itecons

Rua Pedro Hispano, s/n
3030-289 Coimbra

Tel: (+351) 239 79 89 49
itecons@itecons.uc.pt
www.itecons.uc.pt

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

Member of EOTA
www.eota.eu

European Technical Assessment ETA 18/0984 of 08/07/2022

English version prepared by Itecons

General Part

Technical Assessment Body issuing the European Technical Assessment: Itecons - Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade	
Trade name of the construction product	ITS (Insulated Timber System)
Product family to which the construction product belongs	Product area code: 34 Prefabricated Buildings and Building Systems
Manufacturer	RUSTICASA-CONSTRUÇÕES, LDA.
Manufacturing plant(s)	Zona Industrial de Campos – Polo 1 – 4920-909 Vila Nova de Cerveira
This European Technical Assessment contains	38 pages including 2 Annexes which forms integral part of this ETA
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) No. 340308-00-0203, edition January 2019, for "*Timber Building Kits*"
This version replaces	ETA 18/0984, version 1 issued on 13/08/2019

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.

Specific parts

1. Technical description of the product

ITS (Insulated Timber System), hereinafter referred to ITS, is a predesigned timber frame building kit prepared in the factory for each individual building, and delivered as a package to be assembled on site. The kit includes the main building parts such as external and internal walls, floors and roof panels. Further components and materials are presented in Annex A. The essential construction details, including their joints, are also described in Annex A. The number of storeys of the kit is one or two (ground floor + 1st floor).

The external walls are load-bearing and formed by NATURLAM W180 Monolam or by NATURLAM W180 Bilam (max. dimensions 10 x 3 m^2) with the following composition:

- NATURLAM W180 Monolam – essentially composed of 40 mm cryptomeria + 100 mm ICB insulation + 40 mm cryptomeria
- NATURLAM W180 Bilam – essentially composed of 2 x 20 mm cryptomeria + 100 mm ICB insulation + 40 mm cryptomeria.

The internal walls are formed by NATURLAM W90 - ICB or by NATURLAM W90 (max. dimensions 10 x 3 m^2) with the following composition:

- NATURLAM W90 - ICB – essentially composed of 20 mm cryptomeria + 50 mm ICB insulation + 20 mm cryptomeria.
- NATURLAM W90 – essentially composed of 20 mm cryptomeria + 45 mm Nordic pine or Nordic spruce + 20 mm cryptomeria.

The connection between panels is screwed. The panel finish is in varnish at the inner side and in stain at the outer side.

The roof is formed by NATURLAM R230 ISOL 160 (10 x 1.25 m^2) with 160 mm of insulation. The insulation may be composed of wood fibre (WF), mineral wool (MW) or cork insulation (ICB). The roof panels are finished on the inner side with 40 mm of cryptomeria and on the outside with a 20 mm of cryptomeria. The panels outside may be comprised of a moisture-resistant chipboard with 18 mm or OSB board with 18 mm, coated with a sub-tile waterproof membrane. The edges are comprised by 160 x 25 mm^2 of cryptomeria. The panel joints are covered by an appropriate adhesive tape. A ventilation grille, embedded in the lower end of each panel, crosses all roof perimeter.

When the building has a 1st floor, the slab between floors is formed by CRIPTOLAM F210 panels (0.5 x 8.0 m^2), directly placed on the walls, built in cryptomeria glued laminated solid wood with 210 mm of thickness, assembled side-by-side with nailed joint covers in the upper-face. The maximum free-span of these panels is 6.0 m. This panels are covered by mineral wool (45 mm) and wooden floor.

The kit is intended to be assembled on a rigid ground slab, for example a concrete slab that is covered by mineral wool and a wooden floor.

The insulation products that may be incorporated in the kit ITS, as described, do not contribute to the loadbearing capacity and stability of the works.

Other accessories complete the ITS kit, such as:

- Columns on the exterior building corners. They are screwed to the walls and, beyond an aesthetic function, they support the cantilever beams by anchoring for hold the roof panels who compose the eaves in the gable wall;

- Anchorages to assemble the façade panels and interior wall partitions into the concrete slab;
- External joint-covers;
- Exterior roof-boards;
- Roof eaves wood boards;
- Windows and doors.

The kit is manufactured in accordance with the provisions of this European Technical Assessment and as laid down in the technical documentation deposited at the Itecons.

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

Timber building kit ITS is intended, mainly, to be used as a residential building. It can be produced as ground floor buildings or can have one additional storey. The ITS kit is suitable for various climatic conditions.

The external envelope was evaluated as sufficient watertight under normal climatic conditions.

Concerning the vapour permeability and moisture resistance, the timber frame building kit is intended to be used for buildings with a humidity flow (diffusion) from inside towards outside.

Vapour permeability of the timber building kit was evaluated for specific climatic conditions. The kit should be re-assessed in case of application under different climatic conditions.

The use of the kit in areas where termite attack can occur is extremely inadvisable without additional chemical treatment. This kind of treatments are not part of this assessment.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the building kit of 50 years for the load-bearing structure and non-accessible components and materials, and 25 years for repairable or replaceable components and materials like claddings, roofing materials, exteriors trims, and integrated components like windows and doors provided. The kit, during its working life, should be subject to appropriate use and maintenance.

Package, transport, storage, assembly and maintenance of the kits are laid down in the manufacturer's technical documentation.

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

The assessment of the fitness for use of this kit according to the basic requirements for construction works were carried out in compliance with EAD 340308-00-0203.

3.1. Mechanical resistance and stability (BWR1)

The components of the kit, which are necessary for the mechanical resistance, stiffness and stability, are listed in Annex A and described regarding to their composition and geometry.

If the kit is intended to be used in areas where seismic actions are predictable, the response of the structure should be studied case-by-case, taking into account national regulations, if needed.

The foundations are not part of the kit. The individual loads and conditions of each kit should be taken in account for the structural design of the foundations or design of constructions that the kit will be fitted on.

3.1.1. Resistance, stability and stiffness of wall, floor and roof structures and their connections against vertical and horizontal loads

Indication of geometrical data of the components and elements and their properties related to mechanical resistance and stability are used as an expression of resistance, stability and stiffness of wall, floor and roof elements against vertical and horizontal loads.

The wall, floor and roof elements, including relevant fasteners for their assembling, are presented in Annex A.

Information given are used case by case calculations according to EN 1990, EN 1991, EN 1995-1-1 and EN 1998-1 taking into consideration respective requirements of the Member States regarding ultimate limit state and serviceability limit state.

Additionally, numerical calculations are presented in Annex B for CRIPTOLAM F210.

3.1.2. Shear resistance in plane direction against horizontal loads

The shear resistance and stiffness were determined according to EN 594. The test specimens were composed by NATURLAM W180 Bilam and the dimensions were 2.4 m x 2.4 m without openings. The test specimens were fixed to the test rig by clamps. The test was carried out with vertical load of 5 kN. The racking stiffness of NATURLAM W180 Bilam is 2490 N/mm and the racking strength of NATURLAM W180 Bilam is 12.45 kN.

Racking stiffness and the racking strength of NATURLAM W180 Monolam, NATURLAM W90 - ICB and NATURLAM W90: No performance assessed.

3.1.3. Compression resistance – log walls

The compression resistance of the NATURLAM W180 Bilam was assessed according to the procedure of EN 26891. The test specimen dimensions were 10.0 m x 3.0 m with 5 bracing elements. The dowel system was composed of threaded bars and screws. In order to determine the characteristic resistance one test are used, therefore, the characteristic resistance is:

$$F_{C,k} = 0.83 \text{ x } 750 \text{ kN} = 622.5 \text{ kN}$$

Compression resistance of the NATURLAM W180 Monolam, NATURLAM W90 - ICB and NATURLAM W90: No performance assessed.

3.1.4. Settling of construction – log walls

Log house walls are settling in vertical direction after construction due to drying the logs. The amount of the settling is influenced by the way of installation and the final moisture content (MC%) of the structure compared with the moisture content during installation.

The settling of a log house shall be taken into account in the assessment of at least the following detailing:

- Sliding supports on the walls for roof beams;
- Door and window openings;
- The settling must not be prohibited by any construction even if they are not a part of the kit;
- Adjustable screw foot connections for columns, removal of possible adjustments bits, etc. They shall be used as described in the construction manual.

The expected settling of the ITS walls is 5 mm/m (non-settling logs) and needs to be taken in account in the kit design.

3.1.5. Corrosion protection of metal fasteners

The corrosion protection of metal fasteners of the ITS kit are presented in Table 1.

Table 1: Corrosion protection of metal fasteners

Corrosion protection of metal fasteners	
Screws and threaded rods	Corrosion protection in service class 1 and 2 acc. ETA 11/0030
Clip connectors	Corrosion protection in service class 1, 2 and 3 acc. ETA 10/0189

3.2. Safety in case of fire (BWR2)

3.2.1. Reaction to fire of components (materials)

No performance assessed.

3.2.2. Resistance to fire

No performance assessed.

3.2.3. External fire performance of roofs

No performance assessed.

3.3. Hygiene, health and environment (BWR3)

3.3.1. Water vapour resistance

Vapour permeability and moisture resistance of the external envelope was assessed based on calculations according to EN ISO 13788. The calculations showed that the building envelope is adequate for the intended use in case of humidity flow (diffusion) from inside towards outside, taking into account an internal humidity class of 2 according to EN ISO 13788.

If the kit is used under different conditions, a separate assessment needs to be carried out in accordance with EN ISO 13788 using the material properties listed in Annex A as part of the design of works.

3.3.2. Watertightness

3.3.2.1. External envelope

The watertightness of the facade was assessed according to EN 1027. The test specimens were composed by a log straight wall and a log corner wall of NATURLAM W180 Bilam.

The log straight wall specimen consisted of 4 logs and 3 joints, the total dimension of the test specimen was 1200 mm x 800 mm. The total length of the joints was 3.57 m.

The log corner wall specimen consisted of 2 straight log walls with a corner connection. The dimensions of the test specimens were 1200 mm x 1000 mm, totalizing 10 logs and 8 joints. The total length of the joints was 8.24 m.

The results are presented in Table 2.

Table 2: Watertightness class according EN 12208

Type of wall	Test specimen	Watertightness class
NATURLAM W180 Bilam	Log straight wall	Class E1500
	Log corner wall	Class E1200

Type of wall	Test specimen	Watertightness class
NATURLAM W180 Monolam	Log straight wall	No performance assessed
	Log corner wall	

3.3.2.2. Internal surfaces

Internal surfaces in wet areas are not part of the kit.

3.3.3. Durability class/use class

The ITS kit is designed in compliance with durability requirements according the intended working life of 50 years for the load-bearing structure and non-accessible components and materials, and 25 years for repairable or replaceable components and materials like claddings, roofing materials, exteriors trims, and integrated components like windows and doors provided.

The adequacy of the hazard classes/use classes according to EN 335 for wood and wood-based products used in the kit is presented in the Table 3.

Table 3: Hazard class/use class according to EN 335

Type of component	Hazard classes/Use classes
External components	2, 3
Internal components	1

The natural durability according EN 350 is presented in Table 4.

Table 4: Natural durability according EN 350

Species	Fungi	Hylotrupes	Anobium	Termites
Cryptomeria Japonica *(Cryptomeira japonica D. Don)*	5	D	n/a	S
Fir *(Abies alba Mill)*	4	S	S	S
Maritime pine *(Pinus pinaster Ait.)*	3-4	D	D	S
Scots pine redwood *(Pinus sylvestris L.)*	3-4	D	D	S
Southern blue gum *(Eucalyptus globulus Labill)*	5	---	n/a	S

The use of the kit in regions where termite attack may occur is impermissible without additional chemical treatment. The chemical treatment shall be done according to local regulations for such use. This European Technical Assessment does not involve methods of chemical treatment of the kit.

Additional measures of the works shall be taken to provide adequate durability if the kit will be used in climate condition with often incidence of driving rain and snow.

The assumed intended working life requires regular maintenance as specified by the manufacturer instructions.

The adequacy of the service classes according to EN 1995-1-1 for the fasteners used in the kit is given in Annex A.

3.3.4. Content and/or release of dangerous substances

The content, emission and/or release of dangerous substances was assessed taking into account the release scenarios applicable:

IA1: Product with direct contact to indoor air;

The emission of volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) of the NATURLAM W180 Bilam was assessed according to EN 16516. The loading factor considered was L = 0.93 m^2/m^3. The results are presented in Table 5.

Table 5: Emissions of volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) after 28 days of exposure of the NATURLAM W180 Bilam.

Compound	CAS	Concentration ($\mu g/m^3$)	Compound	CAS	Concentration ($\mu g/m^3$)
1,1,2,2-Tetrachloroethane	79-34-5	< 5	Cyclohexane	110-82-7	< 5
1,1,1-Trichloroethane	71-55-6	< 5	Cyclohexanone	108-94-1	< 5
1,1,2-Trichloroethane	79-00-5	< 5	Dibromochloromethane	124-48-1	< 5
1,2,4-Trichlorobenzene	120-82-1	< 5	Ethyl acetate	141-78-6	< 5
1,2,4-Trimethylbenzene	95-63-6	< 5	Ethylbenzene	100-41-4	< 5
1,2-Dibromoethane	106-93-4	< 5	Formaldehyde	50-00-0	6
1,2-Dichlorobenzene	95-50-1	< 5	Hexachloro-1,3-butadiene	87-68-3	< 5
1,2-Dichloroethane	107-06-2	< 5	Methyl iso-butyl ketone (MIBK)	108-10-1	< 5
1,2-Dichloropropane	78-87-5	< 5	Methyl n-butyl ketone	591-78-6	< 5
1,3,5-Trimethylbenzene	108-67-8	< 5	m-Xylene	108-38-3	< 5
1,3-Dichlorobenzene	541-73-1	< 5	n-Hepthane	142-82-5	< 5
1,4-Dichlorobenzene	106-46-7	< 5	n-Hexadecane	544-76-3	< 5
1,4-Dioxane	123-91-1	< 5	n-Hexane	110-54-3	< 5
1-Ethyl-4-methyl benzene	622-96-8	< 5	o-Xylene	95-47-6	< 5
2-Butoxyethanol	111-76-2	< 5	Phenol	108-95-2	< 5
Acetaldehyde	75-07-0	< 3	p-Xylene	106-42-3	< 5
Benzene*	71-43-2	< 1	Styrene	100-42-5	< 5
Benzyl chloride	100-44-7	< 5	Tetrachloroethene	127-18-4	< 5
Bromodichloromethane	75-27-4	< 5	Tetrahydrofuran	109-99-9	< 5
Bromoform	75-25-2	< 5	Toluene	108-88-3	< 5
Butylacetate	123-86-4	< 5	trans-1,3-Dichloropropene	10061-02-6	< 5
Carbon tetrachloride	56-23-5	< 5	Trichloroethylene*	79-01-6	< 1
Chlorobenzene	108-90-7	< 5	TVOC	---	258
Cis-1,2-Dichloroethene	156-59-2	< 5	Bis(2-ethylhexyl)phthalate*	117-81-7	< 1
Cis-1,3-Dichloropropene	10061-01-5	< 5	Dibutylphthalate*	84-74-2	< 1
Cloroform	67-66-3	< 5	TSVOC	---	< 5

* CRM - Carcinogenic, mutagenic and reprotoxic substances

Emission of volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) of NATURLAM W180 Monolam, NATURLAM W90 - ICB, NATURLAM W90, NATURLAM R230 ISOL 160, CRIPTOLAM F210: No performance assessed.

3.4. Safety in use (BWR4)

3.4.1. Impact resistance

No performance assessed.

3.5. Protection against noise (BWR5)

The acoustical performance of the components was carried out in accordance with EN ISO 10140-1, EN ISO 10140-2, 3 and EN ISO 10140-4 and EN ISO 717-1 and EN ISO 717-2.

3.5.1. Airborne sound insulation of walls, floors and roof structures

The wall solutions of the kit, NATURLAM W180 Monolam, NATURLAM W180 Bilam and NATURLAM W90 - ICB were tested. The test specimen nominal dimensions were 3140 x 3140 mm^2. The perimeter of the test specimens was sealed with mineral wool. The test area had the standardized value of 10 m^2 (3160 x 3160 mm^2).

The CRIPTOLAM F210 were also tested. The test specimen area was 3540 x 3540 mm^2 and the test area had ≈ 10 m^2 (3160 x 3160 mm^2). The perimeter of the test specimens was sealed with mineral wool.

The weighted apparent sound reduction index of the components tested is shown in the Table 6.

Table 6: Weighted apparent sound reduction index

Component	Acoustical performance
NATURLAM W90 – ICB	R_w = 26 dB
NATURLAM W90	No performance assessed
NATURLAM W180 Monolam	R_w = 33 dB
NATURLAM W180 Bilam	R_w = 31 dB
CRIPTOLAM F210 with mineral wool (45mm) and wooden floor	R_w = 53 dB
NATURLAM R230 ISOL 160	No performance assessed

3.5.2. Impact sound insulation of floors

The CRIPTOLAM F210 with mineral wool (45 mm) and wooden floor was tested. The specimen tested for the impact sound insulation was the same used in the determination of airborne sound insulation. The result is shown in the Table 7.

Table 7: Impact sound insulation for the CRIPTOLAM F210 panels

Component	Acoustical performance
CRIPTOLAM F210 with mineral wool (45mm) and wooden floor	Weighted apparent sound reduction index $L_{n,w}$ = 59 dB

3.5.3. Sound absorption

No performance assessed.

3.6. Energy economy and heat retention (BWR6)

3.6.1. Thermal resistance and thermal transmittance

The thermal resistance, R_T, of the components was determined according to EN ISO 6946 and EN ISO 10211. The results are shown in Annex A.

3.6.2. Air permeability of log walls

The air permeability of the NATURLAM W180 Bilam was assessed according to EN 1026. The test specimens were composed by a log straight wall and a log corner wall.

The test results are shown in the Table 8.

Table 8: Air permeability test results of the NATURLAM W180 Bilam

Test specimen	Pressure P (Pa)	Airflow / join meter V_L (m^3/h.m) – positive test pressure	Airflow / join meter V_L (m^3/h.m) – negative test pressure	Classification acc. EN 12207
Log straight wall	50	0.15	0.0056	Class 4
	100	0.15	0.0056	
	150	0.15	0.0056	
	200	0.18	0.0056	
	250	0.20	0.0056	
	300	0.30	0.014	
	450	0.44	0.240	
	600	0.55	0.250	
Log corner wall	50	0.72	0.46	Class 3
	100	0.92	0.68	
	150	1.10	0.88	
	200	1.40	1.10	
	250	1.60	1.20	
	300	1.80	1.30	
	450	2.20	1.70	
	600	2.80	2.30	

Air permeability of the NATURLAM W180 Monolam: No performance assessed.

3.6.3. Thermal inertia

Specific heat capacities and material densities are listed in Annex A. These values were obtained from EN ISO 10456:2007 and declarations of performance of the kit components.

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

According to the Decision 1999/455/EC of the European Commission[1], the system of assessment and verification of constancy of performance (see Annex V to the regulation (EU) No 305/2011) is System 1.

[1] Official Journal of the European Communities L 178/56-57 of 14.7.1999

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

The ETA is issued on the basis of agreed data/information, deposited at Itecons, which identifies the product that has been assessed and judged. It is the manufacturer's responsibility to make sure that all those who use the kit are appropriately informed of specific conditions laid down in this ETA.

Changes to the kit or the components or their production process should be notified to the Itecons before the changes are introduced. Itecons will decide whether or not such changes affect the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

Issued in Coimbra on 08.07.2022

By

Technical Assessment Unit of

Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade

Andreia Gil
Senior Official

(*Technical Assessment Unit Coordinator*)

Validated document

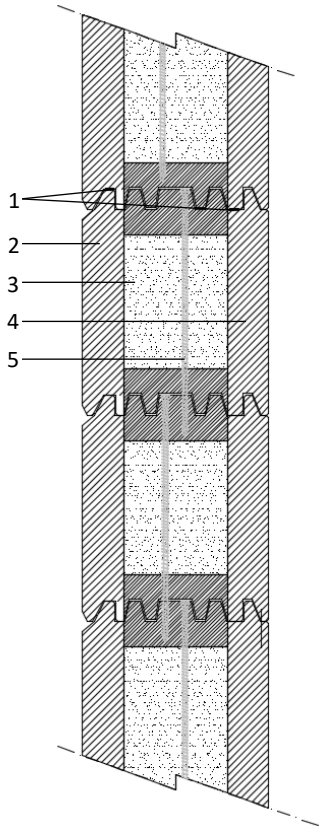
(Administration)

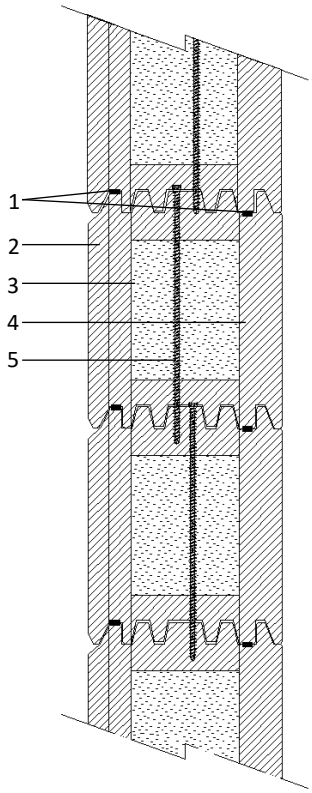
ANNEX A

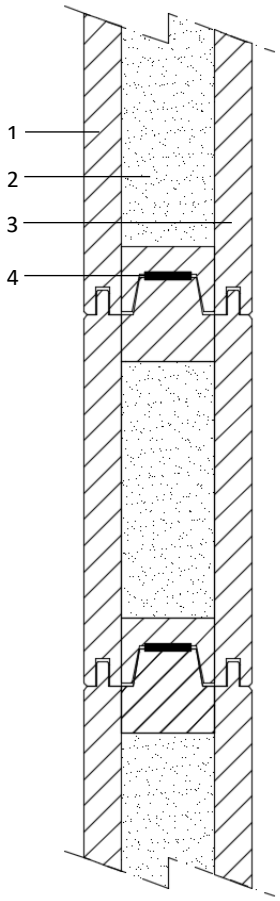
Index of building elements:

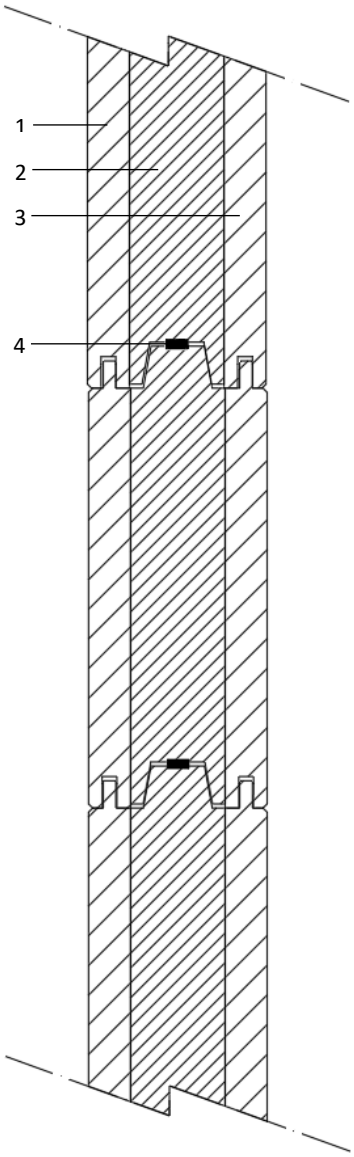
The list of relevant drawings of the ki build-up and construction details
External walls
1. NATURLAM W180 Monolam
2. NATURLAM W180 Bilam
Internal Walls
3. NATURLAM W90 – ICB
4. NATURLAM W90
Roof
5. NATURLAM R230 ISOL 160
Floor
6. CRIPTOLAM F210
Connection between kit parts
7. NATURLAM W180 Monolam – ground floor
8. NATURLAM W180 Bilam – ground floor
9. NATURLAM W180 Monolam – CRIPTOLAM F210
10. NATURLAM W180 Monolam – NATURLAM R230 ISOL 160
11. NATURLAM R230 ISOL 160 – ridge beam
12. Exterior wall – Interior wall
13. Interior wall – interior wall
14. NATURLAM W180 Monolam – window – transversal cross section
15. NATURLAM W180 bilam – window – transversal cross section
16. Exterior wall – window – longitudinal cross section
17. Sill – Exterior Wall NATURLAM W180 Monolam
18. Sill – Exterior Wall NATURLAM W180 Bilam
19. Exterior corner
20. Interior corner
21. External wall longitudinal joints
22. Corner NATURLAM W90

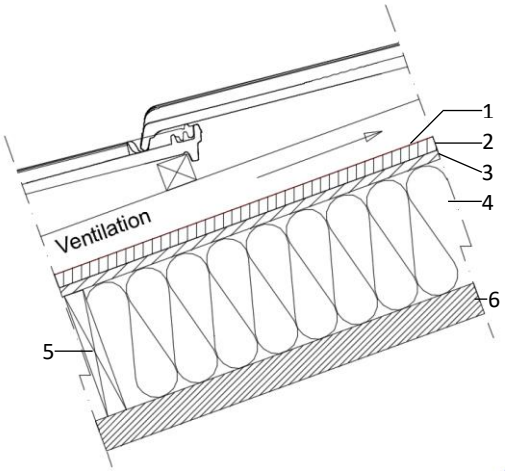
Materials/products specifications

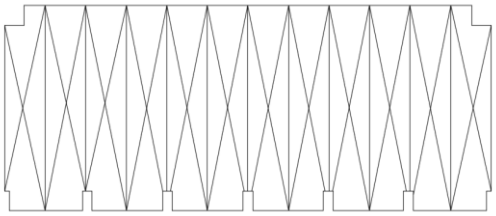
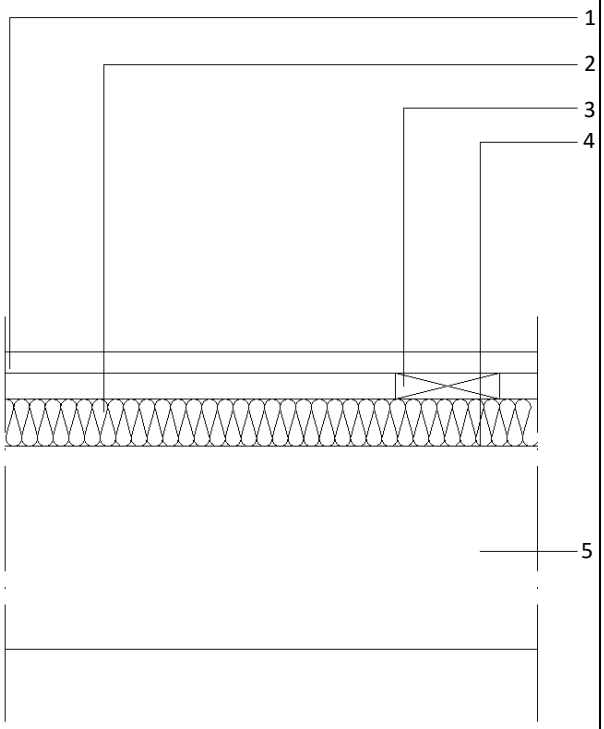
1 – External wall – NATURLAM W180 Monolam	
Wall cross section:  	Element composition (from outside to inside): 1 – Self-expanding sealing tape 10x10 mm 2 – Cryptomeria 40 mm 3 – Expanded Insulated Cork Board 100 mm 4 – Cryptomeria 40 mm 5 – Screw 6x240mm cc 1.0 m Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): R_T = 3.03 m^2K/W Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): R_W = 33.00 dB

2 – External wall – NATURLAM W180 Bilam	
Wall cross section:  	Element composition (from outside to inside): 1 – Self-expanding sealing tape 10x10 mm 2 – 2x Cryptomeria 20 mm 3 – Expanded Insulated Cork Board 100 mm 4 – Cryptomeria 40 mm 5 – Screw 6x240mm cc 1.0 m Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): R_T = 2.86 m^2K/W Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): R_W = 31.00 dB

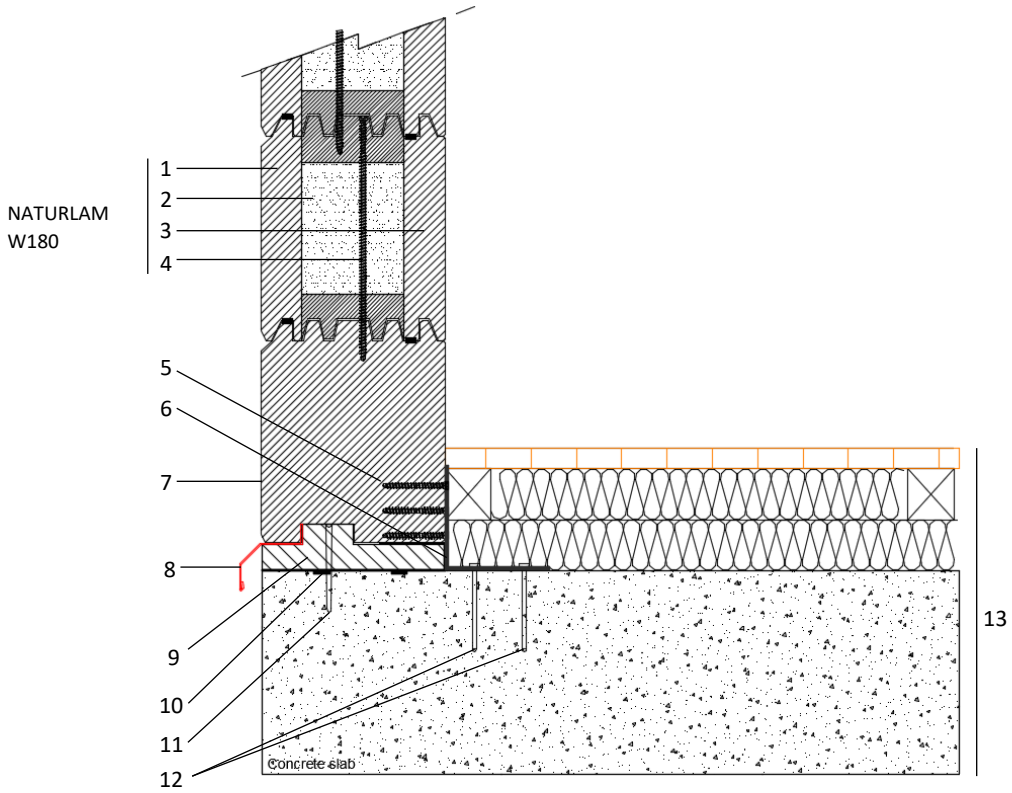
3 – Partition wall – NATURLAM W90 – ICB	
Wall cross section:  	Element composition (from outside to inside): 1 – Cryptomeria 20 mm 2 – Expanded Insulated Cork Board 50 mm 3 – Cryptomeria 20 mm 4 – Self-expanding sealing tape 10x10 mm Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): No performance assessed Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): R_W = 26.00 dB

4 – Partition wall – NATURLAM W90	
Wall cross section:  	Element composition (from outside to inside): 1 – Cryptomeria 20 mm 2 – Nordic pine or Nordic spruce 45 mm 3 – Cryptomeria 20 mm 4 – Self-expanding sealing tape 10x10 mm Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): No performance assessed Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): No performance assessed

5 – Roof – NATURLAM R230 ISOL 160	
Roof cross section:  	Element composition (from outside to inside): 1 –Roof membrane 2 –OSB 3 18 mm or Resistant multifunctional construction board 18 mm 3 – Cryptomeria 20 mm 4 – Wood Fibre or Mineral wool –or Expanded Insulation Cork Board– 5 – Cryptomeria 25x160 mm^2 6 – Cryptomeria 40 mm Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): Ascendent flow $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ MW}$ = 4.62 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ WF}$ = 4.41 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ ICB}$ = 4.36 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ MW}$ = 4.61 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ WF}$ = 4.40 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ ICB}$ = 4.35 m^2K/W Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): Descendent flow $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ MW}$ = 4.69 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ WF}$ = 4.58 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ OSB\ and\ ICB}$ = 4.43 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ MW}$ = 4.68 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ WF}$ = 4.47 m^2K/W $R_{T\ ISOLAM\ R230\ composed\ by\ moisture\text{-}resistant\ multifunctional\ construction\ board\ and\ ICB}$ = 4.42 m^2K/W Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): No performance assessed

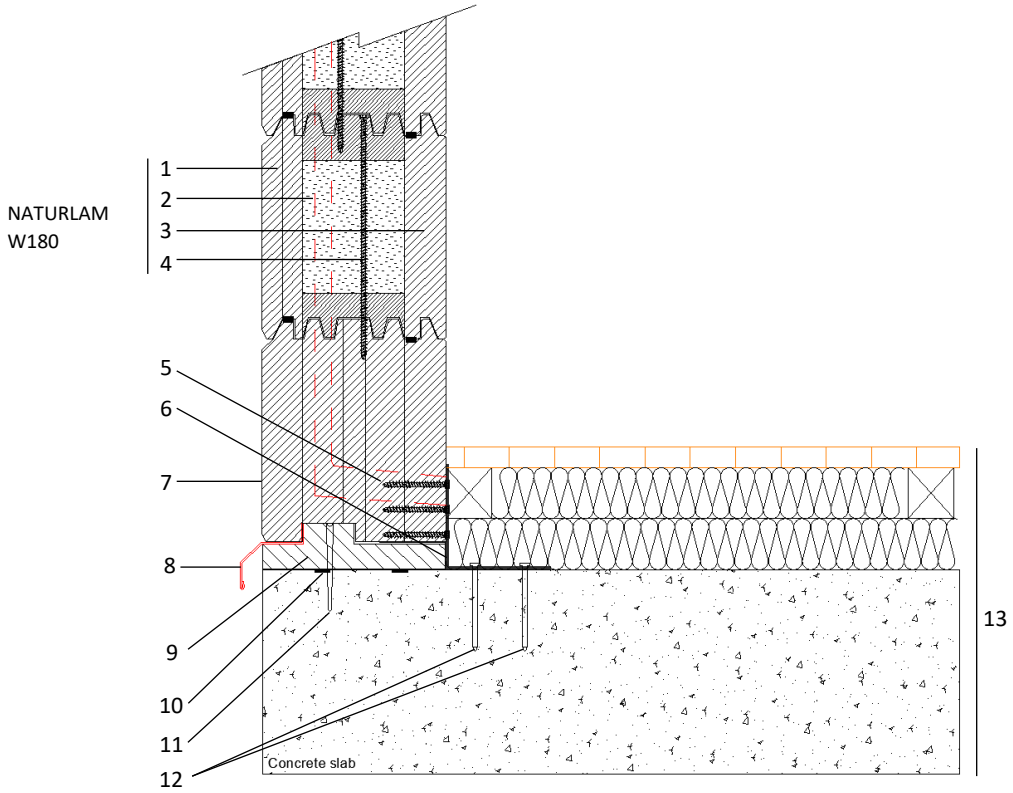
6 – Floor – CRIPTOLAM F210	
Floor transversal cross section (without coating layers):  Floor longitudinal cross section (with coating layers) 	Element composition: Floor transversal cross section (without coating layers): Cryptomeria glued laminated solid wood with 210x500 mm^2 and 8000 mm of length Maximum free span = 6.0 m Floor longitudinal cross section (with coating layers): 1 – Wooden floor 20 mm 2 – Mineral wool 45 mm 3 – Wooden lath 25x100 cc 0.33 m 4 – Polyethylene sheet – 5 – CRIPTOLAM F210 Thermal characteristics (Determined acc. EN ISO 6946 and EN ISO 10211): Ascendent flow R_T = 4.15 m^2.K/W Descendent flow R_T = 4.32 m^2.K/W Acoustic characteristics (Determined acc. EN ISO 10140-1, 2, 3 and 4 and EN ISO 717-1 and 2): R_W = 53.00 dB $L_{n,w}$ = 59.00 dB

Detail 7: External wall – NATURLAM W180 Monolam – ground floor



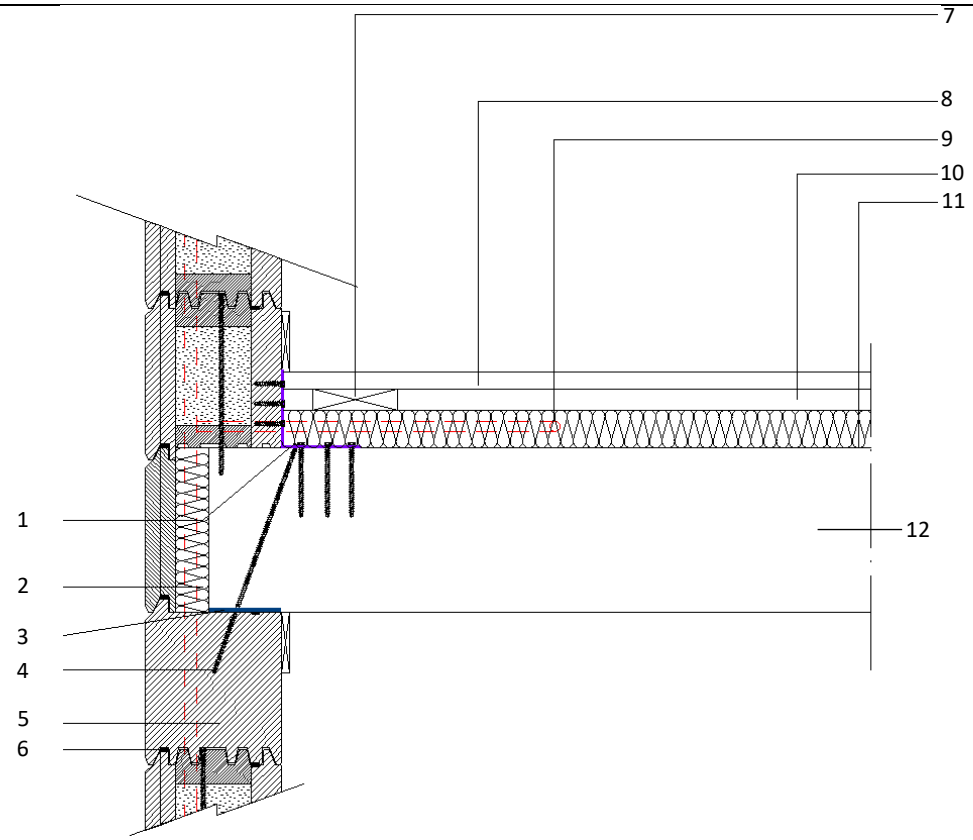
1 – Cryptomeria 40 mm
2 – Expanded Insulated Cork Board 100 mm
3 – Cryptomeria 40 mm
4 – Screw 6x240 mm cc 1.0 m
5 – 3 Screws 8x80 mm
6 – Angle bracket 100x100 mm^2 cc 1.0 m
7 – Solid base log
8 – Metallic drip edge
9 – Wooden sleeper CL4
10 – PE Membrane
11 – Anchor 6x80 mm cc 1.0 m
12 – 2 Mechanical Anchors –10x80 mm
13 – Ground floor layers (not included in the kit)

Detail 8: External wall – NATURLAM W180 Bilam – ground floor



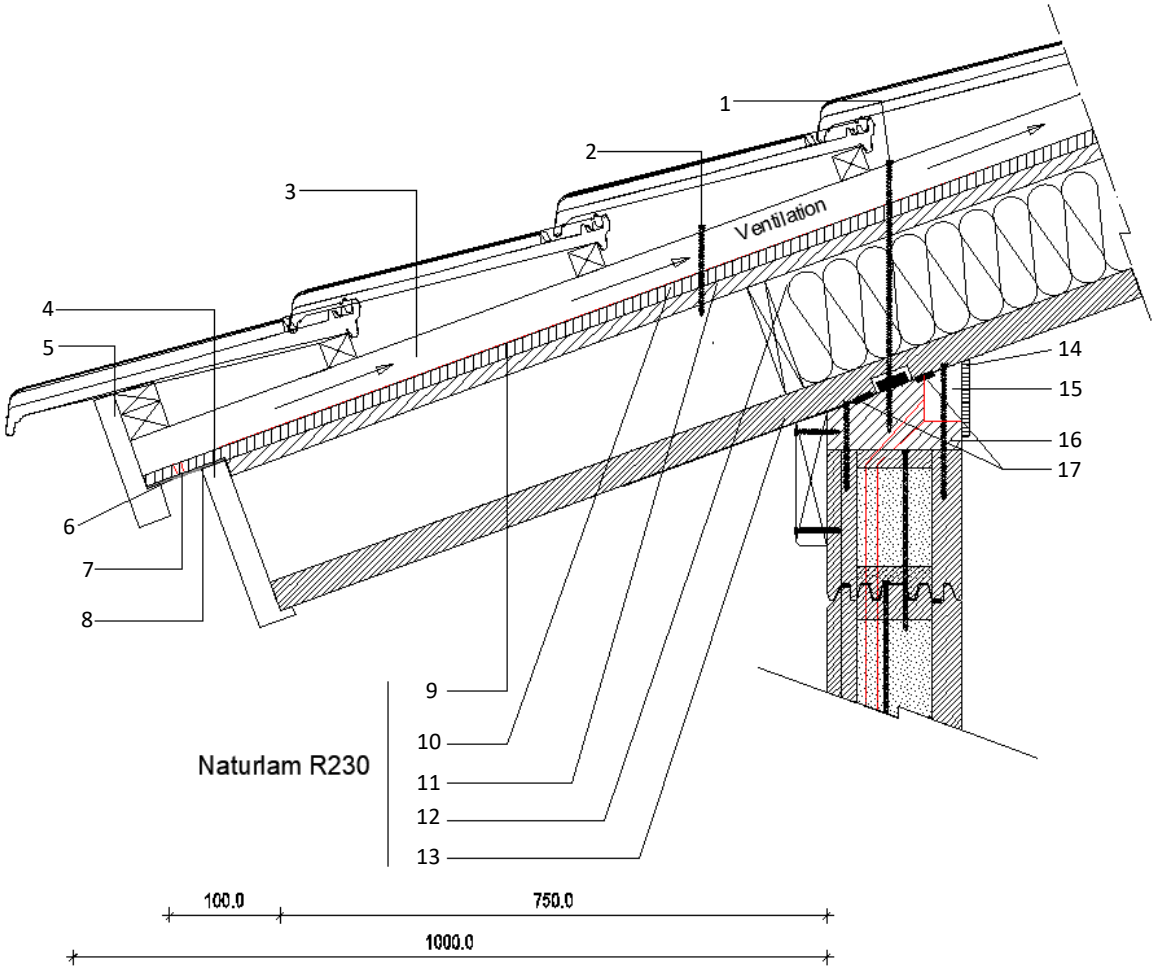
1 – 2 x Cryptomeria 20 mm
2 – Expanded Insulated Cork Board 100 mm
3 – Cryptomeria 40 mm
4 – Screw 6x240 mm cc 1.0 m
5 – 3 screws 8x80 mm
6 – Angle bracket 100x100mm cc 1.0 m
7 – Solid base log 180 mm
8 – Metallic drip edge
9 – Wooden sleeper CL4
10 – PE Membrane
11 – Anchor 6x80 mm cc 1.0 m
12 – 2 mechanical anchors –10x80 mm
13 – Ground floor layers (not included in the kit)

Detail 9: External wall (NATURLAM W180 Bilam) – intermediate floor (CRIPTOLAM F210)



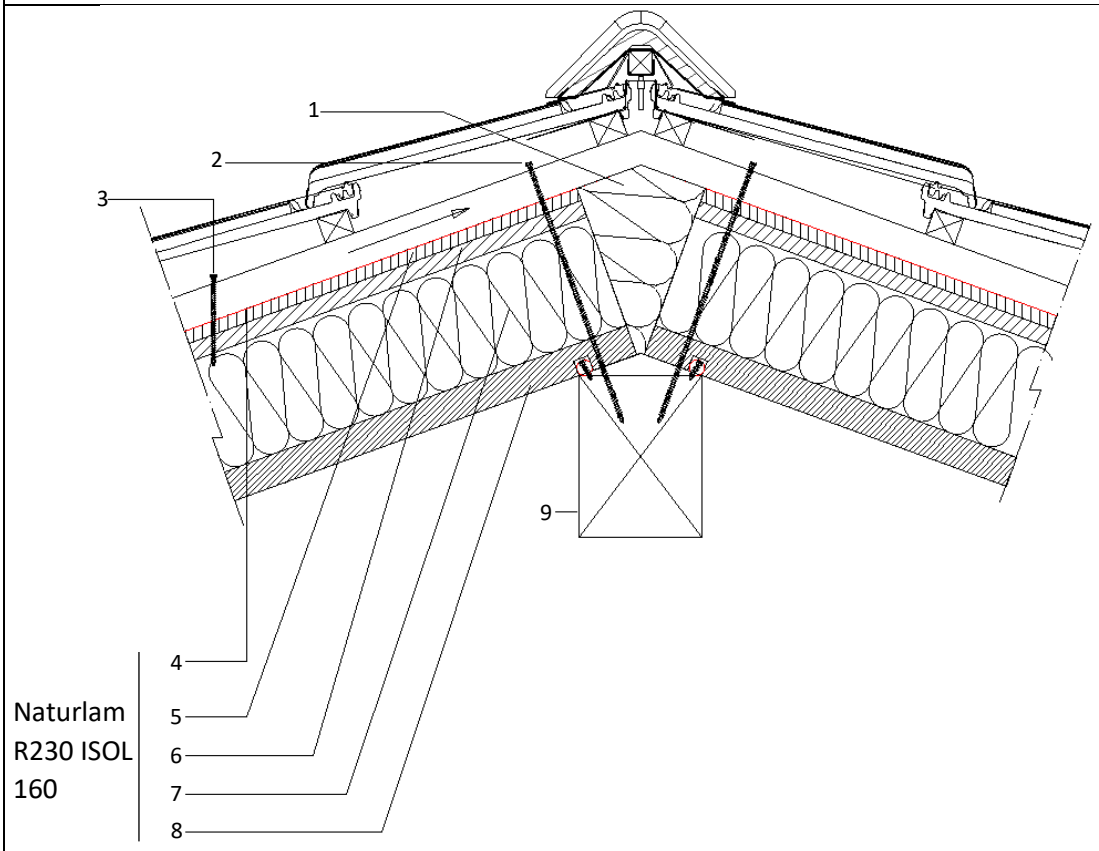
1 – Angle bracket –100x100 mm^2 cc 1.0m/3 screws 8x80 mm + 3 screws 8x40 mm
2 – Insulation PU foam
3 – resilient soundproofing profile made of linen – load 7.35 kN/m
4 – Screw 10x360 mm cc 0.5 m
5 – Solid log
6 – Self-expanding sealing tape 10x10 mm^2
7 – Wooden lath 25x100 mm^2 cc 0.33 m
8 – Wooden floor 20 mm
9 – Mineral wool – E – 525 – 45 mm
10 – Air layer 25 mm
11 – Polyethylene sheet
12 – CRIPTOLAM F210

Detail 14: External wall (NATURLAM W180 Bilam) – roof (NATURLAM R230 ISOL 160)



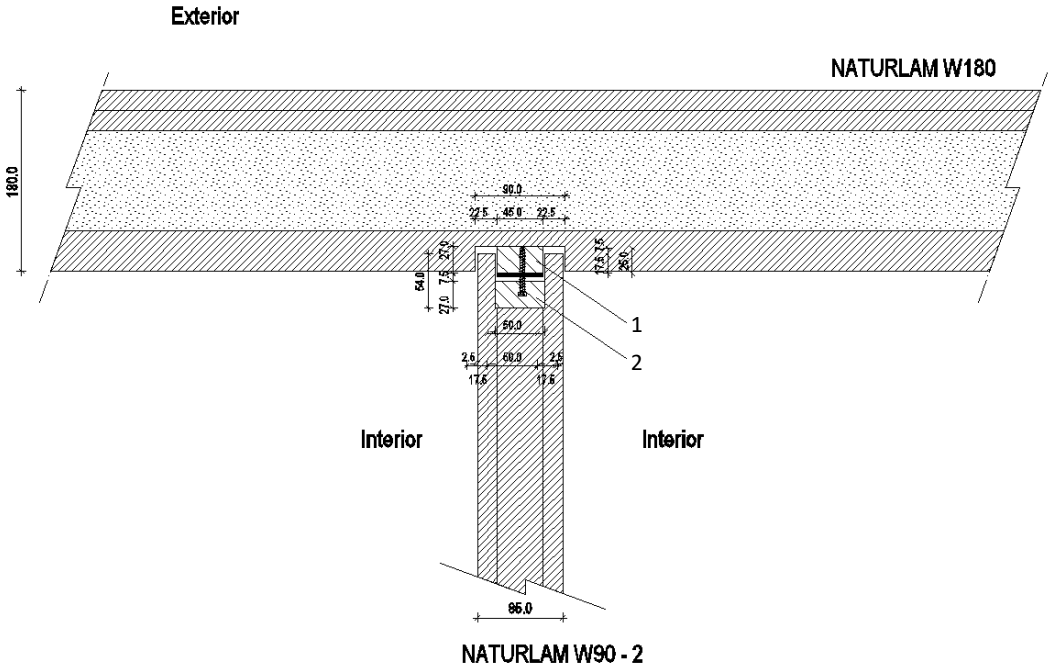
1 – Screw 10x360 mm cc 0.63 m
2 – Screw 6x100 mm cc 0.60 m
3 – Wooden beam 45x45 mm^2 cc 0.63 m
4 – Eaves wooden board 40x225 mm^2
5 – Eaves wooden board 40x160 mm^2
6 – Air open
7 – Ventilation grille
8 – Exit for condensed water
9 – Roof membrane
10 – OSB 3 18 mm or Moisture-resistant chipboard 18 mm
11 – Cryptomeria 20 mm
12 – Wood Fibre –or Expanded Insulated Cork Board or Mineral wool – 165 mm
13 – Cryptomeria 40 mm
14 – Crown molding made of cryptomeria
15 – Groove for electric pipelines 80x50 mm^2
16 – Wooden solid sleeper
17 – Self-expanding sealing tape

Detail 11: Roof (NATURLAM R230 ISOL 160) – Ridge Beam



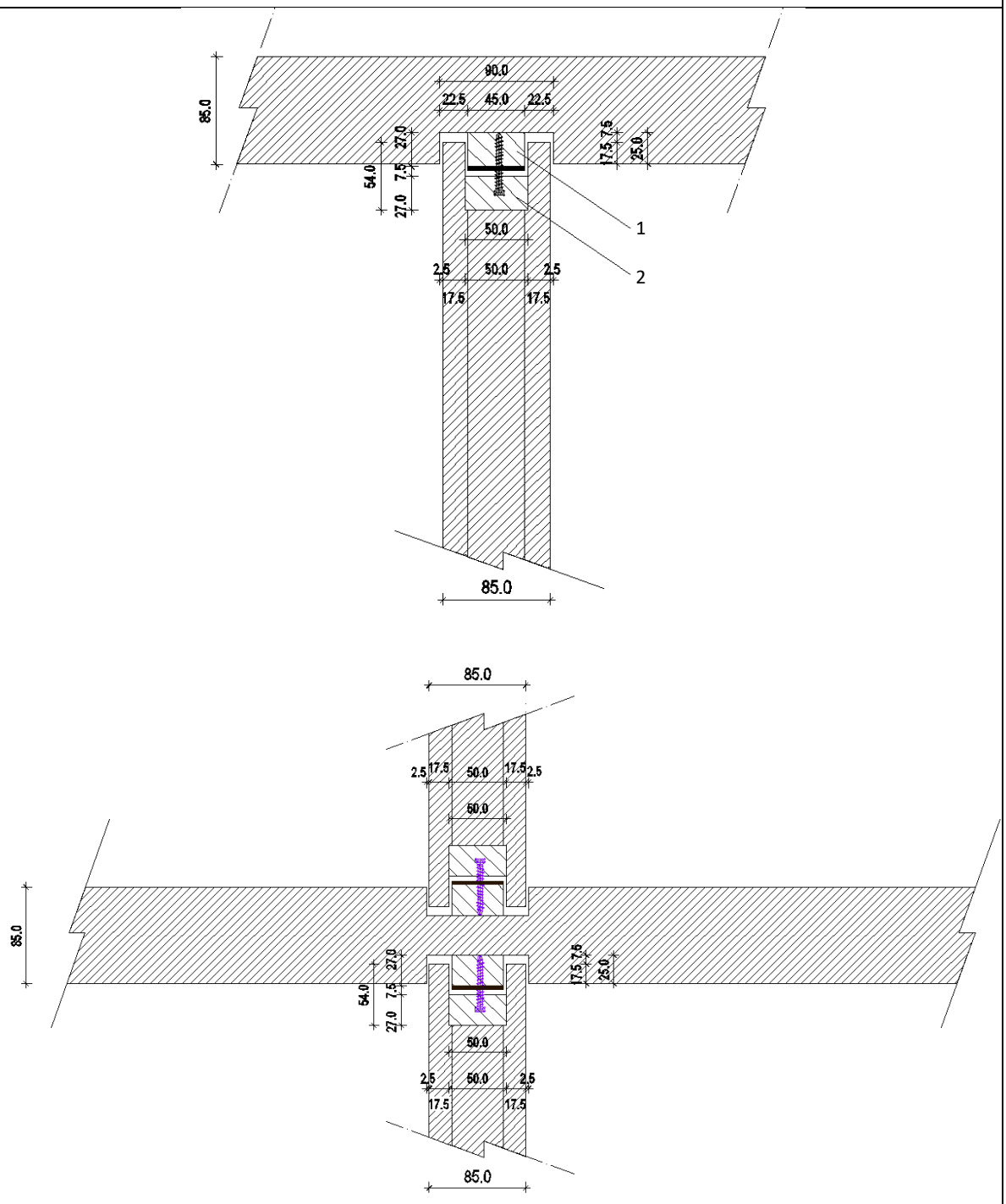
1 – Thermal insulation – Wood fibre or Expanded Insulated Cork Board or Mineral wool
2 – Screw 10x360 mm cc 0.63 m
3 – Screw 6x100 mm cc 0.60 m
4 – Roof membrane
5 – OSB 3 18 mm or moisture-resistant chipboard 18 mm
6 – Cryptomeria 20 mm
7 – Wood Fibre or Expanded Insulated Cork Board or Mineral wool – 160 mm
8 – Cryptomeria 40 mm
9 – Ridge beam

Detail 12: Exterior Wall – Interior Wall



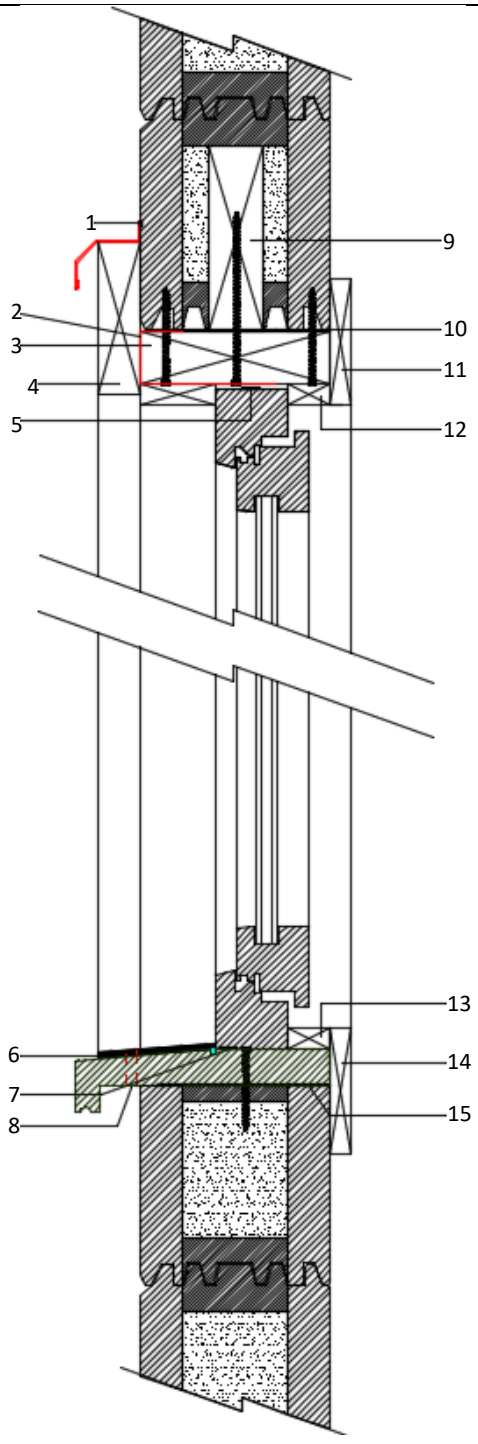
1 – LVL 45x27 mm^2
2 – LVL 50x50 mm^2

Detail 13: Interior Wall – Interior Wall



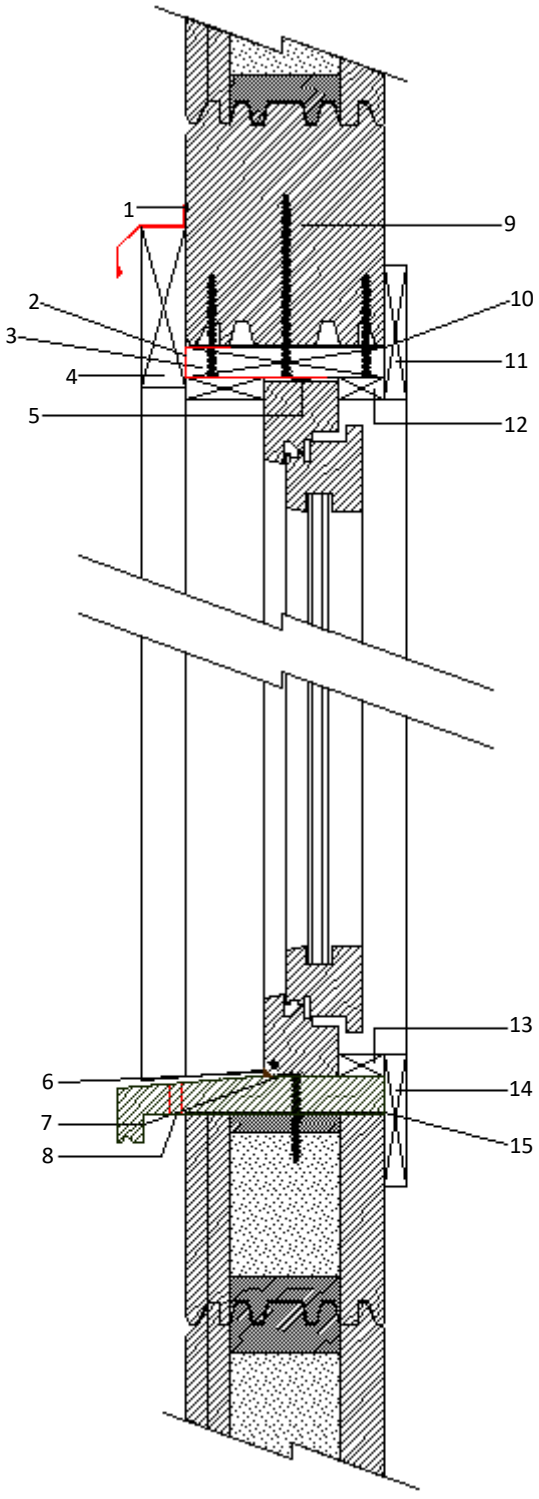
1 – LVL 45x27 mm^2
2 – LVL 50x50 mm^2

Detail 14: Exterior Wall (NATURLAM W180 Monolam) – Window transversal cross section



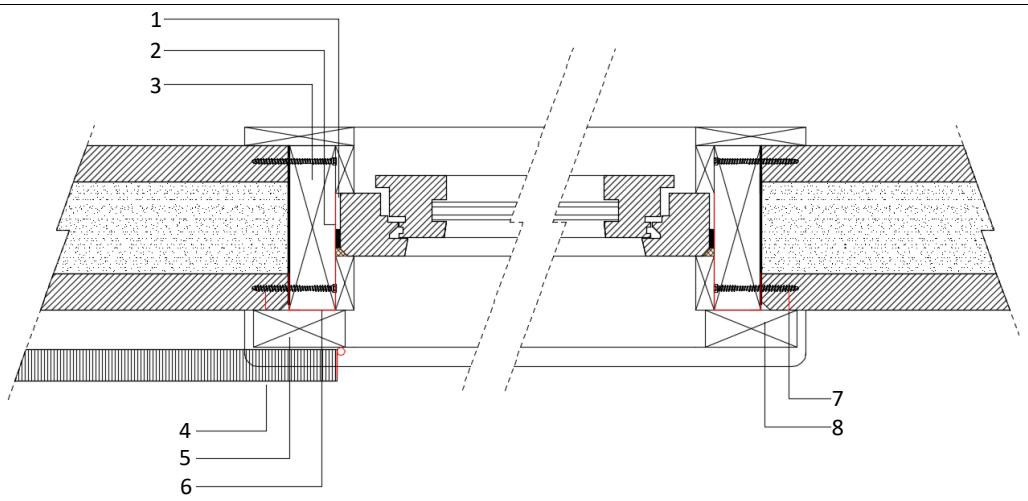
1 – Butyl joint 2 – Waterproof membrane 3 – LVL 50 mm 4 – Trim (window frame) 40x160 mm^2 5 – Joint – connect band 6 – Joint – connect band 7 – Self-expanding sealing tape – 8 – Drainage channel	9 – Embedded beam LVL 50 mm (for big spans) 10 – Connect band seal joint 11 – Trim 20x100 mm^2 12 – Panelled 13 – Panelled 14 – Trim 20x100 mm^2 15 – Self-expanding sealing tape

Detail 15: Exterior Wall (NATURLAM W180 Bilam) – Window transversal cross section



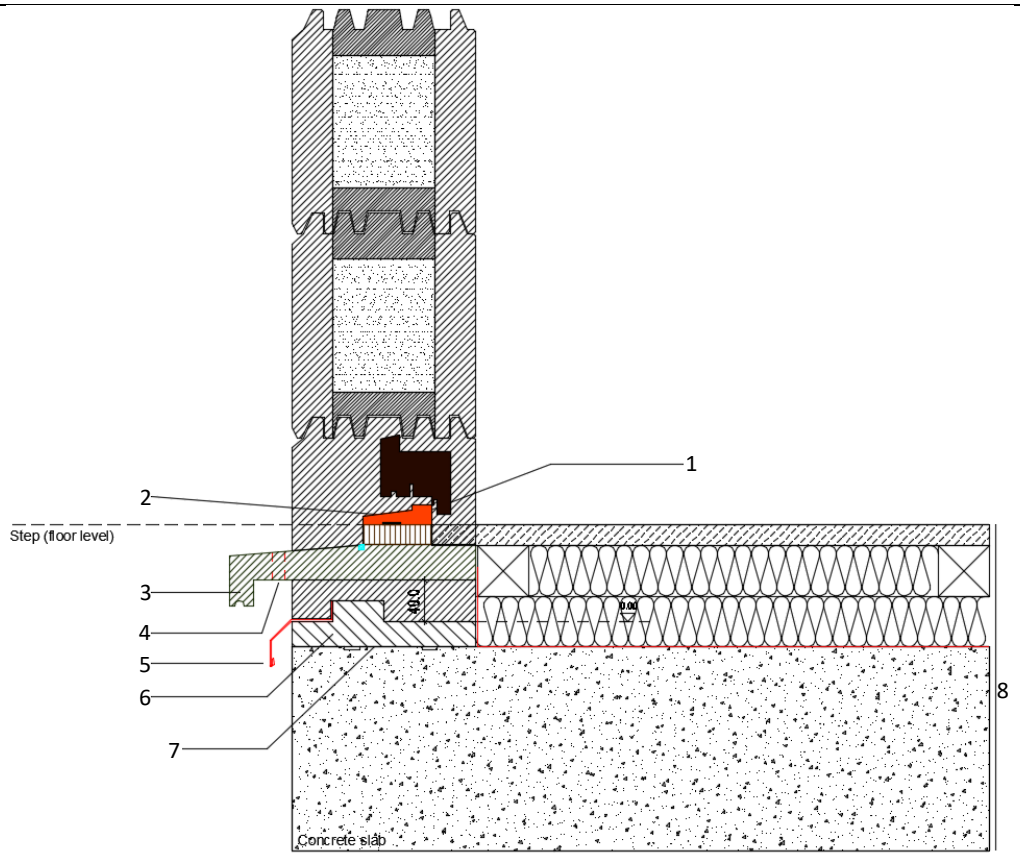
1 – Butyl joint 2 – Waterproof membrane 3 – LVL 27 mm 4 – Trim (window frame) 40x150 mm^2 5 – Joint – connect band 6 – Joint – connect band 7 – Self-expanding sealing tape 8 – Drainage channel	9 – Solid log (for big spans) 10 – Connect band seal joint – 11 – Trim 20x100 mm^2 12 – Paneled 13 – Paneled 14 – Trim 20x100 mm^2 15 – Self-expanding sealing tape

Detail 16: Exterior Wall – Window – Longitudinal cross section



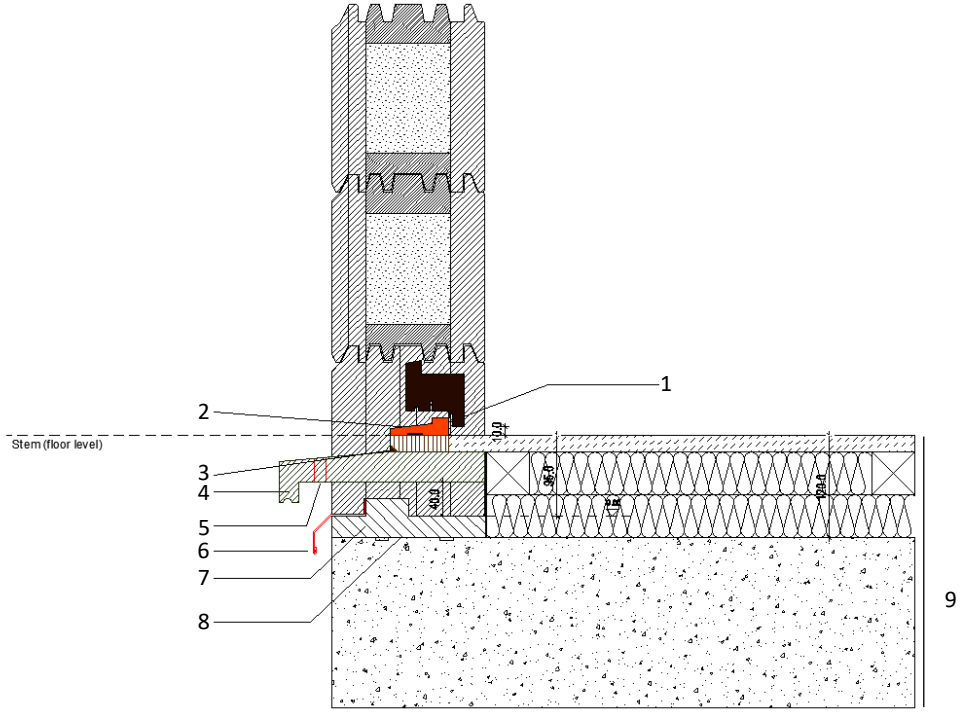
1 – Looseness 5 mm
2 – Joint – connect band
3 – LVL 50 mm – NATURLAM W180 – Monolam / LVL 27 mm – NATURLAM W180 – Bilam
4 – Window blinds
5 – Window pillar 40x100 mm^2
6 – Waterproof membrane
7 – Water barrier (aluminium profile)
8 – Drainage channel

Detail 17: Sill – Exterior Wall (NATURLAM W180 Monolam)



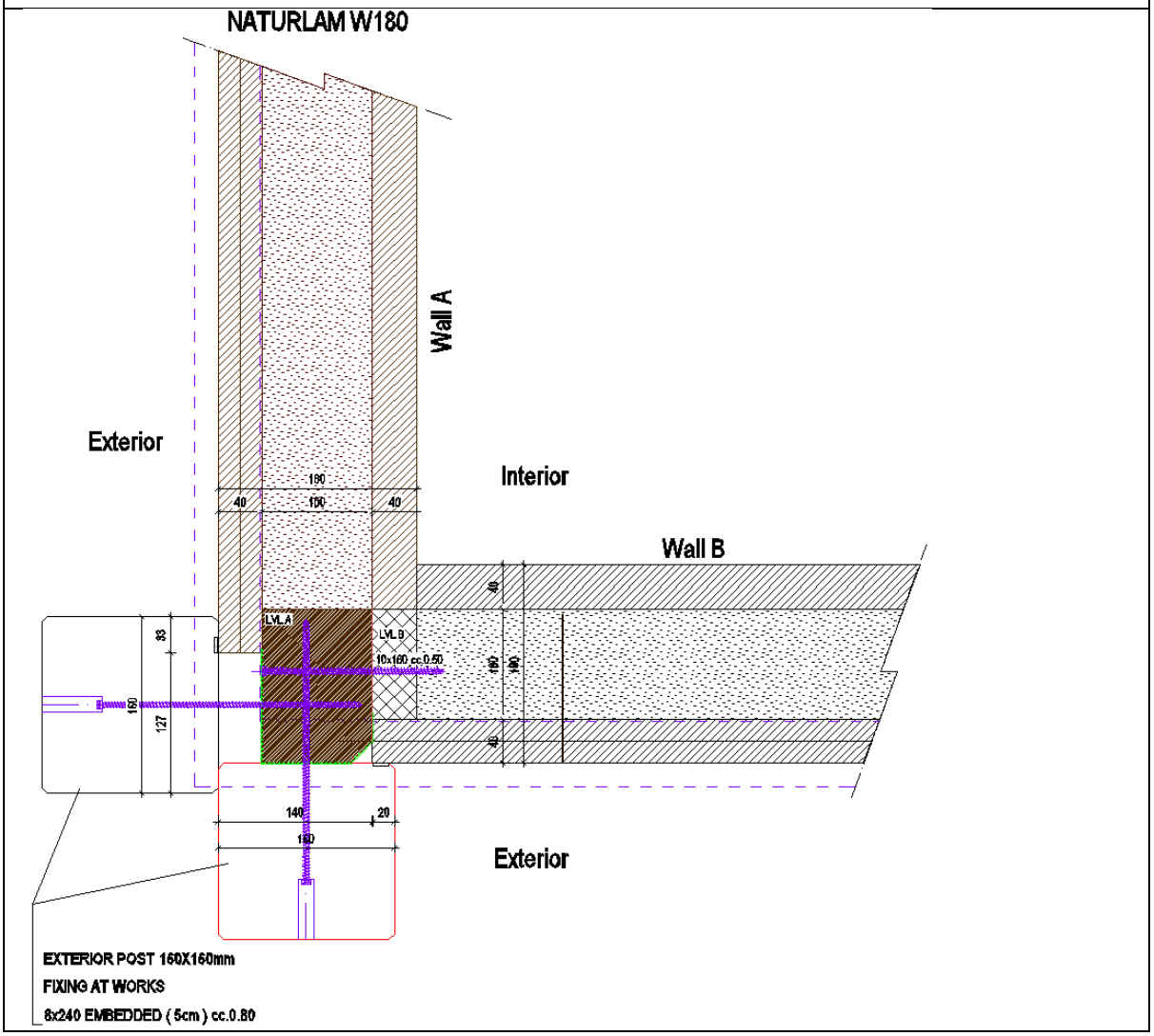
1 – Self-expanding sealing tape
2 – Window sill from persons with reduce mobility
3 – Wooden window sill
4 – Drainage channel
5 – Metallic drip edge
6 – Striker CL4
7 – Capillarity barrier
8 – Ground floor layers (not included in the kit)

Detail 18: Sill – Exterior Wall (NATURLAM W180 bilam)

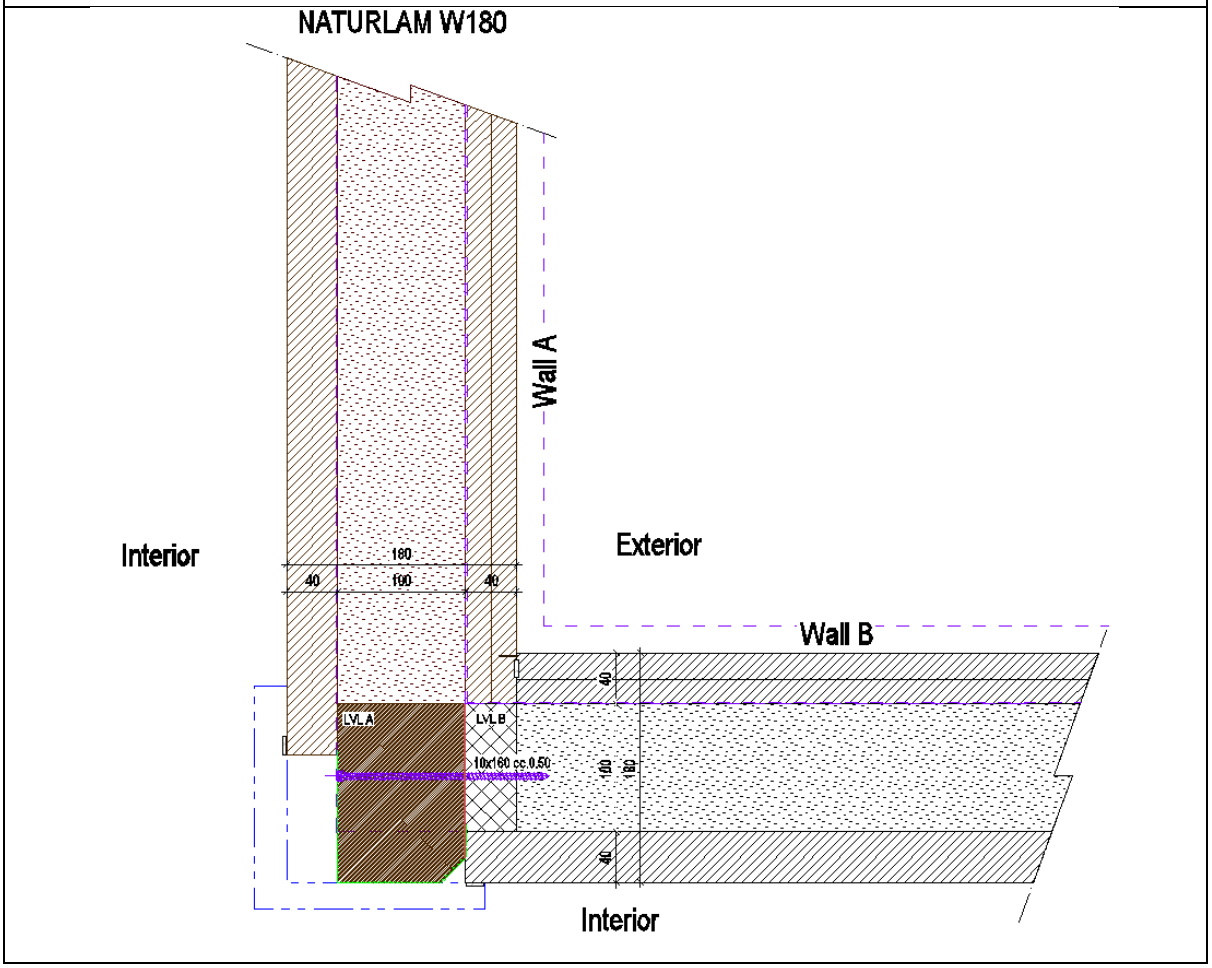


1 – Self-expanding sealing tape –
2 – Window sill from persons with reduce mobility
3 – Silicone joint
4 – Wooden window sill
5 – Drainage channel
6 – Metallic drip edge
7 – Striker CL4
8 – Capillarity barrier
9 – Ground floor layers (not included in the kit)

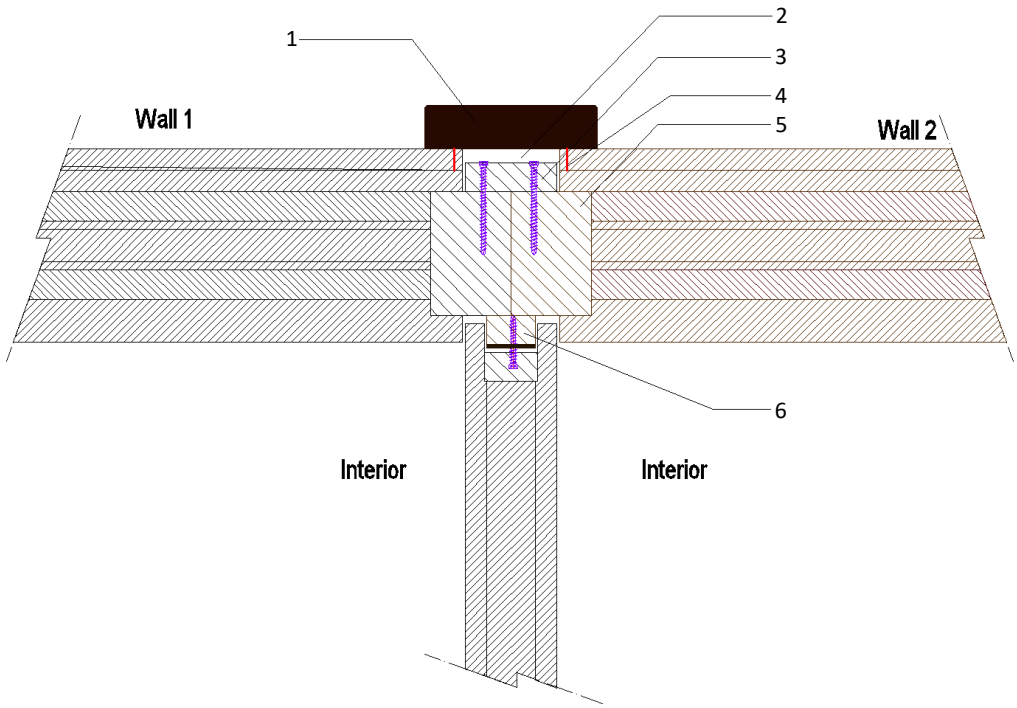
Detail 19: Exterior corner



Detail 20: Interior corner

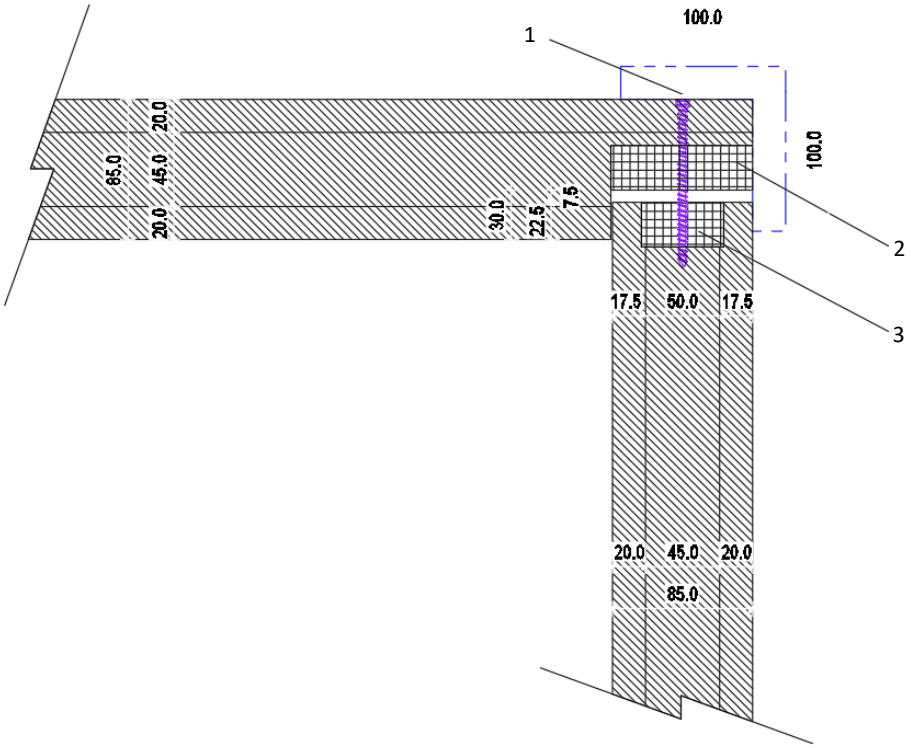


Detail 21: Longitudinal joints – NATURLAM W180



1 – Wooden joint cover 160x40 mm²
2 – Drainage channel 85x15 mm²
3 – LVL 85x27 mm²
4 – Water barrier (aluminium profile)
5 – LVL 115x75 mm²
6 – LVL 45x27 mm²

Detail 22: Corner NATURLAM W90



1 – Screw 6x100 cc 0.50 m
2 – LVL 86x27 mm
3 – LVL 50x27 mm

Table A.1 – Materials and products specifications

Product	Technical Specification	ρ (Kg/m³)	λ (W/mK)	μ (-) or Sd (m)	C (J/kgK)	Reaction to fire EN 13501-1+A1
Particleboard	CE Marking acc. EN 13986+A1:2015	---	0.14	μ = 16	---	D-s2,d0
Flexible sheet for waterproofing	CE Marking acc. EN 13859-2:2014	---	---	Sd = 0.15 m	---	E
Universal single-sided tape without release liner (e.g., SPEEDY BAND)	---	---	---	Sd = 40 m	---	---
OSB 3	CE Marking acc. EN 13986:2004+A1:2015	650	0.13	---	---	D-s2, d0
Wood Fibre	CE Marking acc. EN 13171:2012+A1:2015	---	0.038	μ = 2	---	E
Anti-birds net for the air ventilation gap in the roof (e.g. Riwega)	---	Metal or PVC anti-birds Flexible net of the air ventilation gap in the roof				
Mineral wool	CE Marking acc. EN 13162:2012+A1:2015	---	0.041	1	---	A1
Resilient soundproofing profile (e.g., ALADIN STRIPE)	---	---	---	---	---	E
PE Membrane (e.g. alberplás)	---	920 – 940	---	---	---	---
Bolt for wooden floor (e.g., INEMER – Cavilhas para soalho – zincado amarelo)	---	Reference: 6 x 80 Zn Amr Dimensions: 6 x 80 mm Material: Steel 200 HV Finishing: Yellow zinc plated A2L				
Dowel (e.g., WORLDFIX BUCHA CH)	---	Reference: BUCHA CH Dimensions: 10 x 80 mm				
Linen insulating band (e.g., ISOLINA)	ISO 8301 DIN 52615 EN ISO 12571	---	0.038	μ = 1 – 2	1600	E
Angle Bracket	CE Marking acc. ETAG015	Reference: WBR 100 Dimensions: 100 x 100 x 90 x 3 mm Material: Stainless Steel Reaction to fire: A1 Durability: Corrosion protection for class 1 and 2 Characteristic load-carrying capacity: see ETA 09/0323				
Metal drip edge	---	Material: Stainless Steel				
ICB Insulation	CE Marking acc. EN 13170:2012+A1:2015	120	0.039	μ = 20	---	E
self-expanding sealing tape	CE Marking acc. EAD 320001-00-0605	---	0.052	μ ≤ 100	---	B1
Varnish (e.g., IGUALAK IL-201)	---	Ford viscosity cup Nº4 = 1000 cps Density = 1.04 gr/cm³ Solids = 33% pH = 8				
Waterproof anti-termite barrier for foundations	CE Marking acc. EN 13967	± 1000	0.4	Sd = 232 m	1800	F
Structural laminated veneer lumber	CE Marking acc. EN 14374:2004	530	---	---	---	D-s1,d0

Product	Technical Specification	ρ (Kg/m³)	λ (W/mK)	μ (-) or Sd (m)	C (J/kgK)	Reaction to fire EN 13501-1+A1
Glue (e.g., AkzoNobel)	---	Reference: Cola MUF 1247 Viscosity: 10000 – 25000 mPas pH: 9.5 – 10.7 Dry extract: 64 – 69% Density: ± 1270 kg/m³				
Hardener (e.g., AkzoNobel)	---	Reference: Endurecedor MUF 2526 Viscosity: 1700 – 2700 mPas pH: 1.3 – 2.0 Density: ± 1070 kg/m³				
PU Glue (e.g., Soudaflex)	---	Reference: Pro 45P Total solid content: 95% Temperature resistance: -30K – 100 K Pressing pressure: 1 kg/cm² – 1.2 kg/cm² Water resistance: D4 Shear strength: > 10MPa				
PU Foam (e.g., Soudafoam GUN)	---	Reference: Soudafoam Gun Density: 17 kg/m³ Acoustic insulation: 58 dB Compression resistance: Ca. 2.0 N/cm² Shear resistance: Ca. 4.0 N/cm² Temperature resistance: -40K – 90 K Water absorption: 1% volume				
Clip connectors	CE Marking acc. ETAG 015	Reaction to fire: A1 Durability: Corrosion protection for class 1, 2 and 3 Mechanical resistance: see ETA 10/0189				
Joist bearing for timber/concrete	CE Marking acc. ETAG 015	Reference: Alumidi Reaction to fire: A1 Durability: Corrosion protection for class 1 and 2 Mechanical resistance: see ETA 09/0361				
Support of timber columns and posts as load-bearing elements	CE Marking acc. ETAG 015	Reaction to fire: A1 Durability: Corrosion protection for class 1, 2 and 3 Mechanical resistance: see ETA 10/0422				
Cryptomeria	NP 4544:2015 EN ISO 10456	ρ_m = 350 (Quality class CYS I) ρ_m = 290 (Quality class CYS II)	0.09	50	1600	---
Portuguese Pine	EN 1611-1:2010 EN ISO 10456	540	0.13	50	1600	---
Eucaliptus	EN ISO 10456	720 – 850	0.18	200	1600	---
Whitewood	EN 1611-1:2010 EN ISO 10456	440 – 480	0.12	50	1600	---
Redwood	EN 1611-1:2010 EN ISO 10456	500 – 540	0.13	50	1600	---
Self-tapping screws and threaded rods	CE Marking acc. EAD 130118-01-0603	Reaction to fire: A1 Durability: Corrosion protection for class 1 and 2 Mechanical resistance: see ETA 11/0030				
Connect band	CE Marking acc. 13984:2010	---	---	---	---	E

Table A.2 – Mechanical characteristics of cryptomeria

Mechanical characteristics of Cryptomeria acc. NP 4544:2015		
	Quality class CYS I	Quality class CYS II
Bending strength (N/mm^2)	19	12
Tension strength parallel to grain (N/mm^2)	13	9
Tension strength perpendicular to grain (N/mm^2)	0.4	0.4
Compression strength parallel to grain (N/mm^2)	20	17
Compression strength perpendicular to grain (N/mm^2)	2.2	1.8
Shear strength (N/mm^2)	3.0	3.0
Modulus of elasticity (kN/mm^2) Parallel to grain: mean value	7.0	5.8
Parallel to grain: characteristic value	4.7	3.9
Modulus of elasticity (kN/mm^2) Perpendicular to grain: mean value	0.24	0.19
Shear modulus (kN/mm^2): mean value	0.44	0.36

ANNEX B

The maximum admissible loads and deformation of the panels CRIPTOLAM F210 were determined by numerical simulation based on experimental data.

The results are shown in the Table B.1.

Table B.1: CRIPTOLAM F210 maximum admissible load for a final maximum deformation of L/300 [mm]

Span [m]	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**
Maximum load values [kN/m^2] beyond: panel self-weight + Q = 2.0 kN/m^2	6.50	4.00	2.40	1.30	0.55
Instantaneous deformation | S.L.S. – P_{sd} = G+Q					
Deformation [mm]	7.90	9.14	10.53	12.33	13.98
Maximum deformation (L/360) [mm]	11.11	12.50	13.89	15.28	16.67
Final deformation | S.L.S. P_{sd} = 1.8G+1.24Q					
Deformation [mm]	13.25	14.91	16.62	18.24	19.99
Maximum deformation (L/300) [mm]	13.33	15.00	16.67	18.33	20.00

The resistant capacity of CRIPTOLAM F210 panels, for the service limit state, was calculated using EN 1995-1-2 (Eurocode 5) method. The results are shown in the Table B.2.

Table B.2: Maximum admissible loads for CRIPTOLAM F210 panels beyond panel self-weight + Q = 200 kg/m^2 (P_{sd} = 1.8G+1.24Q)

	Limit [mm]	**Span [m]**				
		4.0	**4.5**	**5.0**	**5.5**	**6.0**
Maximum admissible loads [kg/m^2]	L/300	650	400	240	130	55
	L/200	1000	640	400	235	120