13986
	12 mm Forestia walls2paint	-	D-s2,d0	EN 13986
	12 mm Forestia Elite X	-	D-s2,d0	EN 13986
	12 mm Forestia Tak-ess Inspirasjon	-	D-s2,d0	EN 13986
	Products with SINTEF Technical Approval for current application	-	-	-
	12,5 mm Gyproc Normal Ergo	-	A2-s1,d0	EN 520
	12,5 mm Gyproc Habito	-	A2-s1,d0	EN 520
	15 mm Gyproc Protect F	-	A2-s1,d0	EN 520
Flooring	Tarkett Standard Plus	-	-	EN 14041
	Tarkett Granit Multisafe	-	-	EN 14041
	Tarket Eclipse and Promo Premium	-	-	EN 14041
	Tarket iQ Granit and iQ Optima	-	-	EN 14041
Thermal insulation				
Mineral wool	Paroc Ultra (eXtra) stonewool	-	A1	EN 13162
	Knauf mineral wool – 033 and 035 glasswool	TG 20580	A1	EN 13162
Membranes and sealings				
Wind barrier, roll products	Products with SINTEF Technical Approval for current application	-	-	-
Roof underlay, roll products	Products with SINTEF Technical Approval for current application	-	-	-
Water vapour control layer	Products with SINTEF Technical Approval for current application	-	-	-
Roofing felt	Products with SINTEF Technical Approval for current application	-	-	-
	Icopal Top-Safe	PS 1738	B_{ROOF}(t2)	EN 13707

(Continues)

Table 1 continued

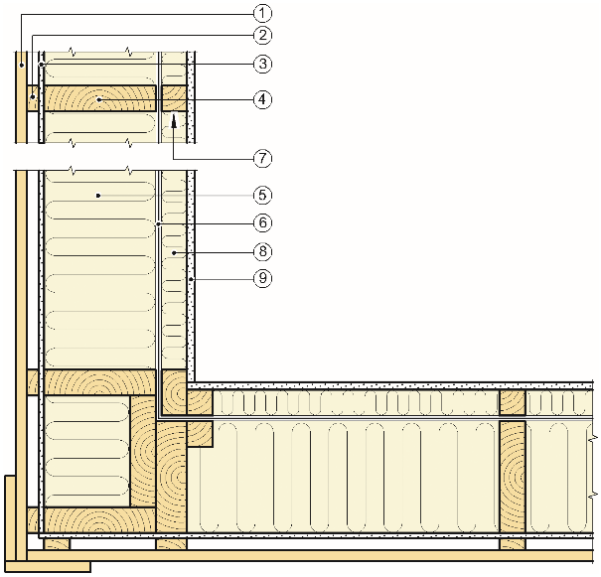
Material / component	Spesification [1]	TG/PS [2]	Fire classification [3]	CE-marking [4]
Wet rooms				
Bathroom membrane	Products with SINTEF Technical Approval for current application	-	-	-
Tiles	Ceramic tiles		-	EN 14411
Adhesive	Bostik Maxibond Seal		-	
Leveling Compound	Mira X-plan			
Filler	Products with SINTEF Technical Approval for current application	-	-	-
Panel	Products with SINTEF Technical Approval for current application	-	-	-
Pipe systems	Products with SINTEF Technical Approval for current application	-	-	-
Waterstops	Products with SINTEF Technical Approval for current application	-	-	-
Drain	Purus Joti plastic floor gully	PS 3339	-	EN 1253
Fastener products				
Tape	Products with SINTEF Technical Approval for current application	-	-	-
Nails / screws	Screws, nails and metal fastenings for external claddings etc. shall have hot dip zinc coating or equal effective corrosion protection	-	-	EN 14592
Miscellaneous				
Windows / doors	Windows and doors are not part of the approval, but products installed in the modules shall satisfy the requirements for thermal insulation and tightness in the technical regulations for construction works (TEK)			

[1] Dimensions not specified in the table shall be stated in "Standard construction details belonging to TG 20563" or according to specifications given for each individual building project

[2] The component has SINTEF Technical Approval (TG) or SINTEF Product Certificate (PS)

[3] Fire classification according to EN 13501-1, for applications according to "Standard construction details". Where the Guidance to TEK does not mention a preaccepted performance the fire classification is marked as (-).

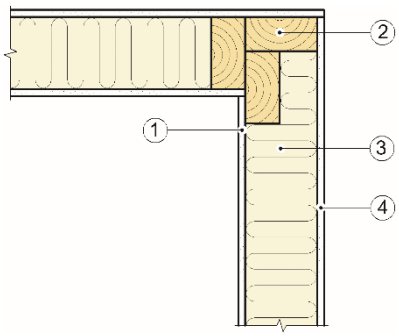
[4] The component shall be CE-marked according to the specified standard or ETA



Horizontal section

1	External cladding	6	Water vapour control layer
2	21x45 mm battens c/c 600 mm	7	45 x 45 mm battens
3	Wind barrier	8	50 mm mineral wool
4	45x145/195/245 mm studs c/c 600 mm	9	Internal lining
5	150/200/250 mm mineral wool		

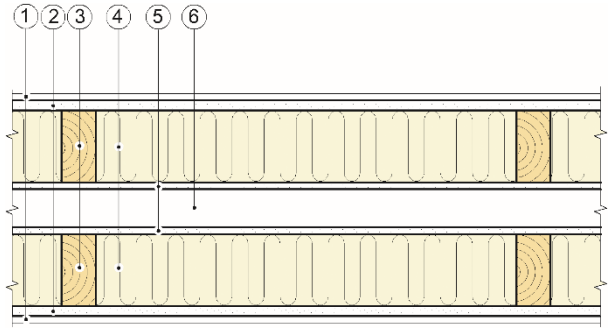
Fig. 2
Principle design of external walls.
Walls that supports sound- and fire separating floors have two layers of gypsum boards as internal lining.



Horizontal section

1	Internal liningg	3	70/100/125/150 mm mineral wool
2	45x70/95/120/145 mm studs c/c 600 mm	4	Internal liningg

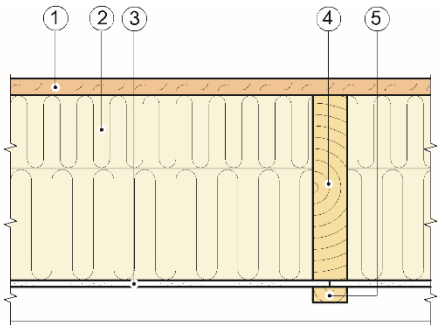
Fig. 3
Principle design of internal walls.
Load-bearing walls have two layers of gypsum boards as internal lining.



Horizontal section

1	Gypsum board	4	100/125/150 mm mineral wooll
2	Internal lining	5	Wind barrier boards
3	45x95/120/145 mm studs c/c 600 mm	6	Min. 50 mm void

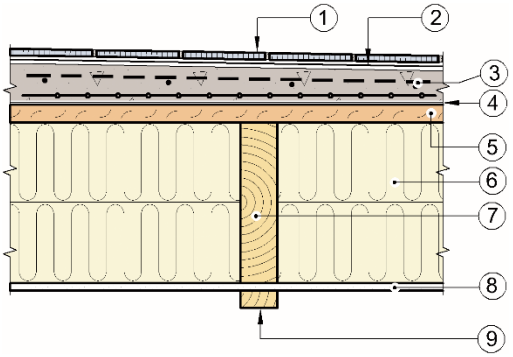
Fig. 4
Principle design of separating walls between modules



Vertical section

1	22 mm OSB- or particleboard	4	45x245 mm joists c/c 600 mm
2	250 mm mineral wool	5	21 x 45 mm battens
3	Wind barrier board		

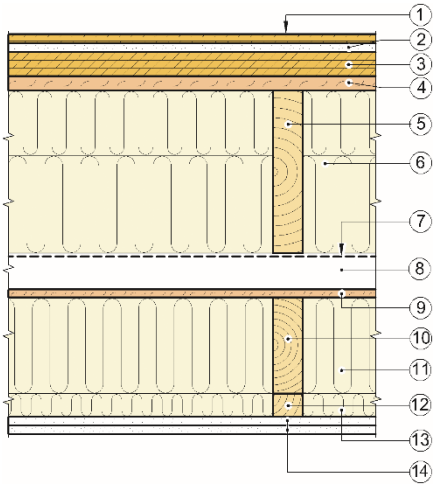
Fig. 5
Principle design of floor above foundations



Vertical section

1	Ceramic tiles	6	250 mm mineral wool
2	Membrane	7	45x245 mm joists c/c 300 mm
3	Screed with electrical cables	8	Wind barrier board
4	Primer	9	21 x 45 mm battens
5	22 mm OSB-or particleboard		

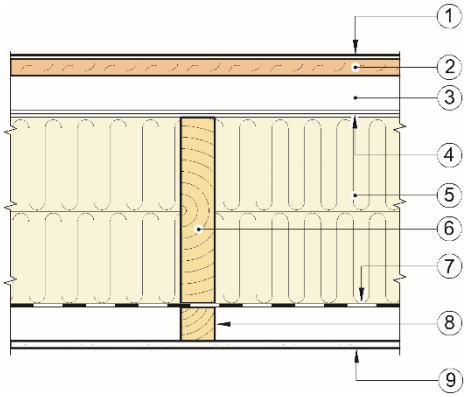
Fig. 6
Principle design of floor in wet rooms



Vertical section

1	Parquet flooring.	8	45 mm void
2	12,5 mm gypsum board	9	12 mm OSB board
3	36 mm soft fibreboard	10	45x145 mm beams c/c 600 mm
4	22 mm OSB- or particleboard	11	150 mm mineral wool
5	45x245 mm joists c/c 600 mm	12	35 x 45 mm battens c/c 600 mm)
6	250 mm mineral wool	13	50 mm mineral wool
7	Steel wire c/c 400 mm	14	Internal cladding

Fig. 7
Principle design of floor between modules



Vertical section

1	Roofing felt	6	45x245mm rafters or 250-400 mm I-beams c/c 600 mm
2	18/22 mm OSB-board	7	Vapour barrier
3	Min. 45 mm void	8	45 x 45 mm battens
4	Roof underlay	9	Internal lining
5	250-400 mm mineral wool		

Fig. 8
Principle design of flat ventilated roof structure

4. Properties

4.1 Structural capacity

Structural capacity of load-bearing module structures is calculated specifically for each individual building project, see chap. 6.1.

Floor structures shown in chap. 2 are designed for imposed load category A according to NS-EN 1991-1-1, i.e. 2,0 kN/m^2 uniformly distributed load, and in accordance with the stiffness requirements recommended in SINTEF Building Research Design Guide 522.351.

4.2 Reaction to fire
Fire classification according to EN 13501-1 for products applied in Byggnor building modules is shown in Table 1. The classification is only valid for the products as used in this building system.

4.3 Fire resistance
Fire resistance for the module structures is shown in Table 2. The fire resistance has been calculated on the basis of the calculation methods in the handbook Brandsäkra Trähus version 3 and in EN 1995-1-2:2004. The declared fire resistances assume construction specifications and materials according to chap. 2.2, 2.3 and Table 1.

Design load capacity at limit state fire after the specified fire resistance time is given in Table 2 as vertical load capacity for walls and bending moment capacity for joists and rafters.

The fire resistance given in Table 2 assumes one sided fire exposure, from the inside of external walls and from the underside of floors and roof. The fire resistance for internal walls assumes also one sided fire exposure, unless specified otherwise in Table 2.

Design load capacity for walls at limit state fire is given as maximum centric axial load per meter wall (kN/m). Design load capacity for floors and roof with single span is given as maximum bending moment (kNm) per joist or rafter. "Full capacity" means that no charring of load-bearing material will take place during the specified fire resistance time. Hence the design capacities determined for ultimate and serviceability limit states are applicable also in case of fire.

Mineral wool insulation in floors and roofs must in some cases be secured to stay in place during a fire, see chap. 6.2.

Table 2
Brannmotstand for bygningsdeler med branncellebegrensende og/eller lastbærende egenskaper

Structure, internal lining and stud dimension		Fire resistance [1]	Design load capacity [2]
External walls, fig. 2 height ≤ 2,4 m, with 13 mm gypsumboards type A internal and 9 mm gypsumboards GU external			
A	With minimum 45 x 145 mm studs C18	REI 15	Full
B	With 45 x 145 mm studs C18 og 150 mm stonewool	REI 30	93 kN/m
		R 60	3,5 kN/m
C	With45 x 195 mm studs C18 og 200 mm stonewool	REI 30	170 kN/m
		REI 60	55 kN/m
D	With 45 x 245 mm studs C18 og 250 mm stonewool	REI 30	232 kN/m
		REI 60	129 kN/m
Walls between housing units, fig. 4 [4], height ≤ 2,4 m			
A	with 45 x 95 mm studs C18	REI 15	Full
		REI 30	20 kN/m
B	with 45 x 120 mm studs C18	REI 15	Full
		REI 30	55 kN/m
C	with 45 x 145 mm studs C18	REI 15	Full
		REI 30	106 kN/m
		REI 60	4,0 kN/m
Load-bearing internal walls, fig. 3 [4], height ≤ 2,4 m			
A	2 x 13 mm gypsumboards type A, min. 45x95/ studs C18 and min. 100 mm stonewool	R 30	Full
B	11/12 mm fibre- or chipboard plus 13 mm gypsumboard type A [5], 45x95 mm studs C18 og 100 mm stonewool	R 15 R 30	Full 3,5 kN/m
C	11/12 mm fibre- or chipboard plus 13 mm gypsumboard type A [5], 45x120 mm studs C18 og 120 mm stonewool	R 15 R 30	Full 23 kN/m
D	11/12 mm fibre- or chipboard plus 13 mm gypsumboard type A [5], 45x145 mm studs C18 og 150 mm stonewool	R 15 R 30	Full 65 kN/m
E	2 x 15 mm gypsumboard type F, 45x95 mm studs C18, 100 mm stonewool	R 30 R 60	Full 18 kN/m
F	2 x 15 mm gypsumboard type F, 45x120 mm studs C18, 120 mm stonewool	R 30 R 60	Full 57 kN/m
Floor between house units, fig. 7 [6]			
A	2 x 13 mm gypsumboard type A in ceiling, stonewool	REI 30	Full
B	2 x 15 mm gypsumboard type F in ceiling, stonewool	REI 30 REI 60 [7]	Full Full

(continues)

Table 2

Structure, internal lining and stud dimension		Fire resistance [1]	Design load capacity [2]
Roof, fig. 8			
A.	2 x 13 mm gypsumboard type A in ceiling, stonewool	REI 30 R 60 [7]	Full 2,5 kNm
B.	2 x 15 mm gypsumboard type F in ceiling, stonewool	REI 30 R 60 [7]	Full 5,1 kNm

[1] Fire resistance equivalent to classification according to EN 13501-2. Properties for EI and R is given in minutes.

[2] Design load capacity for the structure after 15-, 30- and 60-minutes fire exposure. "Full capacity" means that no charring of load-bearing material will take place during the specified fire resistance time. Hence the design capacities determined for ultimate and serviceability limit states are applicable also in case of fire

[3] Capacity for each single wall structure

[4] Fire exposure from two sides

[5] Placement of gypsumboards and woodbased boards can be switched

[6] Given capacity applies to loadbearing to the floor joist in the top module

[7] The mineral wool must be kept in place with steel mesh

4.4 Sound insulation

With separating constructions as specified in chap. 2, and connections between building components as shown in *"Standard Construction Details for Byggnor building modules belonging to SINTEF Technical Approval no. 20563",* is the expected sound insulation performances as described in table 3 for completed house constructions.

The values in table 3 require that floors between house units are supplemented with floating floor and ceiling constructions as shown in Building Research Design Guide 522.511.

Table 3

Expected sound insulation in completed houses [1]

Structure	Airborne sound reduction $R'_w + C_{50\text{-}3000}$	Impact sound pressure level $L'_{n,w} + C_{I,50\text{-}5000}$
Floors between house units (fig. 7)	≥ 55 dB	≤ 53 dB
Separating walls between house units (fig. 4)	≥ 55 dB	≤ 53 dB [2]

[1] According to EN ISO 16283 and EN ISO 717-1

[2] Horizontal impact transmission

The values satisfy sound insulation class C in NS 8175:2019 and the recommended requirements for sound insulation between house units, including spectrum adaptation term for enlarged frequency range. The sound insulation depends also on the installation of technical service components like pipes, ducts etc., and must be assessed case by case in each building project.

4.5 Thermal insulation

Table 4 shows thermal transmittance values, U-values, for standard module designs described in chap. 2, calculated according to EN ISO 6946. U-values for external walls are based on 12,5 % timber area proportion, and do not include thermal loss due to extra timber around door and window openings.

Table 4

Thermal transmittance, U-value, for Byggnor building modules structures

Structure	Insulation thickness [1] mm	U-value W/m2K
External wall (fig. 2)	200	0,22
	250	0,18
	300	0,15
Floor above foundations (fig. 5)	250	0,17
Roof (fig. 7)	250	0,17
	300	0,14
	350	0,12
	400	0,10

[1] Mineral wool with thermal conductivity λ_D = 0,035 W/mK

4.6 Durability

The module design satisfies SINTEF's recommended requirements concerning tightness and durability of the external building envelope. See chapter 6.5 regarding ventilation of flat roof.

5. Environmental aspects

5.1 Chemicals hazardous to health and environment

The modules 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.

5.2 Effect on indoor environment

The modules 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 Effect on soil and ground water

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

5.4 Waste treatment/recycling

At disposal the module components shall be sorted as wood, metal, gypsum, residual waste or other appropriate waste fractions, and delivered to an authorized waste treatment plant for material recovery, energy recovery or waste deposit.

5.5 Environmental declaration
No environmental declaration (EPD) has been worked out for Byggnor building modules.

6. Special conditions for use and installation

6.1 Structural design
For cases not covered by declared structural capacities in chap. 4.1 the performance of load-bearing timber components in the module shall be specifically calculated for each building project according to NS-EN 1995-1-1 with national annex NA. Loads shall be determined according to NS-EN 1991 with national annex NA.

6.2 Safety in case of fire
The required fire resistance for the modules according to the building regulations (TEK) shall be determined specifically for each building project. The required design load capacity at limit state fire must be decided and checked towards the capacities shown in chap. 4.3. Buildings in fire class 3 requires a special, comprehensive fire design analysis according to TEK for the complete building structure.

Products for internal and external surfaces, behind ventilated claddings, insulation etc. must be used according to pre accepted performances in the guideline to TEK. Necessary measures to prevent spread of fire along facades must be evaluated for each building project.

Board materials for internal lining shall be installed according to the principles in SINTEF Building Research Guide 543.204.

The mineral wool insulation in floors and roof must be kept in place during a fire by minimum three 1,5 mm steel wires per insulation board or with maximum spacing c/c 350 mm. An alternative is to use a steel mesh with minimum 1,5 mm wire, fixed to the underside of the joists with minimum 50 mm long staples.

Penetrations through building parts with required fire resistance, and connections to other building parts, must be made in a way which do not reduce the fire resistance performance. See SINTEF Building Research Guide 520.342.

6.3 Design of sound insulation in buildings with several house units
When used in buildings with several house units, the modules must have separating floors and supporting external and internal walls adapted to reduced sound transmission as specified in *"Standard Construction Details for Byggnor building modules belonging to SINTEF Technical Approval no. 20563"*.

Elastic connections and must be established towards all walls and at penetrations. Vibration damping pads or strips must be placed between the top sills of the modules and the bottom sills of the modules above. The vibration damping pads or strips must be structurally designed specifically for the relevant loads.

Any temporary board covering on top of the modules must be removed before the installation of the next modules above. Penetrations for water pipes, ventilation ducts or other installations placed in the sound insulation structures should be avoided as far as possible.

6.4 Thermal insulation design
The required energy efficiency according to TEK shall be determined for each building project. The U-values shown in chap. 4.5 may be used to check the minimum requirements for thermal insulation performance in TEK. The total energy loss for each individual building must be calculated with a specific calculation program (e.g. SINTEF Building Research Design Guide 472.212).

6.5 Ventilated flat roof structures
For ventilated flat roof structures with external drainage according to standard construction details the maximum length of the ventilation airgap (roof width) is 10 m.

6.6 Foundations
The modules must be placed on a basement or perimeter wall, or on an open foundation, which meets the module manufacturer's requirements concerning tolerances on dimensions and flatness. The foundation must be in accordance with the recommended principles for ventilation under the modules and prevention of moisture damage in wood materials as shown in SINTEF Building Research Design Guides.

6.7 Installation
The modules shall be installed and connected according to the details shown in *"Standard Construction Details for Byggnor building modules belonging to SINTEF Technical Approval no. 20563",* and specific installation details worked out for each individual project.

6.8 Wet rooms
Bathrooms and other wet rooms shall be designed and built in accordance with the principles and the recommendations in SINTEF Building Research Design Guides and the construction industry's Wet Room Standard (BVN), using the specified materials and components shown in Table 1 with the respective installation provisions.

6.7 Transport and storage
The modules shall be protected from precipitation under transport and storage with a watertight cover until the modules are protected by a watertight roof. During transport and storage the modules must be placed on supports with positions equivalent to what is presumed in the structural design of the modules.

6.8 Products with SINTEF Technical Approval and Product certificate
Products with SINTEF Technical Approval and Product certificate that is applicated in the modules shall be used according to the respective approvals.

7. Factory production control

The modules are produced by Laattalinja OÜ: Ilunurme 5, Liivamäe küla, Jõelähtme vald, Harju maakond, 74207 Harjumaa, Estonia.

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

The manufacturing of Byggnor building modules 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 the assessment of the overall construction design, the properties of the materials and components used in the standard module design, and on performances documented in specific test reports and calculations.

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 Byggnor building modules belonging to SINTEF Technical Approval no. 20562",* The approval mark for SINTEF Technical Approval TG 20563 may also be used.

10. Liability

The holder/manufacturer has sole product responsibility according to existing law. Claims cannot be brought against SINTEF beyond the provisions in Norwegian Standard NS 8402

for SINTEF

Hans Boye Skogstad
Godkjenningsleder