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

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European Technical Assessment

ETA 08/0178
of 07/09/2015

General Part

SINTEF Building and Infrastructure is a Technical Assessment Body designed by (MS) **according to Article 29 of the Regulation (EU) No 305/2011.**	
Trade name of the construction product	Kodumaja building modules
Product family to which the construction product belongs	Timber frame building kits based on prefabricated house modules
Manufacturer	Kodumaja AS Ravila 61 Tartu 51014 Estonia http://www.kodumaja.ee
Manufacturing plant(s)	- Kodumajatehase AS, Betooni 2, Tartu 51014, Estonia - OÜ KM Element, Ravila 61, Tartu 51014, Estonia
This European Technical Assessment contains	13 pages including Annex A1-A4 and separate document Annex B, which form an integral part of this assessment. Annex B refers to confidential information which is not included in the European Technical Assessment when that assessment is publicly disseminated
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	ETAG 007(11-2012) Timber frame building kits, used as European Assessment Document (EAD).
This ETA amends a corrigendum to	ETA 08/0178, version 1, issued on 29/09/2008

1. Technical description of the product

Kodumaja building modules are kits made of prefabricated building modules with timber frame structures in floors, walls and roof. The modules are delivered from the factory with installed windows and doors, external cladding, internal linings and technical service installations. Module size is custom made for each delivery, but maximum dimensions are 5.3 m width, 3.8 m height and 14.5 m length.

This assessment covers the standard design of the module structures, including wet rooms, and the connections between several modules installed together as a building. The basic module design is shown in Annex A1, and the material and component specifications in Annex A2. The detailed construction design is shown in Annex B.

The assessment does not cover external or internal surface, finishes, windows, doors and supplementary components like stairs, balconies etc., or technical service installations. These products are specified case by case, and their performance has to be verified specifically as parts of the works in each case.

The modules shall be placed on a foundation that meets the manufacturer's specified requirements concerning dimensions, tolerances (± 3 mm) and loadbearing capacity. A damp-proof course or equivalent must prevent moisture uptake in the modules from foundations.

The modules shall be installed according to the relevant construction details in Annex B, plus a special installation manual worked out by the manufacturer for each individual works. The installation manual shall cover all installation aspects for the modules, including: erection systems and equipment, temporary bracing, permanent anchoring to foundations and between modules, weather protection during installation, materials and components which are necessary supplements to the modules as well as standard assembly joints and special joint designs for individual modules.

The modules shall be fully protected from weather exposure and mechanical damage during storage, transportation and installation.

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

The building modules are intended for low rise or multi-storey houses, with vertical and horizontal separations between housing units. The modules may also be used for non-residential buildings where the performance requirements are more or less the same as for residential houses.

The modules should only be used in areas where cooling systems may be installed and operated for long periods of time when the risk of interstitial moisture condensation has been assessed for each individual site and use conditions.

No special verification of structural resistance related to seismic actions has been determined.

The kits are intended to be placed on all types of ordinary foundations like concrete slabs on ground, masonry or concrete basement walls, or strip foundations.

For the serviceability of the kit, it shall be ensured that suspended floors have sufficient stiffness to avoid unacceptable vibrations from normal use. The verification of this characteristic shall be part of the calculation according to clause 3.2.1 in this ETA.

The wood components are not treated for use in areas with termite attacks.

The provisions made in this European technical assessment are based on an assumed working life of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the

producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 General

The following table shows the characteristics for which the product performances are declared in Annex A2-A4. The characteristics correspond to the Kodumaja building modules design specified in Annex A1 and B.

Basic works requirement		**Product characteristic**	**Product performance**
BWR 1	Mechanical resistance and stability	Resistance of walls, floor and roof structures and their connections against horizontal and vertical loads	See cl. 3.2 and Annex A1 and A2 of this ETA
	Resistance against seismic reaction	See cl. 3.2.1 No performance determined (NPD)	
BWR 2	Safety in case of fire	Reaction to fire	See cl. 3.3.1 and Annex A2 Table A2-1
		Fire resistance	See cl. 3.3.2 and Annex A3 Table A3-1- A3-2
BWR 3	Hygiene, health and the environment	Vapour permeability and moisture resistance	See cl. 3.4.1
		Water-tightness	See cl. 3.4.2
		Content and release of dangerous substances	See cl. 3.4.3
BWR 4	Safety and accessibility in use	Slipperiness of the floor	No performance determined (NPD)
		Impact resistance	See cl. 3.5.2
BWR 5	Protection against noise	Airborne sound insulation	See cl. 3.6.1
		Impact sound insulation	See cl. 3.6.2
BWR 6	Energy economy and heat retention	Thermal resistance	See cl. 3.7.1 and Annex A4 Table A4-1.
		Air permeability	See cl. 3.7.2
		Thermal inertia	No performance determined (NPD)
BWR 7	Sustainable use of natural resources	No performance determined (NPD)	
Durability aspects		See cl. 3.8	

3.2 Mechanical resistance and stability (BWR 1)

3.2.1 General

The mechanical resistance and stability of all load-bearing parts of each individual kit are calculated and structurally designed for each delivery, on the basis of the standard component design and material specifications shown in Annexes A1, A2 and B. The calculations shall be made according to relevant parts of EN 1991-1 and EN 1995-1-1, including the national annexes to standards and any supplementary requirements which are relevant for the country of delivery.

If the kit is intended to be used in areas with seismic actions, its behaviour in this respect should be considered and clarified case-by-case, taking into account national rules on works, if needed.

3.3 Safety in case of fire (BWR 2)

3.3.1 Reaction to fire

Reaction to fire classification according to EN 13501-1+A1 is shown for each individual material and component in Annex A2.

A European reference fire scenario has not been laid down for facades. In some Member States, the classification according to EN 13501-1 might not be sufficient for the use in facades. An additional assessment of Kodumaja building modules according to national provisions (e.g. on the basis of a large scale test) might be necessary to comply with Member State regulations, until a European classification system has been completed.

3.3.2 Resistance to fire

For basic module designs, as shown in the Annex A1, the resistance to fire classified according to EN 13501-2+A1 is tabulated in Annex 3, table A3-1.

For alternative module design, as shown in Annex B only, the resistance to fire classified according to EN 13501-2+A1 is tabulated in Annex 3, table A3-2.

3.4 Hygiene, health and environment (BWR 3)

3.4.1 Vapour permeability and moisture resistance

Vapour permeability and moisture resistance of the module construction have been assessed on the basis of calculations according to EN ISO 13788 to be acceptable for the intended use indicated in clause 2.

The water vapour resistance s_d (equivalent air resistance) for the layers on both sides of the thermal insulation is:

- Water vapour control layer: $s_d \geq 80$ m

- Breather paper/wind barrier: $s_d \leq 0,05$ m

3.4.2 Watertightness

The design of the external walls has been assessed on the basis of engineering judgement and experience to give adequate tightness against driving rain exposure in general.

The membrane system used to provide watertightness of zones with direct water exposure in internal wet room floors and walls has been tested and assessed according to the provisions in ETAG 022.

3.4.3 Release of dangerous substances

The modules comply with the provisions of EC Guidance Paper H and EU database on dangerous substances. The manufacturer has declared that the materials and components in the modules do not have any known emissions of particles or radiation that may have a negative influence on the internal or external environment.

The wood-based products in the modules meet the requirements for formaldehyde class E1 in EN 13986.

In addition to the specific clauses relating to dangerous substances contained in this 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.

3.5 Safety in use (BWR 4)

3.5.1 Slipperiness of floors

No performance determined (flooring is not part of the approved kit).

3.5.2 Impact resistance

Impact resistance of wall structures has been assessed on the basis of experience to be adequate for the intended use of the kit.

3.6 Protection against noise (BWR 5)

3.6.1 Airborne sound insulation

Estimated weighted apparent airborne sound reduction index for standard separating wall and floor constructions between housing units as defined in ISO 140/ISO 717 is $R'_w \geq 55$ dB.

No performance has been determined for the external walls and roof constructions.

3.6.2 Impact sound insulation

Estimated weighted normalized impact sound pressure level of the standard separating floor construction between housing units as defined in ISO 140/ISO 717 is $L'_{n,w} \leq 53$ dB.

3.7 Energy economy and heat retention (BWR 6)

3.7.1 Thermal resistance

The design thermal resistance and thermal transmittance of the building modules, calculated according to EN ISO 6946 is as tabulated in Annex A4 table A4-1.

3.7.2 Air permeability

The standard construction details of the module design shown in Annex B have been assessed to have adequate air tightness for the specified intended use. A building based on a properly installed kit should provide an overall air leakage ≤ 1.5 air changes per hour, tested at 50 Pa static pressure difference according to ISO 9972.

3.8 Aspects of durability

The timber species used in the modules are softwood in class 4 concerning natural durability and resistance to fungus attack according to EN 350-2. Structural components and internal linings are in hazard class 1 according to EN 335-1, and timber cladding is in hazard class 2.

The assumed minimum working life of 50 years for the kits indicated in clause 2 requires regular maintenance. The manufacturer shall ensure that each delivery contains proper information about necessary maintenance requirements and guidance for the modules.

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

According to the Decision 99/455/EC[1] of the European Commission as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is system 1.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at SINTEF Building and Infrastructure[2].

Issued in Oslo, Norway on 07/09/2015

By

SINTEF Building and Infrastructure

Jan Olav Hjermann

Research Director

Annexes:

Annex A1 – Basic module design

Annex A2 – Material and component specifications

Annex A3 – Resistance to fire

Annex A4 – Design thermal resistance

Annex B – Standard construction details (separate document, not included)

[1] Official Journal of the European Communities N° L 178, 14.7.1999, p.56

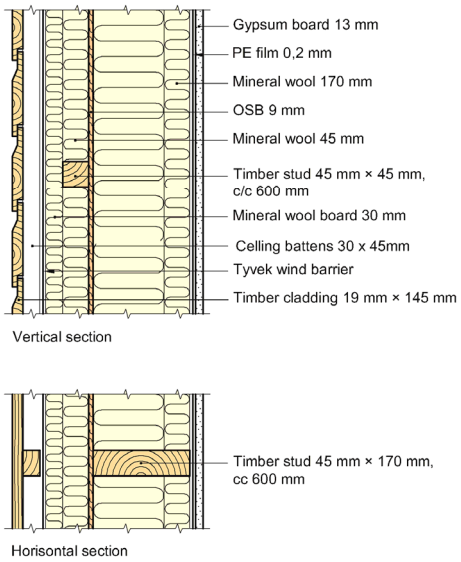
[2] The "control plan" is a confidential part of the European Technical approval and only handed over the approved body or bodies involved in the procedure of attestation of conformity.

Kodumaja building modules **Annex A1**

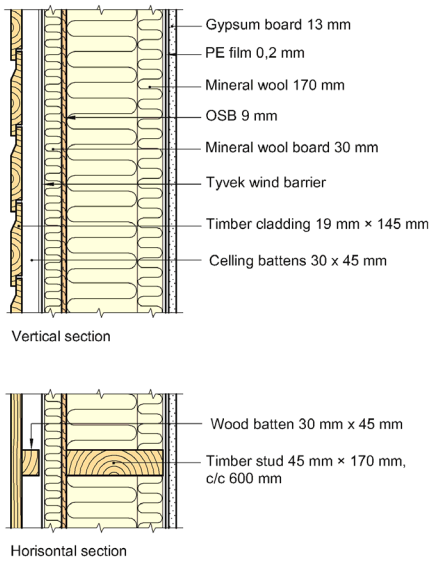
Basic module design

Walls

The principle wall designs are shown in fig. A1 – A3.



Standard wall



Optional external wall design

Fig. A1
Principle design of standard external walls.

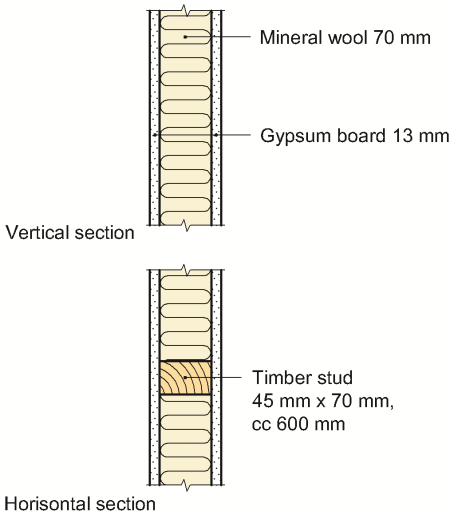


Fig. A2
Principle design of standard internal walls.
Stud dimension is 45 mm x 95 mm in loadbearing walls.
Shaft walls EI 30 have single layers of gypsum board on each side as shown, shaft walls EI 60 have double layers on each side or an additional 15 mm gypsum board type F on the shaft side.

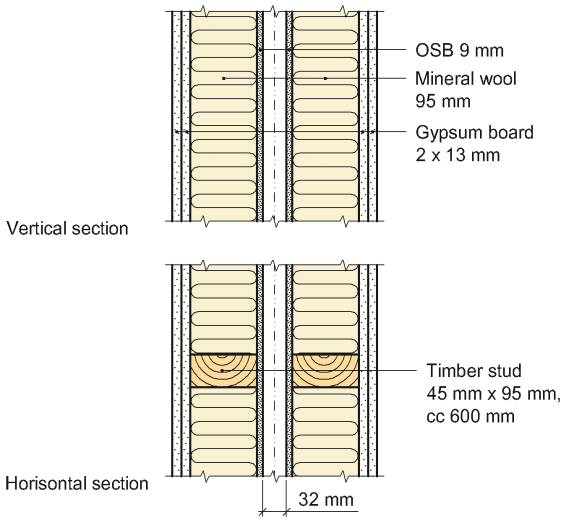


Fig. A3
Principle design of standard separating wall between modules and between housing units.

Floors

The principle floor designs are shown in fig. A4 – A7.

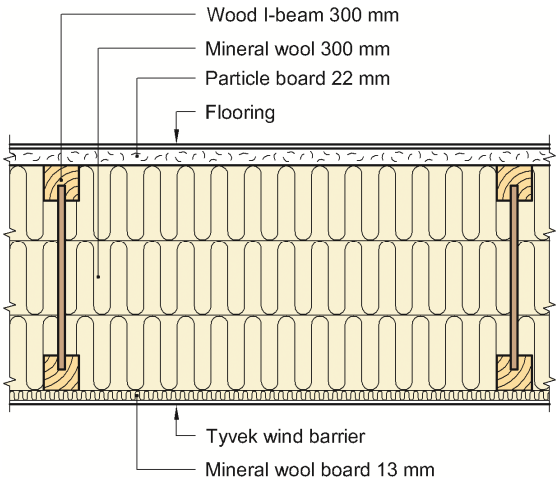


Fig. A4
Principle design of suspended ground floor. Floor joists may be of solid wood sections or wood I-beams.

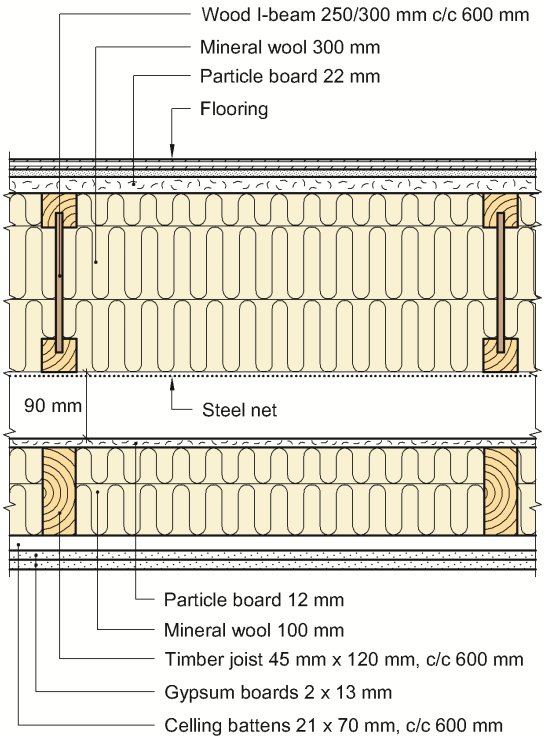


Fig. A6
Principle design of separating floor construction between modules. I-beam joists.

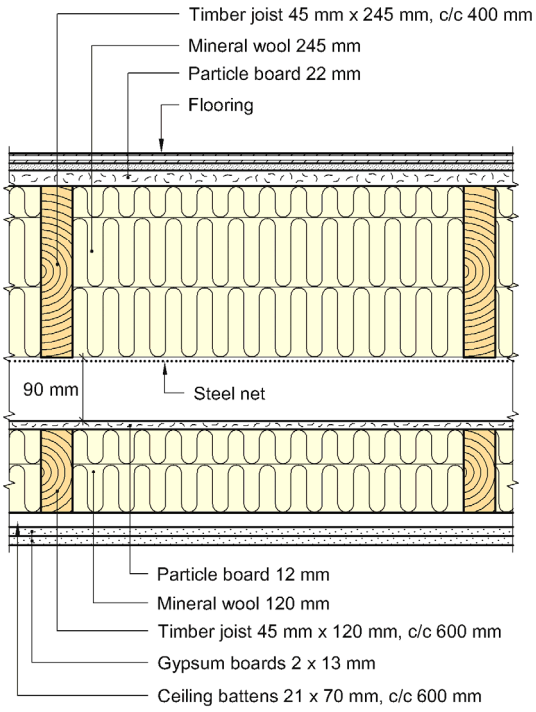


Fig. A5
Principle design of separating floor construction between modules. Solid wood joists.
The lowest part is the roof/ceiling structure of the bottom module, and the top part is the floor structure of the top module.

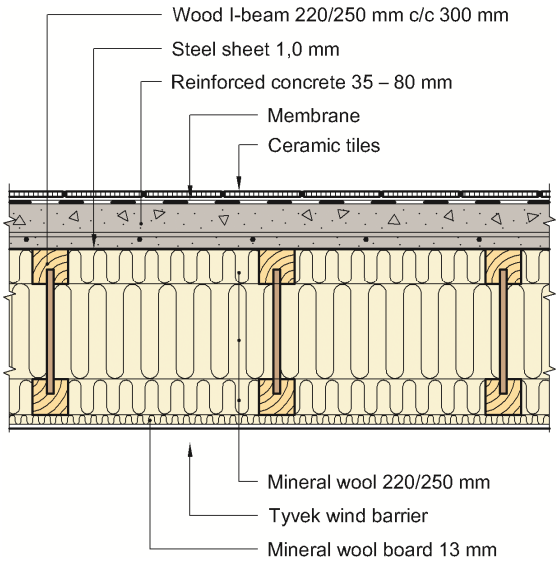


Fig. A7
Principle design of suspended ground floor construction in bathrooms.

Roof

A separate roof structure is installed on top of the modules. Fig. A8 shows the principle design of a flat roof construction.

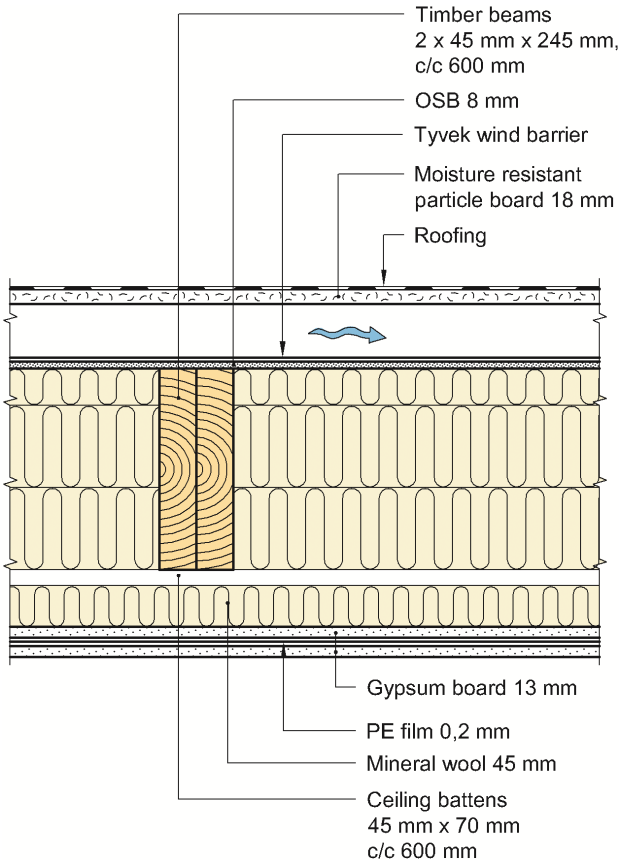


Fig. A8
Principle design of flat roof structure installed on top of the modules

Kodumaja building modules **Annex A2**

Material and component specifications

Material / component	**Specification** (None specified dimensions shall be according to Annex 3 or specifications worked out separately for each delivery))	**Reaction to fire class according to EN 13501-1**
Structural components		
Timber members in walls, floors and roof	Untreated structural grade timber class C30, C24, C18 and C16 according to EN14081/EN 338, and according to specific calculations. Maximum moisture content 18%	D-s2, d0
I-beams	Masonit I-beams according to ETA-12/0018	D-s2, d0
Roof sheathing	18 mm particleboard type P5 according to EN 13986 or equivalent, formaldehyde class E1	D-s2, d0
Subfloor	22 mm particleboard type P6 according to EN 13986, formaldehyde class E1	D-s2, d0
Insulation materials		
Thermal insulation	Saint-Gobain Isover mineral wool insulation, CE-marked according to EN 13162 and certificate no. C248/03 issued by VTT(Technical Research Centre of Finland), with the following declared thermal conductivities: Type KL-A35: λ_D = 0,035 W/mK for insulation between studs and beams (density ≥ 16 kg/m^3). Type RKL: λ_D = 0,031 W/mK for additional insulation of external walls (density ≥ 60 kg/m^3) Type VKL: λ_D = 0,032 W/mK for underside of suspended ground floors (density ≥ 130 kg/m^3) or similar mineral wool insulation.	A1
Membranes and barriers		
Water vapour control layer	0,2 mm polyethylene Rani MOBar, according to certificate no.3189/90 issued by SP Technical Research Institute of Sweden and SINTEF Technical Approval no. 20201	F
Breather paper / Wind barrier	Tyvek 2460B in conformity with CE marking according to EN 13859-2 and SINTEF Technical Approval no. 2043	E
Claddings and linings		
External cladding	Min. 19 mm timber boards with quality equivalent to NS 3186	D-s2, d0
External wall sheathing	9 mm OSB boards type OSB/3 according to EN 13986, formaldehyde class E1	D-s2, d0
Internal linings	- 10 mm particleboard type P1 according to EN 13986, formaldehyde class E1 - OSB/3 ECO strand board panels according to EN 13986 and EN 300 and SINTEF Technical Approval no. 20155 - 12,5 mm gypsum board type A according to EN 520 - 12,5 mm and 15 mm gypsum board type DF according to EN 520	D-s2, d0 D-s2, d0/ D_{FL}-s1 A2-s1, d0 A2-s1, d0
Fasteners		
Mechanical fasteners and connectors	Mechanical fasteners and connectors for external use shall be protected by hot dip galvanization or have equivalent protection against corrosion	A1
Glue for floor sheathing	CascoILin Object 3459, Casco Proff Solid 3480	NPD
Sealant for façade for interior/exterior application	Silicon - Soudal Silirub AL	E
Wet rooms		
Concrete floor slab	Mira 6998 betomix Quick Weber Vetonit 5400 Kiilto 70 Topcem pronto Heikki Haru Oy/Mapei	A1
Membrane for wet zones	Mira 4400 Multicoat og 4410 Vapourstop according to ETA-09/0156	F
Floor screed	Mira X-plan floor screed according to EN 13813	A1
Internal lining	12,5 mm gypsum board type A or DF according to EN 520	A2-s1, d0
Water pipes	Roth Multipex® Rørsystem according to SINTEF Technical Approval no. 2556	NPD
Drain pipes	Uponor HTP PP drain pipes according to InstaCert 4010, 4032, 4048, 4064	NPD
Gullies	Vieser PP gullies according to EN 1253 and SINTEF certificate no. 0444 Vieser PP spacer for gullies according to EN 1253 and SINTEF certificate no. 0466	NPD

Material / component	**Specification** (None specified dimensions shall be according to Annex 3 or specifications worked out separately for each delivery))	**Reaction to fire class according to EN 13501-1**
Seals for fire penetration	-Essve Squeezer A-PF55 plastic pipe penetration according to certificate no. 339-01/08 issued by EstCert OÜ -Essve fire sealing system Kniparen according to SINTEF product documentation no. SINTEF AA – 102 -ESSVE Fogskum 90 according to SINTEF product documentation no. SINTEF AA – 22 -Soudal Firecryl FR plasto-elastic joint sealant according to EN 1366 or similar Fire Rating: Draft European Commission Decision RG N170 REV 1	F

Kodumaja building modules **Annex A3**

Resistance to fire

Table A3-1
For basic module designs as shown in the Annex A1, the resistance to fire classified according to EN 13501-2 is as follows for fire exposure from the inside. The loadbearing capacities of structures for action fire are calculated according to EN 1955-1-2 for each individual kit and delivery.

Structure	***Fire resistance***
External walls - with 1 layer of 12.5 mm gypsum board type A lining	***REI 30***
External walls - with 1 layer of 15 mm gypsum board type F plus 1 layer of 12 mm particleboard or 12.5 mm gypsum board type A lining	***REI 60***
Internal separating walls – load -bearing - with 2 layers of 12.5 mm gypsum board type A lining	***REI 30***
Internal separating walls – load-bearing - with 1 layer of 12.5 mm type F and 1 layer of 12.5 mm type A gypsum board lining	***REI 60***
Shaft walls not load-bearing - with 1 layer of 12.5 mm gypsum board type A lining on each side	***EI 30***
Shaft walls not load-bearing - two layers of 12.5 mm gypsum board type A lining on each side, alternatively one additional layer of 15 mm type F on the shaft side	***EI 60***
Separating floors - with 2 layers of 13 mm gypsum board type A as ceiling	***REI 30***
Separating floors - with 1 layer of 15 mm type F and 1 layer of 12.5 mm type A gypsum board as ceiling	***REI 60***

Table A3-2
For alternative module designs as shown in Annex B, the resistance to fire classified according to EN 13501-2 is as follows for fire exposure from the inside. The loadbearing capacities of structures for action fire are calculated according to EN 1955-1-2 for each individual kit and delivery.

Structure	***Fire resistance***
Internal separating walls – load-bearing - confidential information	***REI 90***
Separating floors - confidential information	***REI 120***

Kodumaja building modules **Annex A4**

Thermal resistance

Table A4-1
Design thermal resistance of Kodumaja building modules calculated according to EN ISO 6946

Structure	Thermal insulation thickness mm	Total thermal resistance (m^2K)/W	Thermal transmittance (U) W/(m^2K)
External walls			
- Standard	245	6.4	0.156
- Alternative	200	5.3	0.188
Suspended ground floors			
- With I-beam joists	313	8.3	0.121
Roofs			
- With I-beam joists	300	7.8	0.127