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Autorizado y notificado con arreglo al artículo 10 de la Directiva 89/106/CEE del Consejo, de 21 de diciembre de 1998, relativa a la aproximación de las disposiciones legales, reglamentarias y administrativas de los Estados miembros sobre los productos de construcción

ITeC **Institut de Tecnologia de la Construcció de Catalunya**

Member of EOTA

European Technical Approval ETA 09/0032

Nombre comercial *Trade name*	**CNH system**
Holder of approval	Vallplana s/n. Polígono Industrial Mas Reixach E-08389 Palafolls, Spain
Tipo genérico y uso del producto de construcción	kit de construcción de edificios de estructura de madera para viviendas unifamiliares aisladas con una altura máxima de dos plantas (planta baja + 1)
Generic type and use of construction product	*Timber frame building kit for construction of detached single-family two storey houses maximum ground + top floor*
Validez: de *Validity: from*	10.07.2009
	www.cnh.es
Planta de fabricación *Manufacturing plant*	Vallplana s/n. Polígono Industrial Mas Reixach E-08389 Palafolls, Spain
El presente Documento de Idoneidad Técnica Europeo contiene	68 páginas, incluyendo anexos 1, 2, 3 y 4.
This European Technical Approval contains	*68 pages including annexes 1, 2, 3 and 4.*

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I LEGAL BASES AND GENERAL CONDITIONS

1 This European Technical Approval is issued by the Catalonia Institute of Construction Technology (ITeC) in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Pa rliament and of the Council[3];
- Real Decreto 1630/1992, de 29 de diciembre, por el que se dictan disposiciones para la libre circulación de productos de construcción en aplicación de la Directiva 89/106/CEE[4];

  Real Decreto 1328/1995, de 28 de julio, por el que se modifican, en aplicación de la Directiva 93/68/CEE, las disposiciones para la libre circulación aprobadas por el Real Decreto 1630/1992, de 29 de diciembre. (BOE 19-8-95) y la Orden CTE/2276/2002 de 4 de septiembre;
- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the annex to Commission Decision 94/23/EC[5];
- Guideline for European Technical Approval No. 007 Timber Frame Building Kits, edition April 2001

2 The Catalonia Institute of Construction Technology (ITeC) is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 laid down in the context of this European Technical Approval.

4 This European Technical Approval may be withdrawn by the Catalonia Institute of Construction Technology (ITeC), in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Catalonia Institute of Construction Technology (ITeC). In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 The European Technical Approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities N°L 40, 11.2.1989, p. 12

2 Official Journal of the European Communities N°L 220, 30.8.1993, p. 1

3 Official Journal of the European Union N°L 284, 3 1.10.2003, p. 25

4 Boletín Oficial del Estado nº 34 de 9 de febrero de 1993

5 Official Journal of the European Communities N°L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of products and intended use

1.1 Definition of the construction product (kit)

CNH system is an industrially prepared timber frame building kit that is made of pre-designed and prefabricated components.

Walls and roofs are manufactured as prefabricated structural frames supplemented with additional materials on site, and floors are assembled from pre-cut timber members. Glued laminated timber beams used in some cases to substitute structural frame walls are bought in the open market. Pre-cut solid timber columns are manufactured in the factory.

The kits are prepared in the factory for every individual house, delivered as a package, and assembled on site.

Spacing between pre-cut solid wood members in walls, floors or roofs, height and width of prefabricated structural frames, as well as dimensions of glued laminated timber beams and solid timber columns varies according to the design process for every particular application. The variations are within a range. The configuration of the main assembled components is shown in annex 1. Material and component specifications are shown in annex 2. Examples of resistance to fire properties are shown in annex 3. The essential construction details including their joints are described in annex 4.

The content of the kit includes the load-bearing structures, their connections and the connections to the substructure, thermal insulation, internal linings, vapour control layers, claddings, sheathings, roof coverings, and the fire protective assembly for the separating floor from the basement based on calcium silicate boards.

The inner surface coverings are not included in the kit.

Windows, doors, stairs, balconies, treated bottom plates, internal fittings, technical installations for water, heating, cooling, ventilation and other components which are necessary to form a complete house are not part of the kit. They will achieve their respective regulations.

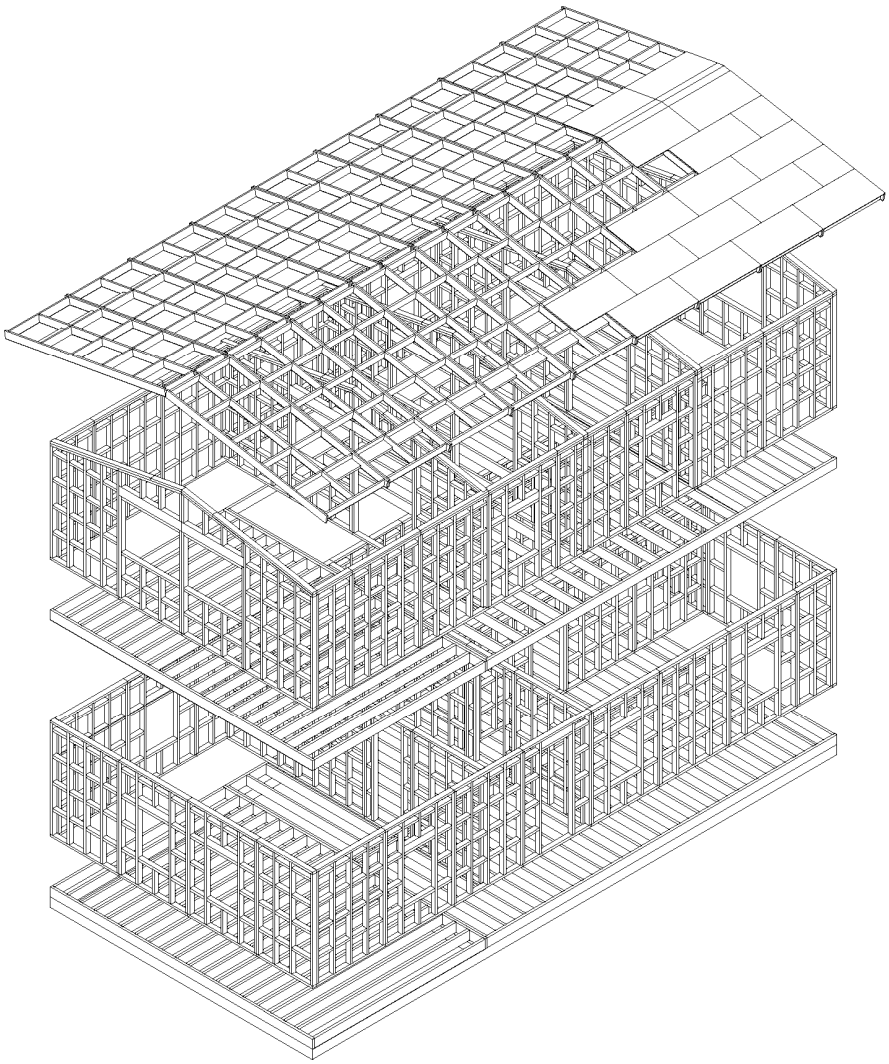

Figure 1. Three dimensional view of *CNH system*.

1.2 Intended use

The intended use of the *CNH system* timber frame building kit is the construction of detached single-family two storey houses, maximum ground + top floor, with or without basement.

The provisions made in this European Technical Approval are based on an assumed working life of the *CNH system* timber frame building kit of 50 years for the load-bearing structure and for non-accessible components and materials, and 25 years for repairable or replaceable components and materials, provided that the conditions laid down in sections 4.2, 5.1 and 5.2 for the packaging, transport, storage, installation, use, maintenance and repair are met. 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.

The *CNH system* timber frame building kit is intended to be placed on foundations made of masonry, concrete basement walls or steel structure.

The *CNH system* timber frame building kit may be used in southern Europe, and in areas with seismic requirements if they are properly satisfied.

2 Characteristics of products and methods of verification

2.1 Mechanical resistance and stability (ER 1)

The properties of structural materials and components related to mechanical resistance and stability are expressed in terms of indication of geometrical data and properties of the materials and constituent products used[6], which includes:

- the geometrical data (dimensions and cross sections, including tolerances) of the installed system and the components of the kit, and
- the properties of the materials and constituent products used that are needed to determine, according to the National Provisions, valid in the place of use, or possible use, load-bearing capacities and other properties, including aspects of durability and serviceability, of the assembled system installed in the works.

The information necessary for the mechanical resistance and stability for each load-bearing building component, as well as the joints between components, is listed in annex 1 and 2. The configuration of the main assembled components is listed in annex 1. The properties of structural materials and components are listed in annex 2.

The mechanical resistance and stability of each load-bearing building component as well as the joints between components are to be determined on the basis of this exact description. During the calculation the respective requirements of each member states shall be taken into account.

Basic calculations are done according to EN 1995-1-1[7], and are adapted according to the requirements of national construction regulations.

All structural timber elements are classified in service class 1 except suspended ground floor which is classified in service class 2. Values of k_{mod} (modification factor for duration of load and moisture content) and k_{def} (deformation factor) are chosen following the recommendations in EN 1995-1-1, and according to the corresponding service class and load-duration class for k_{mod}, and according to the corresponding service class for k_{def}.

System strength factor (k_{sys}) is considered 1,1 in structural walls, floors and roofs frames because of the capability of the load-distribution system of transferring the loads from one member to the neighbouring members.

Partial factor value for material properties and resistances at ultimate state are as follows:

- γ_M = 1,30 for solid timber;
- γ_M = 1,25 for glued laminated timber;
- γ_M = 1,20 for OSB;

and is 1,0 for serviceability limit state.

The deformation criteria for floors and roofs satisfy the national determined parameters.

OSB/3 panels fixed on external, and internal walls if necessary, contribute to the racking resistance.

Partial safety factors:

- γ_G = 1,35 for permanent actions;
- γ_G = 1,50 for variable actions;

The resistance against seismic actions may be calculated in the building project of each individual work for the specific structural design, on the basis of the racking resistance and the anchorage capacities given below, and the densities and total mass taken from annex 1 and annex 2.

Racking resistance is obtained according to the method A in EN 1995-1-1:2006.

Racking resistance must be obtained for each specific design by means of the lateral design capacity of an individual fastener ($F_{f,Rd}$) 35 x 3,5 and using a OSB/3 panel 10 mm thick.

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6 It corresponds with the method 1 in Guidance Paper L "*Application and use of Eurocodes*" (version 27 November 2003).

7 The reference to EN 1995-1-1 in this document means reference to EN 1995-1-1:November 2004 + AC: June 2006.

$F_{f,Rd}$ = 539 N;

The value of $F_{i,v,Rd}$ may be obtained for each panel depending on the wall panel width, the coefficient c_i and the fastener spacing.

$F_{v,Rd}$ may be obtained by means of the following: $F_{v,Rd} = \Sigma F_{i,v,Rd}$.

Anchorage capacities:

- Timber to timber with screws 90 x 5,0: $F_{v,Rd}$ = 1,15 kN
- Steel to timber with screws 60 x 5,0: $F_{v,Rd}$ = 2,37 kN
- Concrete to timber with bolts 200 x 10: $F_{v,Rd}$ = 4,24 kN

2.2 Safety in case of fire (ER 2)

2.2.1 Reaction to fire

Classification in accordance to Euroclasses A1 – F in EN 13501-1 of the components in the assembled kits is shown in the annex 2.

2.2.2 Resistance to fire

The properties related to resistance to fire for assembled components, except for separating floors with basement –option b)-, are expressed in terms of indication of geometrical data of the component and constituent products used[8], due to the variability of configurations of the components. Spacing between pre-cut solid wood members in walls, floors or roofs, height and width of prefabricated structural frames as well as dimensions of glued laminated timber beams and solid timber columns varies according to the specific structural design for every particular application. Resistance to fire must be determined case by case according to each specific structural design.

Anyway tables in annex 3 give tabulated values about properties related to resistance to fire in common situations based on calculations according to the reduced cross-method section indicated in EN 1995-1-1.

The fire protective assembly for the separating floor with basement -option b)- based on two calcium silicate boards Promatect® 100 (ETA 06/0219) of 25 mm thick each, provides a resistance to fire performance EI 180, according to a fire resistance test based on relevant national standards (UNE-EN 1365-2).

2.2.3 External fire performance of the roof covering

External fire performance of concrete and clay roofing tiles is considered deemed to satisfy all the provisions for external fire performance without the need for testing on the basis that they are included within the definitions given in EC decision 2000/553/EC and provided that any national provisions on the design and execution of works are fulfilled.

External fire performance of concrete and clay roofing tiles according to EN 13501-5 is given in annex 2.

2.3 Hygiene, health and environment (ER 3)

2.3.1 Vapour permeability and moisture resistance

The assessment with respect to both interstitial and internal surface condensation shows that the kit provides adequate moisture control for the intended use, taking into account the geographical restrictions specified in cl. 1.2.

Where the climate so requires, the risk of moisture condensation has to be assess for each individual work.

8 It corresponds with the method 1 in Guidance Paper L "*Application and use of Eurocodes*" (version 27 November 2003).

2.3.2 Watertightness

Favourable assessment has been made primarily on the basis of the construction details and later by carrying out a laboratory test of the external envelope of façades, for the specified areas of intended use. Roof coverings, which are not part of the kit, provide properties of watertightness to the roofs.

Watertight internal surfaces are not a part of the kit.

2.3.3 Release of dangerous substances

The manufacturer has submitted a written declaration stating the dangerous substances in the kit.

- Biocides:

As long as the annexes of the Commission Directive 98/8/CE of the European Parliament and of the Council are not implemented, the biocides used in the coating system are registered in the *Registro de plaguicidas no agrícolas o biocidas* which maintains the Spanish authorities -*Ministerio de Sanidad y Consumo*- following the measures of implementation of the Commission Directive 98/8/CE.

- Formaldehyde:

The formaldehyde content of OSB/3 panels is determined as class E1 in accordance with annex B of EN 13986.

The formaldehyde content in glued laminated timber is E1 in accordance with annex B of EN 14080.

Note: In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, 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 Directive, these requirements need also to be complied with, when and where they apply.

2.4 Safety in use (ER 4)

2.4.1 Slipperiness of floor finishes

No performance determined for slipperiness of floor finishes.

2.4.2 Impact resistance

Impact resistance of façades and internal walls has primarily been assessed on the basis of the construction details and later by carrying out laboratory tests. The tests were carried out in external and internal walls following the test procedures described in the ETA Guideline No003 Internal Partition Kits for use as Non-Loadbearing Walls, in Applus+ Certification Technological Center in November 2004. The following classification is obtained for external and internal walls:

Resistance to horizontal loads	Resistance to structural damage from soft body impact load – 50 kg bag	Resistance to structural damage from hard body impact load – 1 kg steel ball
External walls (400 cm height) **(1)**	IV b 500 Nm	IV b 10 Nm
Internal walls (400 cm height)	IV a 400 Nm	IV a 10 Nm

(1): Without application of vertical load.

Table 2: Resistance to horizontal loads (structural damage)

2.5 Protection against noise (ER 5)

2.5.1 Airborne sound insulation

Weighted airborne sound insulation index $R_W(C;C_{tr})$ for suspended floors, internal and external walls and roof as defined in EN ISO 140-3 and ISO 717-1, is expressed as follows:

	Weighted airborne sound insulation index [$R_W(C;C_{tr})$] (dB)
Suspended floor between rooms inside the same house	≥ 52 (-1;-8)
Internal wall	
with thermal insulation	≥ 37 (-2;-9)
without thermal insulation	≥ 33 (-1;-6)
Façade	
timber cladding (outside and inside)	≥ 44 (-2;-9)
timber cladding (outside) and gypsum plasterboard (inside)	47 (0;-7)
Roof	≥ 53 (-4;-12)

Table 3: Weighted airborne sound insulation index.

2.5.2 Impact sound insulation

Weighted impact sound pressure level $L_{n,w}(C)$ for suspended floors between rooms inside the same house as defined in EN ISO 140-6 and ISO 717-2, is indicated below:

	Weighted impact sound pressure level [$L_{n,w}(C)$] (dB)
Suspended floor between rooms inside the same house	≤ 70 (0)

Table 4. Weighted impact sound pressure level.

No performance determined for other floors.

2.5.3 Sound absorption

No performance determined for sound absorption.

2.6 Energy economy and heat retention (ER 6)

2.6.1 Thermal resistance

Thermal resistance and the corresponding thermal transmittance (U-value) of the main building parts shall be determined on the basis of this exact description according to every particular application, using the following design thermal conductivities and thermal resistances:

- The following design thermal conductivities and their references are used:

Solid wood: λ = 0,13 W/(mK)	EN 12524
OSB/3: λ = 0,13 W/(mK)	EN 13986
Mineral wool (glass wool): λ ≤ 0,037 W/(mK)	EN 13162
Mineral wool (rock wool): λ ≤ 0,042 W/(mK)	EN 13162
Wood fibre panels: λ ≤ 0,039 W/(mK)	EN 13171
Gypsum plasterboards: λ ≤ 0,25 W/(mK)	EN 12524 / EN 520

In addition reference calculations according to EN ISO 6949 of thermal transmittances has been made by ITeC considering the upper and the lower values of spacing between pre-cut timber members in external and internal walls, floors and roofs. The results are expressed in the following table:

Façades (classified according to the lining type)			
External lining	**Internal lining**	**Spacing between studs(1) (mm)**	
		417 (timber fraction: 18,3%)	**625 (timber fraction: 14,8%)**
Timber cladding	Timber cladding	0,46	0,45
Timber cladding	Gypsum plasterboards	0,47	0,47

Roofs (classified according to thermal insulation thick)		
Thermal insulation thick (mm)	**Spacing between edge joists in the roof frame (mm)**	
	625 (timber fraction: 13,9%)	**1.250 (timber fraction: 9,4%)**
100	0,31	0,31

Floors (classified according to the type)				
			Spacing between joists in the floor (mm)	
			625 (timber fraction: 7,7%)	
Separating floor with basement option a)			0,43	
Separating floor with basement option b)			0,55	
Suspended ground floor **(2)**	-	Wood fibre panels (60 mm thick)	**B': Characteristic length (m)**	
			5	0,47
			6	0,46
			7	0,45

(1): 625 mm of spacing between noggins is considered.

(2): Thermal resistance of underfloor space calculations use values of characteristic length according to indications of EN ISO 13370.

Table 5. Thermal transmittances.

Windows and doors are not included in the kit.

2.6.2 Air permeability

No performance determined for air permeability.

2.6.3 Thermal inertia

No performance determined for thermal inertia.

2.7 Aspects of durability, serviceability and identification

2.7.1 Aspects of durability

Natural durability of wood-based products

Timber members are from Northern Europe (Sweden and Finland). Timber specie (*Pinus Sylvestris* L.) is in natural durability 3-4 concerning fungus attack and class S concerning insect attack according to EN 350-1 and EN 350-2.

Structural wood components are in hazard class 1, except wood components in suspended ground floors, which are in hazard class 2, according to EN 335-2. Exterior timber cladding is in hazard class 3.

Bottom plates in contact with concrete foundations are not part of the kit. These wood elements should be treated according to EN 599, showing conformity with hazard class 4 according to EN 335-2.

Fasteners

Metal fasteners for exterior timber cladding purposes correspond to a service class 3 and metal fasteners for indoor purposes correspond to a service class 1. Service classes are according to EN 1995-1-1.

Nails used in exterior timber cladding are made of zinc-coated steel with a thickness ≥ 12 μm zinc.

Screws for indoor purposes are made of zinc coated steel.

Metal anchors for connexion to substructure are made of zinc coated steel.

Exterior timber cladding

Protection of exterior timber cladding against meteorological agents is done by application of coating systems according to EN 927-1.

Chemical and physical characteristics of coating systems:

- Natural weathering according to EN 927-3: without damage in the surface.
- Artificial weathering according to EN 927-6: without modifications of the coating.
- Liquid water permeability according to EN 927-5: Variation between measures is less to 10%.

Biological characteristics of coating systems (hazard class 1 and blue stain in service):

- EN 46 + EN 73.
- EN 46 + EN 84.
- EN 118 + EN 73.
- UNE 56419-1 (EN 152-1).

The estimated working life of the various parts of the kit, based on general knowledge of timber frame performance and by examining the building details which are part of the kit, related to the intended use specified in cl. 1.2, is 50 years, if maintenance activities as regards in cl. 5.2 are done.

2.7.2 Aspects of serviceability

Deflections of floor, roof and glued laminated timber beams are to be determined on the basis of their exact description, and according to each building project.

Values for maximum deflections of floor and roof joists on two supports, and in glued laminated timber beams at serviceability limit states are as follows. Span values are doubled in cantilevered joists.

- 1/300 of the span, produced by permanent actions in characteristic value, and variable actions in characteristic value in combination values.
- 1/350 of the span, produced by permanent actions in characteristic value, and instantaneous variable actions in characteristic value in combination values.
- 1/300 of the span, produced by permanent actions in characteristic value and variable actions in quasi-permanent value ($\psi_2 \cdot Q_k$).

Suspended floors will satisfy the criteria for stiffness against vibrations if they satisfy the limiting values for deflections indicated above, according to the Spanish Building Technical Code.

2.7.3 Identification

The Identification parameters for materials and components of the kit are shown in annex 2 of European Technical Approval. The way in which they are assembled is shown in annex 4.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 1999/455/EC of the European Commission[9] system 1 of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(a) Tasks for the manufacturer:
- (1) factory production control;
- (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

(b) Tasks for the approved body:
- (3) initial type–testing of the product;
- (4) initial inspection of factory and of factory production control;
- (5) continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of *CNH system* timber frame building kit in order to undertake the actions laid down in section 3.3. For this purpose, the "control plan" referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body or bodies involved.

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European Technical Approval.

The manufacturer may only use incoming materials stated in the technical documentation of this European Technical Approval.

The factory production control shall be in accordance with the "Control plan of 01-12-2008 relating to the European Technical Approval 09/0032 issued on 10-07-2009" which is part of the technical documentation of this European Technical Approval. The "control plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited within the Catalonia Institute of Construction Technology (ITeC).[10]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the "control plan".

3.2.1.2 Testing of samples taken at the factory

Testing of samples according to a prescribed test plan is not required. A continuous visual checking and checking of component dimensions is prescribed.

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9 Official Journal of the European Communities L 178, 14.07.1999

10 The "control plan" is a confidential part of the European Technical Approval and only handed over to the approved body or bodies involved in the procedure of attestation of conformity. See section 3.2.2.

3.2.1.3 Declaration of Conformity

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European Technical Approval 09/0032 issued on 10-07-2009.

3.2.2 Tasks for the approved bodies

The approved body shall perform the activities referred to above according to the specific conditions, in accordance with the provisions laid down in the “control plan”.

The approved body shall retain the essential points of their actions and state the results obtained and conclusions drawn in a written report.

3.2.2.1 Initial type-testing of the product

Initial assessment of the *CNH system* timber frame building kit has been carried out by the approval body and provides the basis for the initial product assessment for the notified body.

3.2.2.2 Initial inspection of factory and of factory production control

The notified body shall assess the factory production control system to demonstrate that the factory production control is in conformity with this European Technical Approval and any subsidiary information. The notified body shall ensure that the manufacturer has acceptable premises, technical equipment and competent staff to produce the *CNH system* timber frame building kit as described in this European Technical Approval.

3.2.2.3 Continuous surveillance, assessment and approval of factory production control

The notified body shall visit the factory for surveillance inspections twice a year to ensure continuous conformity of the factory production control with the “control plan”, checking the use of the materials and components specified in annex 2 of this European Technical Approval, and ensuring the maintenance of the configuration of main assembled components shown in annex 1 of this European Technical Approval.

It is possible to reduce the number of visits to the factory to once a year if the manufacturer has proven good quality over a long period of time. Special conditions are expressed in the “control plan”.

3.2.2.4 Certification

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the *CNH system* timber frame building kit stating the conformity with the provisions of this European Technical Approval.

In cases where the provisions of this European Technical Approval and its "control plan" are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform the Catalonia Institute of Construction Technology (ITeC) without delay.

3.3 CE marking

The CE marking shall be affixed on the accompanying commercial documents. The letters “CE“ shall be followed by the identification number of the approved certification body, and be accompanied by the following additional information:

- the name and address of the producer,
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European Technical Approval,
- the number of the ETAG (007),
- identification of the specific kit, including project identification,
- dangerous substances.

4 Assumptions under which the fitness of the product for the intended use is favourably assessed

4.1 Local building regulations

A specification of relevant requirements concerning fire resistance, reaction to fire, sound insulation, thermal insulation performance and ventilation provisions shall be elaborated for each delivery, this specification is referred in the building project, which is the basis of the production of a *CNH system* timber frame building kit. The building project will take the performances from the information provided for the manufacturer.

To check that each *CNH system* timber frame building kit meets the local building regulations concerning the essential requirements is a part of the building project.

4.2 Structural design

The production of the *CNH system* timber frame building kit shall be made on the basis of the specific structural design included in the building project.

4.3 Manufacturing

The moisture content in solid wood materials -never exceed 20%.

The European Technical Approval is issued for the product on the basis of agreed data/information, deposited with the ITeC, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the ITeC before the changes are introduced. The ITeC will decide whether or not such changes affect the European Technical Approval and consequently the validity of the CE marking on the basis of the European Technical Approval and if so whether further assessment or alterations to the European Technical Approval, shall be necessary.

4.4 Substructure

The vertical tolerance of the substructure top shall be within ± 10 mm.

A damp-proof membrane, which is not part of the kit, shall be installed between the substructure top and the bottom plate.

4.5 Installation

The kits are installed in the works according to a general manual from the manufacturer, which incorporates the figures of annex 4 of this European Technical Approval. The general manual covers all important installation aspects, including:

- erection systems and equipment
- temporary bracing and weather protection
- completion of joints between kit components
- fixing of wind and any seismic anchorage to the substructure and between building parts
- additional materials and components applied on the site, and which are a precondition for the fitness in use of the kit

Special aspects related to each individual building project will be supplemented to the general manual, if necessary.

Installation of the *CNH system* timber frame building kit in the works can be made by installers from the manufacturer or by means of a technical assistant from the manufacturer who controls the installation process.

The completed building (the works) must comply with the building regulations (regulations on the works) applicable in the Member States in which the building is to be constructed. The procedures foreseen en the Member States for demonstrating compliance with the building regulations must also be followed by the entity responsible for this act. An European Technical Approval for a timber frame building kit does not amend this process in any way.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

The instructions of the manufacturer related to packaging, transport and storage shall be observed. Special attention must be pay on protection against weather conditions which could produce damage.

5.2 Use, maintenance, repair

Maintenance conditions from the manufacturer are attached to each particular delivery. The main aspects are as follows:

- keep ventilated the underfloor space if suspended ground floor are applied.
- Installation conditions of chimney ducts.

On behalf of the Catalonia Institute of Construction Technology

Barcelona, 10 July 2009.

Antón Maria Checa Torres

General Manager, ITeC

ANNEX 1 – CONFIGURATION OF MAIN ASSEMBLED COMPONENTS

1 External walls

There are two types of external walls obtained by combination between external timber cladding and internal timber cladding or gypsum plasterboard.

External walls are manufactured as prefabricated two-dimensional structural timber frames supplemented with materials in site. The dimensions of studs and noggins are always 98x48 mm. The maximum distance between studs in a frame is 625 mm and the minimum is 417 mm

The maximum height is 3.800 mm. The maximum cavity between noggins and studs is 577 x 577 mm. The width of each prefabricated frame depends on the specific design. The studs in a wall are spaced the same distance.

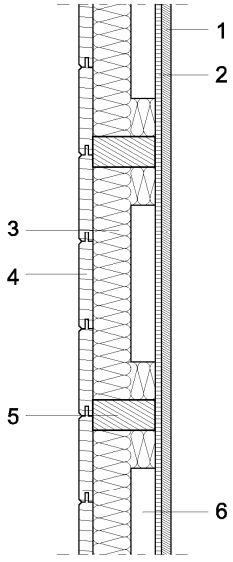
Dimensions of bottom plate and top plate are 98x48 mm.

Thermal insulation, internal and external timber cladding, and gypsum plasterboards are materials supplemented in site.

Timber joists and roof frames sit on the external wall top plate. Top plate is double in external walls in which roof frames sit on.

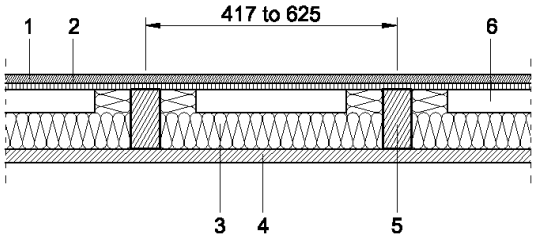
Beams and sidestuds for openings are designed from case to case.

The following figures is not exhaustive. The complete list of configuration is placed in the annex 4.



1 Gypsum plasterboard (15 mm thick)
2 OSB/3 panel (10 mm thick)
3 Mineral wool with vapour control layer (60 mm thick)
4 Tongued and grooved solid wood cladding (22 mm thick)
5 Noggin (98x48 mm)
6 Non-ventilated air space

Figure 1: Vertical cross section of external walls with external timber cladding and internal gypsum plasterboard.



1 Gypsum plasterboard (15 mm thick)
2 OSB/3 panel (10 mm thick)
3 Mineral wool with vapour control layer (60 mm thick)
4 Tongued and grooved solid wood cladding (22 mm thick)
5 Stud (98x48 mm)
6 Non-ventilated air space

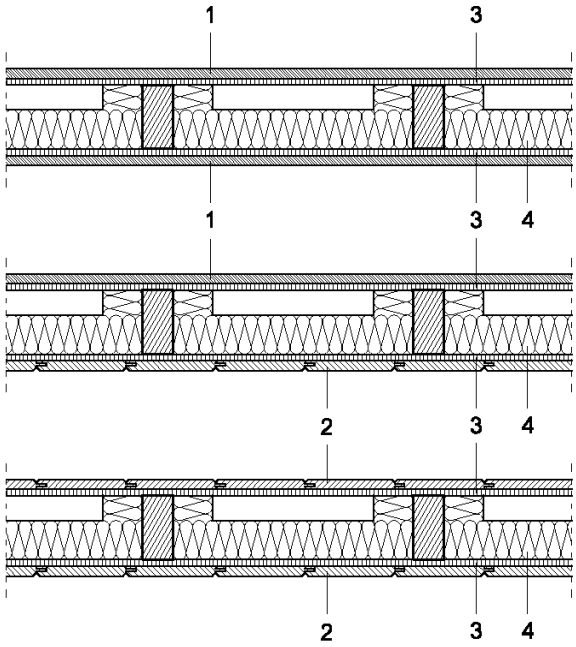
Figure 2. Horizontal cross section of external walls with external timber cladding and internal gypsum plasterboard.

2 Internal walls

Internal walls can be or not load bearing according to the specific design. In both cases the dimensions of studs and noggins in internal timber frames follow the same rules for external walls. Differences between external and internal walls are located in claddings, linings and in thermal insulation.

Internal lining in gypsum plasterboard 15 mm thick or timber cladding 15 mm thick.

It is possible to incorporate a wall sheathing to provide racking resistance If required in the specific design. It is used an OSB/3 10 mm thick.



1 Gypsum plasterboard (15 mm thick)
2 Tongued and grooved solid wood cladding (15 mm thick)
3 OSB/3 panel (10 mm thick)(if racking resistance is required)
4 Thermal insulation (if acoustic performance is required)

Figure 3. Horizontal cross section of internal walls

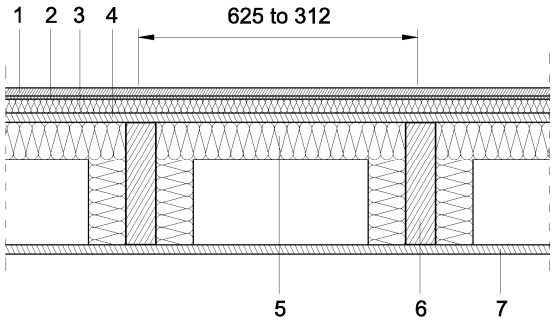
3 Suspended floors

The configuration of suspended floors is different according to the separated areas. Suspended floor between rooms inside the same house is shown in figure 4, suspended ground floor is shown in figure 5, separating floors with basement -option a)- and -option b)- are shown in figures 6 and 7, respectively. The differences between suspended floors are thermal insulation, linings and sheathings.

Separating floors with basement –option a)- can also be used to separate with outer environment.

Floors are assembled in site from pre-cut timber joists. Maximum spacing between joists is 625 mm. Spacing and length of joists are selected according to each structural design. Dimensions of joists are 198 x 48 mm. An edge joist 198 x 48 mm is disposed in the floor perimeter.

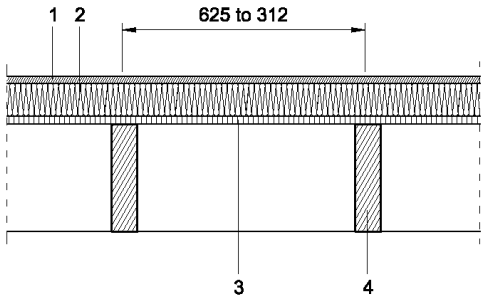
- Suspended floor between rooms inside the same house



1 Flooring (13 mm thick)
2 Expanded polyethylene foam (5 mm thick)
3 High density mineral wool (22 mm thick)
4 OSB/3 panel (15 mm thick)
5 Mineral wool (60 mm thick)
6 Floor joist (198x48 mm)
7 Lining: tongued and grooved solid wood cladding (15 mm thick)

Figure 4. Suspended floor between rooms inside the same house.

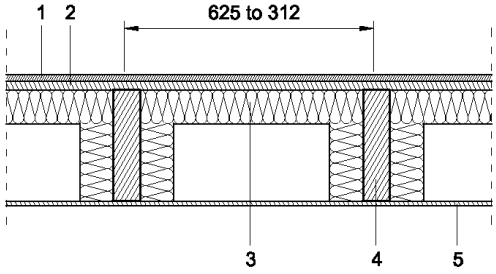
- Suspended ground floor



1 Flooring (13 mm thick)
2 Wood fibre panel (60 mm thick)
3 OSB/3 panel (15 mm thick)
4 Floor joist (198x48 mm)

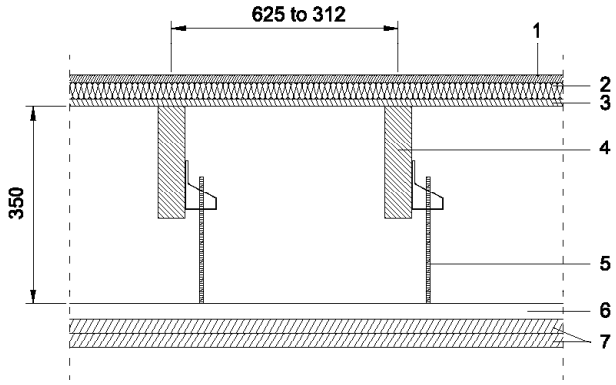
Figure 5. Suspended ground floor.

- Separating floor with basement



1 Flooring (13 mm thick)
2 OSB/3 panel (15 mm thick)
3 Mineral wool (60 mm thick)
4 Floor joist (198x48 mm)
5 Lining: OSB/3 panel (10 mm thick)

Figure 6. Separating floor with basement -option a)-



1 Flooring (13 mm thick)
2 Wood fibre panels (30 mm thick)
3 OSB/3 Panel (12 mm thick)
4 Floor joist (198x48 mm)
5 Threaded bolt M60
6 Galvanised steel channel T-60
7 Calcium silicate boards Promatect® 100 (2x25mm)

Figure 7. Separating floor with basement -option b)-

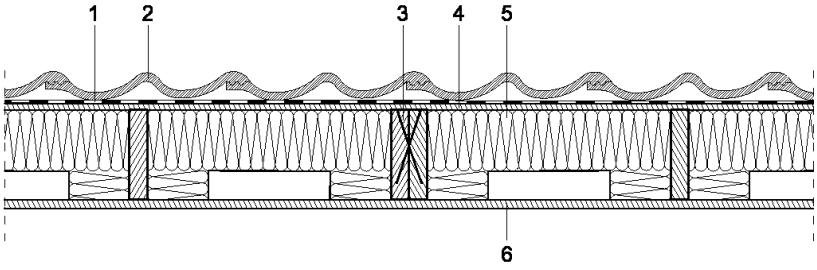
4 Roofs

Roofs are assembled in site by means of prefabricated roof frames. Roof frames are made of pre-cut timber joists and noggins, with OSB/3 in its outer surface and timber cladding on its inner surface. Thermal insulation in mineral wool between roof joists and noggins Includes a vapour control layer in the warm side. Roofs assembled with these roof frames includes the eaves.

The waterproofing membrane above the OSB/3 panel is supplemented in site. Concrete or clay roofing tiles which are part of the kit are installed according to the supplier assembling instructions.

Every roof frame is made of three joists 148 x 30 mm, two of them are in the edges and the third is in the middle of the roof frame. Spacing between edge joists in a roof frame varies between 625 and 1250 mm according to the specific design. Noggins between joists varies between 500 and 1500 mm. The surface of the cavity joist – noggin do not exceed 4000 cm^2. Joists length varies between 1500 and 4500 mm according to the specific design.

Roof frames sit on wall elements by means of a plane joist incorporated in the roof frame. Top plate is double in external walls in which roof frames sit on.



1 Roof lining
2 Concrete tile roof (screwed)
3 Screwed in staggered parallel rows with screws (5x80 mm) each 400 mm
4 OSB/3 panel (10 mm thick)
5 Mineral wool with vapour control layer (100 mm thick)
6 Tongued and grooved solid wood cladding (15 mm thick)

Figure 8. Roofs.

ANNEX 2 – MATERIAL AND COMPONENT SPECIFICATIONS FOR *CNH SYSTEM* TIMBER FRAME BUILDING KIT

Component / material (see drawings in annex 4)	**Specification** (see drawings in annex 1 and 4 for other component or material dimensions not mentioned here)	**EN-Standard / ETA / type and brand name**	**Reaction to fire class according to EN 13501-1**
Structural components:			
Timber studs in walls	Untreated structural grade timber class C24. Cross section: 48 x 98 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Beams over wall openings	Untreated structural grade timber class C24. Cross section according to structural calculations.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Timber joists in floors	Untreated structural grade timber class C24. Cross section: 48 x 198 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Timber joists in roofs	Untreated structural grade timber class C24. Cross section: 30 x 148 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Untreated bottom and top plates	Untreated structural grade timber class C24. Cross section: 48 x 98 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Glued laminated timber beams	Untreated structural grade glued laminated timber GL24h Cross section: 140 x 280 mm, 140 x 320 mm, 140 x 360 mm.	EN 14080	D-s2, d0 (Decision 2005/610/CE)
Timber column	Untreated structural grade timber class C24 Modular cross section: 100 x 200 mm	EN 338	D-s2, d0 (Decision 2003/593/CE)
Non-structural timber:			
Timber noggins in walls	Untreated structural grade timber class C24. Cross section: 48 mm x 98 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Timber noggins in roofs	Untreated structural grade timber class C24. Cross section: 30 mm x 148 mm.	EN 338	D-s2, d0 (Decision 2003/593/CE)
Metal fasteners:			
Nails, screws	Nails for timber cladding. Dimensions 12 x 50, and with zinc coating ≥12 μm Screws for indoor purposes. Dimensions 35 x 3,5; 90 x 5; 80 x 5; with zinc coating	Nails 12 x 50 and screws 35 x 3,5; 80 x 5; and 90 x 5;	A1
Metal anchor to substructure	Metal anchor Dimensions 200 x 10 mm thick with zinc coating	bolt 200 x 10 mm	A1

Component / material (see drawings in annex 4)	**Specification** (see drawings in annex 1 and 4 for other component or material dimensions not mentioned here)	**EN-Standard / ETA / type and brand name**	**Reaction to fire class according to EN 13501-1**
Thermal insulation:			
Thermal insulation between studs and noggins in external walls	Mineral wool (glass wool). 60 mm thick with thermal conductivity ≤ 0,037 W/(mK). Includes a vapour control layer.	EN 13162	F
Thermal insulation between studs and noggins in internal walls	Mineral wool (glass wool). 45 mm thick with thermal conductivity ≤ 0,036 W/(mK), and an airflow resistance = 5 kPa·s/m^2.	EN 13162	A1
Thermal insulation between timber joists and noggins in roofs	Mineral wool (rock wool). 100 mm thick with thermal conductivity ≤ 0,042 W/(mK). Includes a vapour control layer.	EN 13162	F
Thermal insulation between timber joists in suspended floors in the same house unit	Mineral wool (glass wool). 60 mm thick with thermal conductivity ≤ 0,037 W/(mK).	EN 13162	A1
Thermal insulation under pavement and above sheathing in suspended floors in the same house unit	High density Mineral wool (glass wool). 22 mm thick, with thermal conductivity ≤ 0,039 W/(mK). Includes a vapour control layer	EN 13162	F
Thermal insulation under pavement and above sheathing in suspended ground floors without basement	Wood fibre panels. 60 mm thick, with thermal conductivity ≤ 0,039 W/(mK)	EN 13171	E
Thermal insulation under pavement and above sheathing in separating floor with basement (option b)	Wood fibre panels. 30 mm thick, with thermal conductivity ≤ 0,039 W/(mK)	EN 13171	E
Thermal insulation between timber joists in separating floors with basement (option a)	Mineral wool (glass wool). 60 mm thick with thermal conductivity ≤ 0,037 W/(mK).	EN 13162	A1
Internal linings:			
Gypsum plasterboards	Standard gypsum plasterboards 15 mm thick, F type	EN 520	A2-s1, d0 (Decision 2006/673/CE)

Component / material (see drawings in annex 4)	**Specification** (see drawings in annex 1 and 4 for other component or material dimensions not mentioned here)	**EN-Standard / ETA / type and brand name**	**Reaction to fire class according to EN 13501-1**
Membranes and vapour control layers:			
Roof lining membrane	Waterproofing membrane. Water vapour resistance: s_d <0,08 m, measured according to EN 12572 Resistance to tearing: > 130 N, measured according to EN 12310-1.	EN 13859-1	E
Vapour control layers on the warm side of the thermal insulation	Polyethylene film, in high density mineral wool used as thermal insulation under pavement and above sheathing in suspended ground floors without basement.	Polyethylene film	F
	Kraft paper in mineral wool used as thermal insulation in walls and roofs.	Kraft paper	F
Claddings:			
Timber cladding	Solid wood cladding. 15 mm thick, for inner claddings and 22 mm thick, for exterior cladding	Solid wood cladding	D-s2, d0 (Decision 2006/213/CE)
Sheathings:			
Floor sheathing	OSB/3 15 mm thick	EN 13986	D-s2, d0 (Decision 2003/43/CE)
Wall sheathing	OSB/3 10 mm thick	EN 13986	D-s2, d0 (Decision 2003/43/CE)
Fire protective calcium silicate boards	Calcium silicate boards PROMATECT®-100, 25 mm thick	ETA 06/0219	A1
External surface coverings:			
External coating system	Coating systems for exterior wood according	EN 927-1	F

Component / material (see drawings in annex 4)	**Specification** (see drawings in annex 1 and 4 for other component or material dimensions not mentioned here)	**EN-Standard / ETA / type and brand name**	**Reaction to fire class according to EN 13501-1**
Roof covering:			
Roofing tiles	Concrete roofing tiles	EN 490	A1 (Decision 96/603/CE) $B_{Roof}(t1)$ (Decision 2000/553/CE)
	Clay roofing tiles	EN 490	A1 (Decision 96/603/CE) $B_{Roof}(t1)$ (Decision 2000/553/CE)
Others:			
Expanded polyethylene foam	Sheet of closed cell expanded polyethylene 5 mm thick.	Density (ISO 845): 20 kg/m^3 Compressive strength (EN 826): 7,81 KPa	F

ANNEX 3 – TABLES OF RESISTANCE TO FIRE PROPERTIES OF *CNH SYSTEM*

Following tables show, which informative effects, load-bearing capacities of walls, floors and roofs with a classified fire resistance R-30.

1 Walls

Load-bearing walls with timber cladding 15 mm thick and without wall sheathing, but with thermal insulation.

Configuration	Structural Capacities		Notes
Spacing between studs = 625 mm			
Stud's height (mm)	Design load capacities **(1)**		Classified fire resistance
	Maximum vertical load applied on top plate (kN/m)	Maximum load perpendicular to the wall surface (N/m^2)	
250	12,33	1,24	R-30
270	10,66	1,07	R-30
290	9,30	0,92	R-30
310	8,19	0,81	R-30
330	7,26	0,71	R-30
350	6,48	0,63	R-30
Spacing between studs = 500 mm			
Stud's height (mm)	Design load capacities **(1)**		Classified fire resistance
	Maximum vertical load applied on top plate (kN/m)	Maximum load perpendicular to the wall surface (N/m^2)	
250	15,42	1,55	R-30
270	13,33	1,33	R-30
290	11,63	1,15	R-30
310	10,23	1,01	R-30
330	9,07	0,89	R-30
350	8,10	0,79	R-30

(1): Values for maximum vertical load applied on top plate are determined without combination with loads perpendicular to the wall surface.

Values for maximum load perpendicular to the wall surface are determined without combination with vertical loads.

The values in the table are valid for simple compression, and for simple bending about y-axis. For members subjected to combined axial force and bending about y-axis, these values should be combined.

Configuration	Structural Capacities		Notes
Spacing between studs = 417 mm			
Stud's height (mm)	Design load capacities **(1)**		Classified fire resistance
	Maximum vertical load applied on top plate (kN/m)	Maximum load perpendicular to the wall surface (N/m^2)	
250	18,48	1,86	R-30
270	15,98	1,60	R-30
290	13,94	1,38	R-30
310	12,27	1,21	R-30
330	10,88	1,07	R-30
350	9,71	0,95	R-30

(1): Values for maximum vertical load applied on top plate are determined without combination with loads perpendicular to the wall surface.

Values for maximum load perpendicular to the wall surface are determined without combination with vertical loads.

The values in the table are valid for simple compression, and for simple bending about y-axis. For members subjected to combined axial force and bending about y-axis, these values should be combined.

Load-bearing walls with timber cladding 15 mm thick, wall sheathing (OSB/3 10 mm thick), and with thermal insulation.

Configuration	Structural Capacities		Notes
Spacing between studs = 625 mm			
Stud's height (mm)	Design load capacities **(1)**		Classified fire resistance
	Maximum vertical load applied on top plate (kN/m)	Maximum load perpendicular to the wall surface (N/m^2)	
250	51,64	4,34	R-30
270	44,82	3,72	R-30
290	39,24	3,22	R-30
310	34,61	2,82	R-30
330	30,75	2,49	R-30
350	27,49	2,21	R-30
Spacing between studs = 417 mm			
Stud's height (mm)	Design load capacities **(1)**		Classified fire resistance
	Maximum vertical load applied on top plate (kN/m)	Maximum load perpendicular to the wall surface (N/m^2)	
250	77,40	6,50	R-30
270	67,18	5,57	R-30
290	58,81	4,83	R-30
310	51,88	4,23	R-30
330	46,09	3,73	R-30
350	41,21	3,32	R-30

(1): Values for maximum vertical load applied on top plate are determined without combination with loads perpendicular to the wall surface.

Values for maximum load perpendicular to the wall surface are determined without combination with vertical loads.

The values in the table are valid for simple compression, and for simple bending about y-axis. For members subjected to combined axial force and bending about y-axis, these values should be combined.

Suspended floors between rooms inside the same house with timber cladding in solid wood 15 mm thick, and thermal insulation:

Net joist span (mm)	**Maximum design vertical load applied (kN/m^2) (1)**	**Classified fire resistance**
Spacing between joists = 625 mm		
3500	3,37	R-30
3000	4,58	R-30
2500	6,60	R-30
Spacing between joists = 417 mm		
4000	3,86	R-30
3500	5,04	R-30
3000	6,87	R-30
2500	9,89	R-30
Spacing between joists = 312 mm		
4500	4,08	R-30
4000	5,16	R-30
3500	6,74	R-30
3000	9,18	R-30
2500	13,22	R-30

(1): The maximum value of vertical applied load is taken between limitations of bending moment and shear.

Roofs with timber cladding in solid wood 15 mm thick, and thermal insulation:

Net joist span (mm)	**Maximum design vertical load applied (kN/m^2) (1)**	**Classified fire resistance**
Spacing between joists = 1.250 mm		
3500	2,48	R-30
3000	3,37	R-30
2500	4,86	R-30
Spacing between joists = 625 mm		
4000	3,79	R-30
3500	4,96	R-30
3000	6,75	R-30
2500	9,71	R-30
Spacing between joists = 312 mm		
4500	6,01	R-30
4000	7,60	R-30
3500	9,93	R-30
3000	13,51	R-30
2500	19,46	R-30
(1): The maximum value of vertical applied load is taken between limitations of bending moment and shear.		

ANNEX 4 – ESSENTIAL CONSTRUCTION DETAILS

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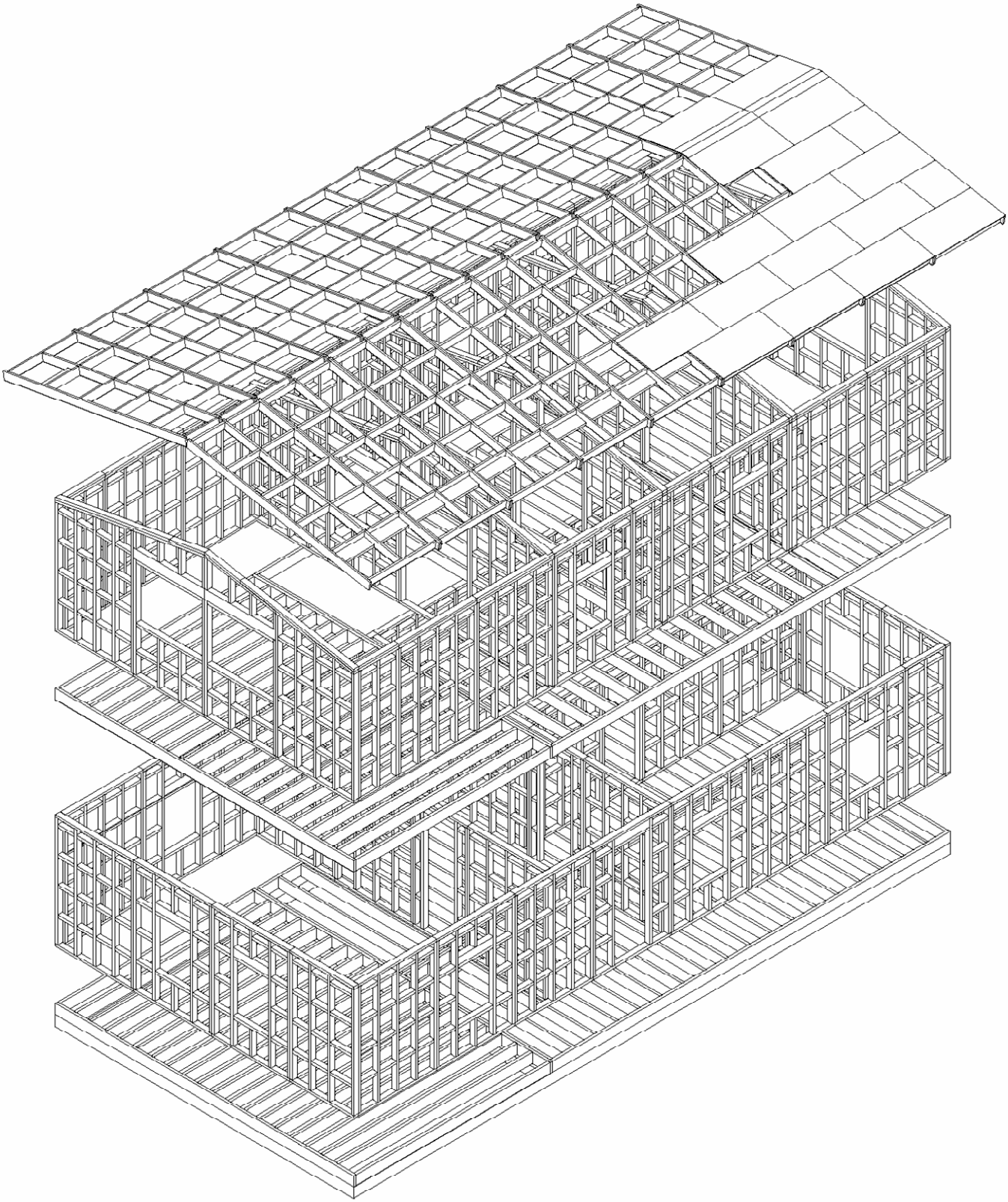
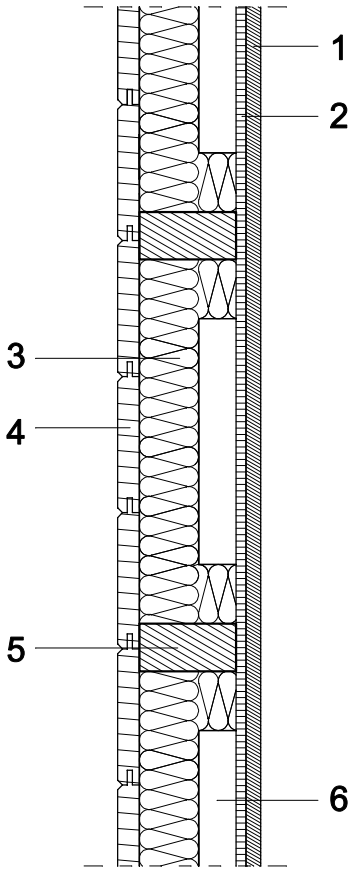
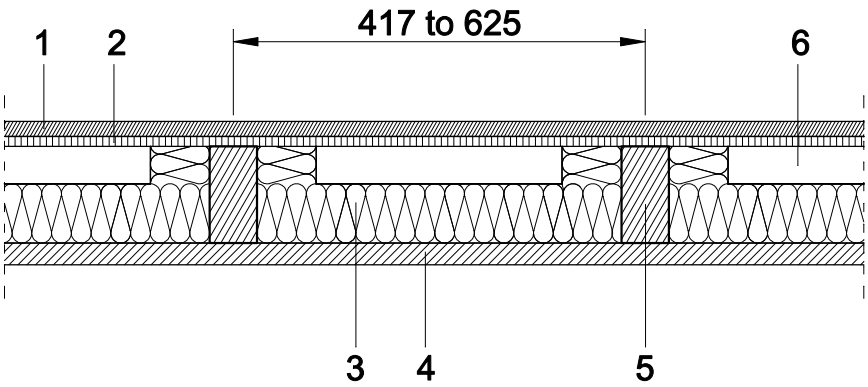


CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 1
Name: Global structural system	



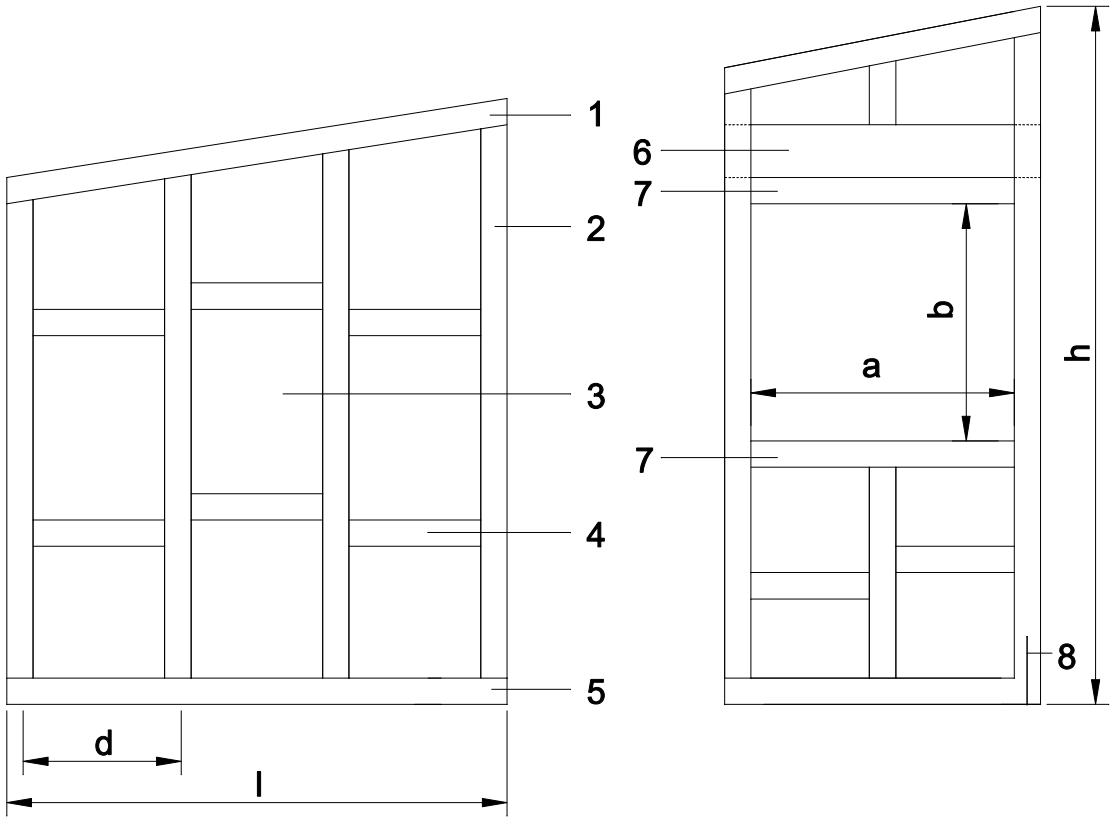
1 Gypsum plasterboard (15 mm thick)
2 OSB/3 panel (10 mm thick)
3 Mineral wool with vapour control layer (60 mm thick)
4 Tongued and grooved solid wood cladding (22 mm thick)
5 Noggin (98x48 mm)
6 Non-ventilated air space

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.1
Name: Vertical cross section	



1 Gypsum plasterboard (15 mm thick)
2 OSB/3 panel (10 mm thick)
3 Mineral wool with vapour control layer (60 mm thick)
4 Tongued and grooved solid wood cladding (22 mm thick)
5 Stud (98x48 mm)
6 Non-ventilated air space

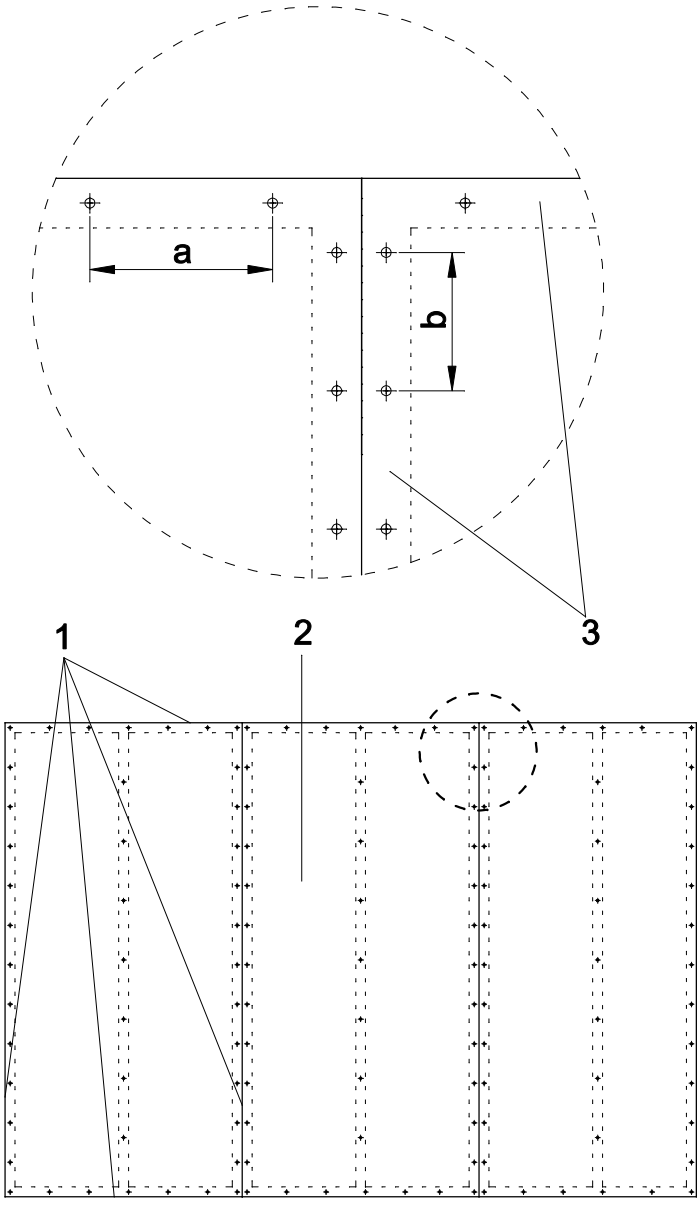
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.2
Name: Horizontal cross section -tongued and grooved wood-	



1 Top plate (98x48 mm)
2 Stud (98x48 mm)
3 Maximum dimension (577x577 mm)
4 Stud (98x48 mm)
5 Bottom plate (98x48 mm)
6 Opening lintel
7 Opening frame
8 Screwing the plate with 2 screws (5x80 mm)

d 417 to 625 mm
l Panel length according to project
axb Window opening
h Panel height according to project

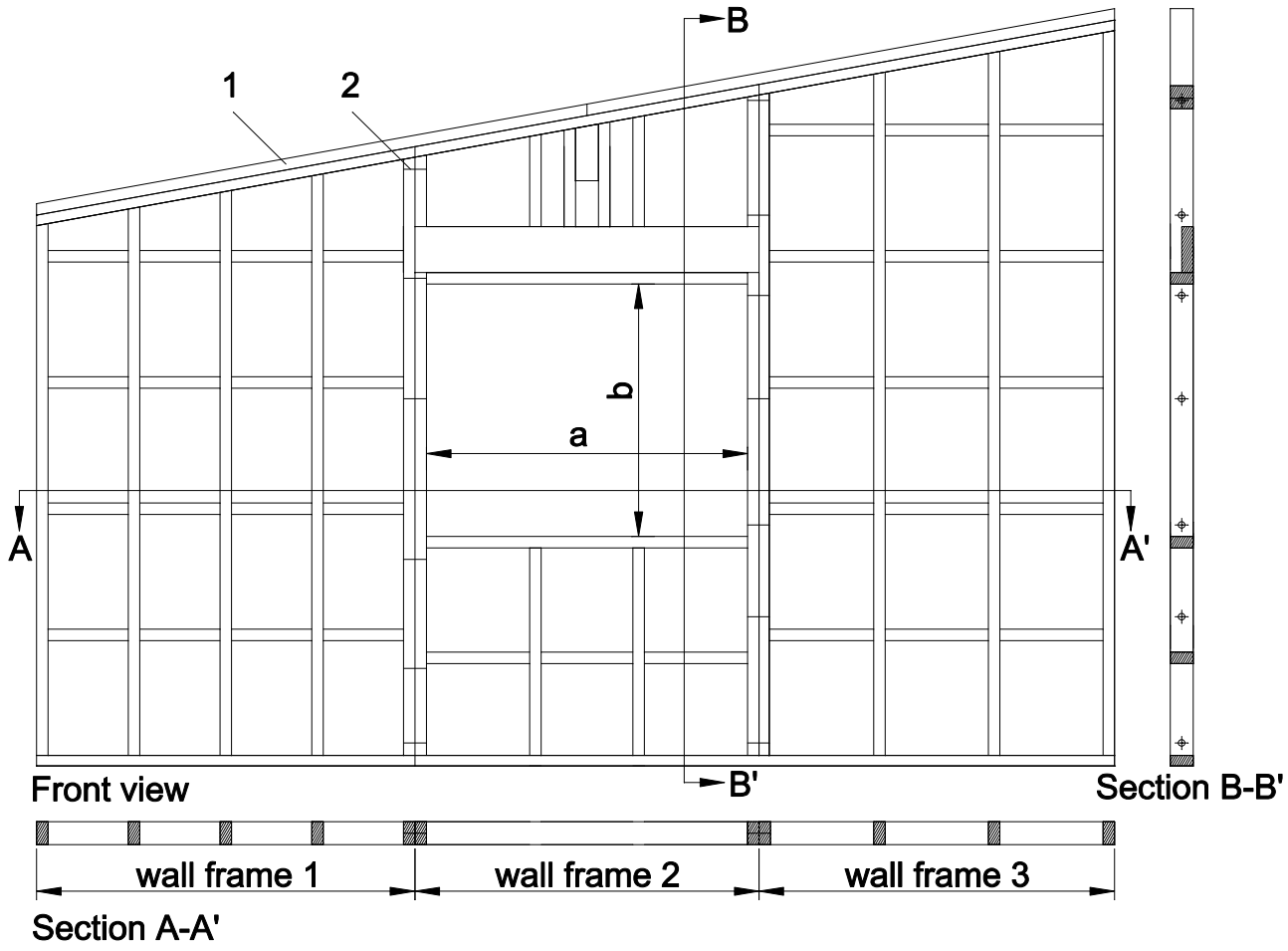
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.3
Name: Structural frame with positions of wall elements	



1 Panel edges alligned with studs and heads of plates
2 OSB/3 panel (10 mm thick)
3 Studs and noggings of wall framing

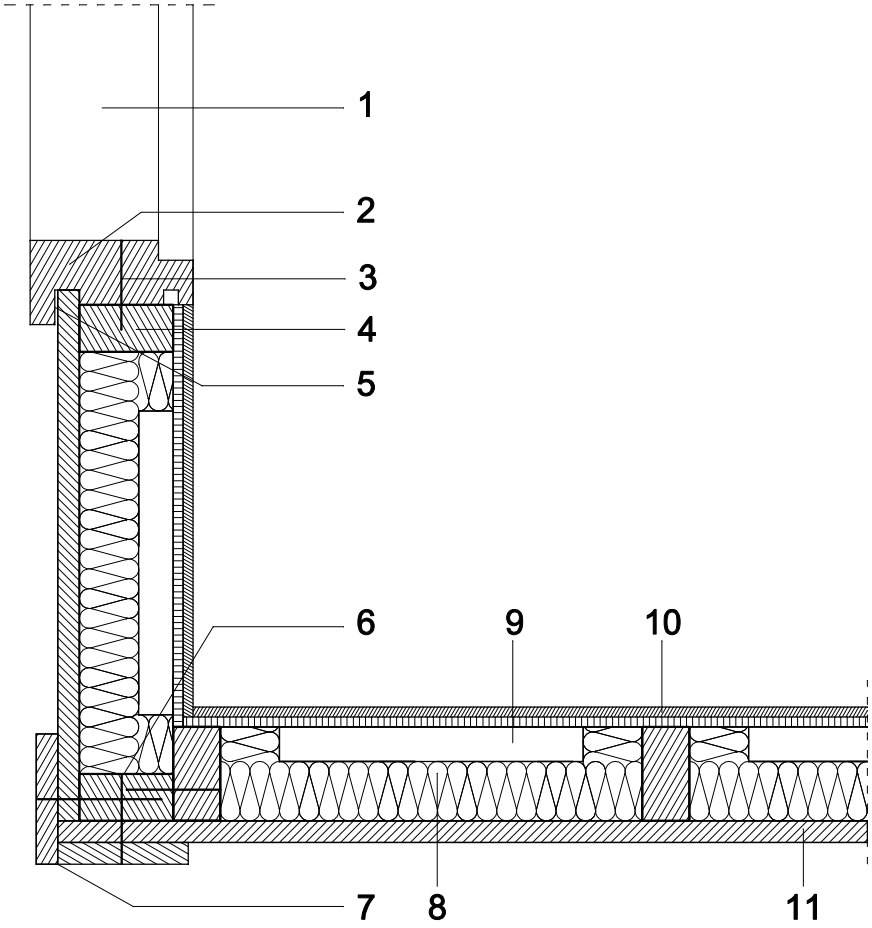
a Screws (3.5x35mm) each 200 mm in edges, the rest each 400 mm
b Screws (3.5x35mm) each 200 mm in edges, the rest each 400 mm

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.4
Name: Horizontal raking resistance system	



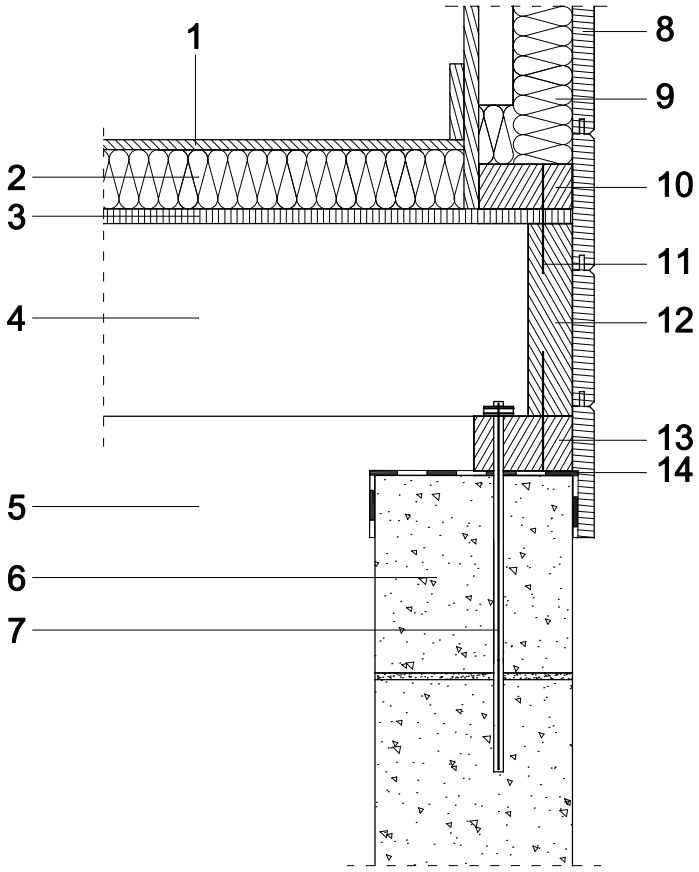
1 Double top plate (98x48 mm)
2 Join of wall frames stud by stud using a screw (5x80 mm) each nogging
axb Window opening

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.5.a
Name: Horizontal cross section of joints between prefabricated elements -wall panels-	



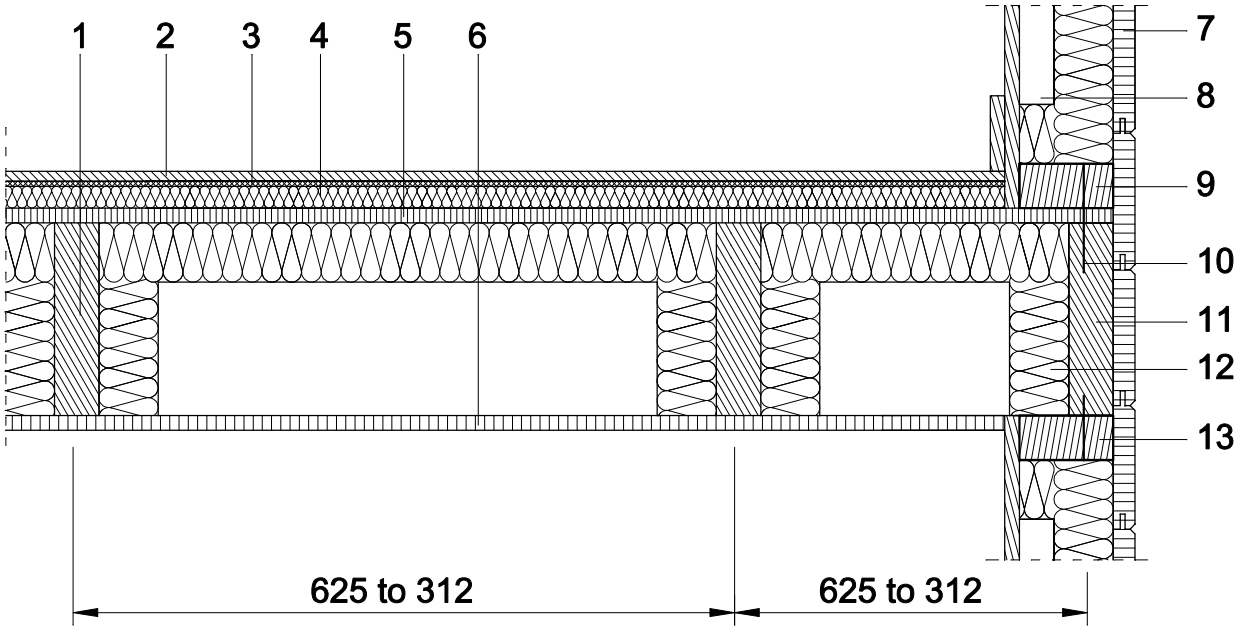
1 Window opening
2 Opening frame
3 Fixing
4 Sidestud
5 Sealed joint between the building envelope and window frame
6 Corner stud
7 Corner planks (120x22 mm)
8 Mineral wool (60 mm thick)
9 Non-ventilated air space
10 Interior lining:
-tongued and grooved solid wood cladding (15 mm thick)
-gypsum plasterboard (15 mm thick)
11 External rendering:
-tongued and grooved solid wood cladding (120x22 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.5.b
Name: Horizontal cross section of joints between prefabricated elements -corner joints-	



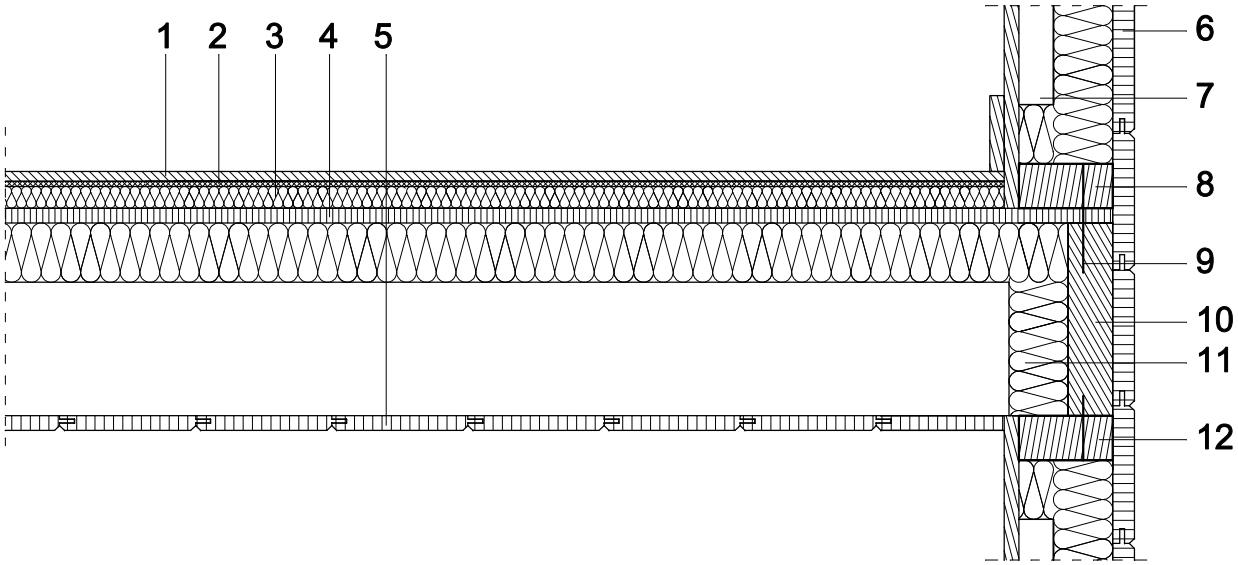
1 Flooring
2 Wood fibre panel (60 mm thick)
3 OSB/3 panel (15 mm thick)
4 Floor joist (198x48 mm)
5 Ventilated air space
6 Concrete block wall
7 Metal anchor (10 mm)
8 Tongued and grooved solid wood cladding (120x22 mm thick)
9 Stud (98x48 mm)
10 Bottom plate (98x48 mm)
11 Screw (5x90 mm) (each stud)
12 End joist (198x48 mm)
13 Treated bottom plate (98x48 mm)
14 Bitouminous felt

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.6
Name: Vertical cross section of joint between exterior wall and foundation	



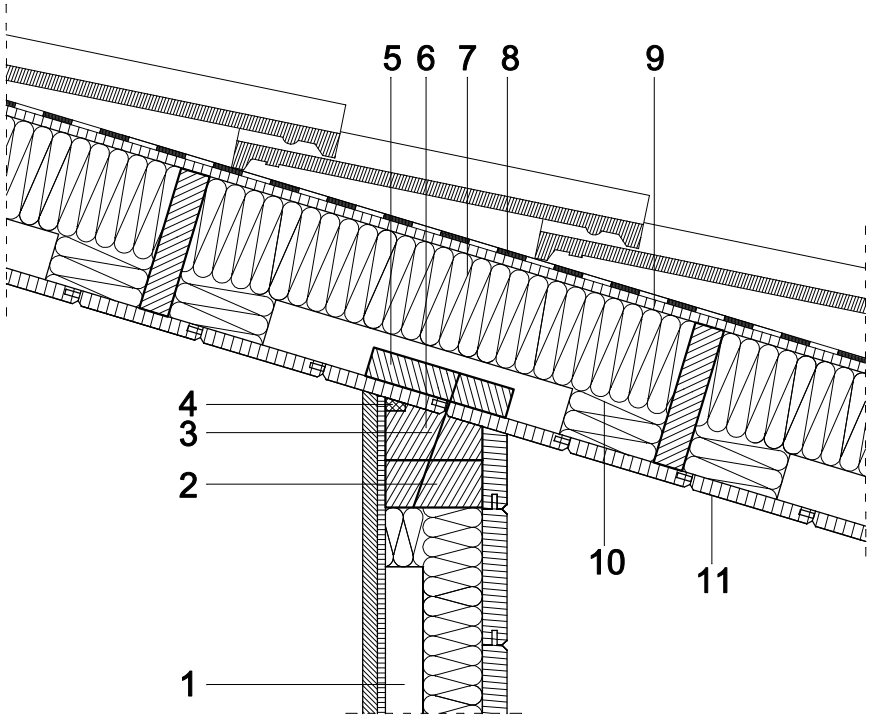
1 Floor joist (198x48 mm)
2 Flooring
3 Expanded polyethylene foam (5 mm thick)
4 High density mineral wool (22 mm thick)
5 OSB/3 panel (15 mm thick)
6 Tongued and grooved solid wood cladding (15 mm thick)
7 Tongued and grooved solid wood cladding (120x22 mm thick)
8 Stud (98x48 mm)
9 Bottom plate (98x48 mm)
10 Screw (5x90 mm)
11 End joist (198x48 mm)
12 Mineral wool (60 mm thick)
13 Top plate (98x48 mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.7.a
Name: Vertical cross section of joint between exterior wall and suspended floor -floor joists parallels to wall-	



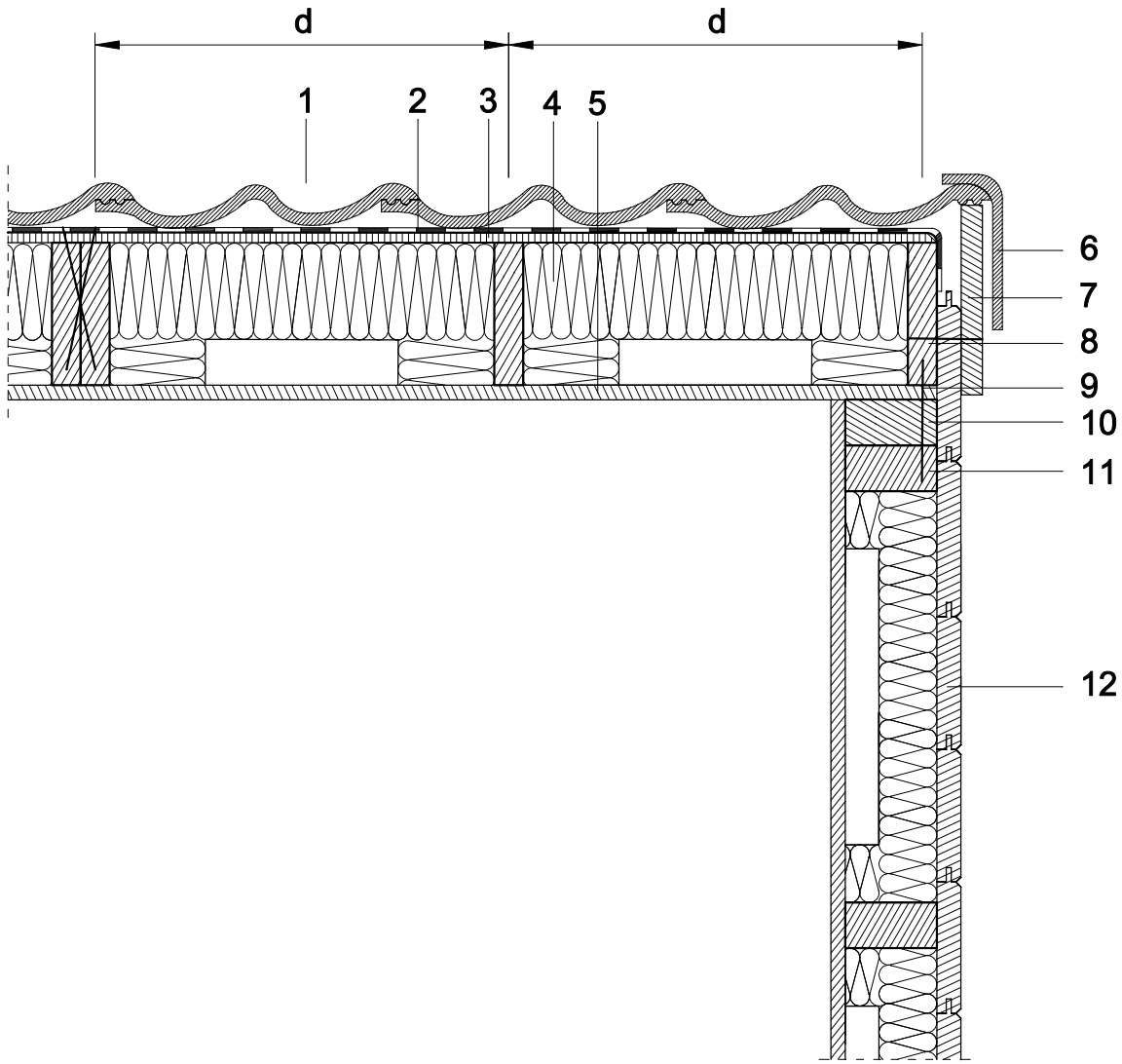
1 Flooring
2 Expanded polyethylene foam (5 mm thick)
3 High density mineral wool (22 mm thick)
4 OSB/3 panel (15 mm thick)
5 Tongued and grooved solid wood cladding (15 mm thick)
6 Tongued and grooved solid wood cladding (120x22 mm thick)
7 Stud (98x48 mm)
8 Bottom plate (98x48 mm)
9 Screw (5x90 mm)
10 End joist (198x48 mm)
11 Mineral wool (60 mm thick)
12 Top plate (98x48 mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.7.b
Name: Vertical cross section of joint between exterior wall and suspended floor -floor joists perpendicular to wall-	



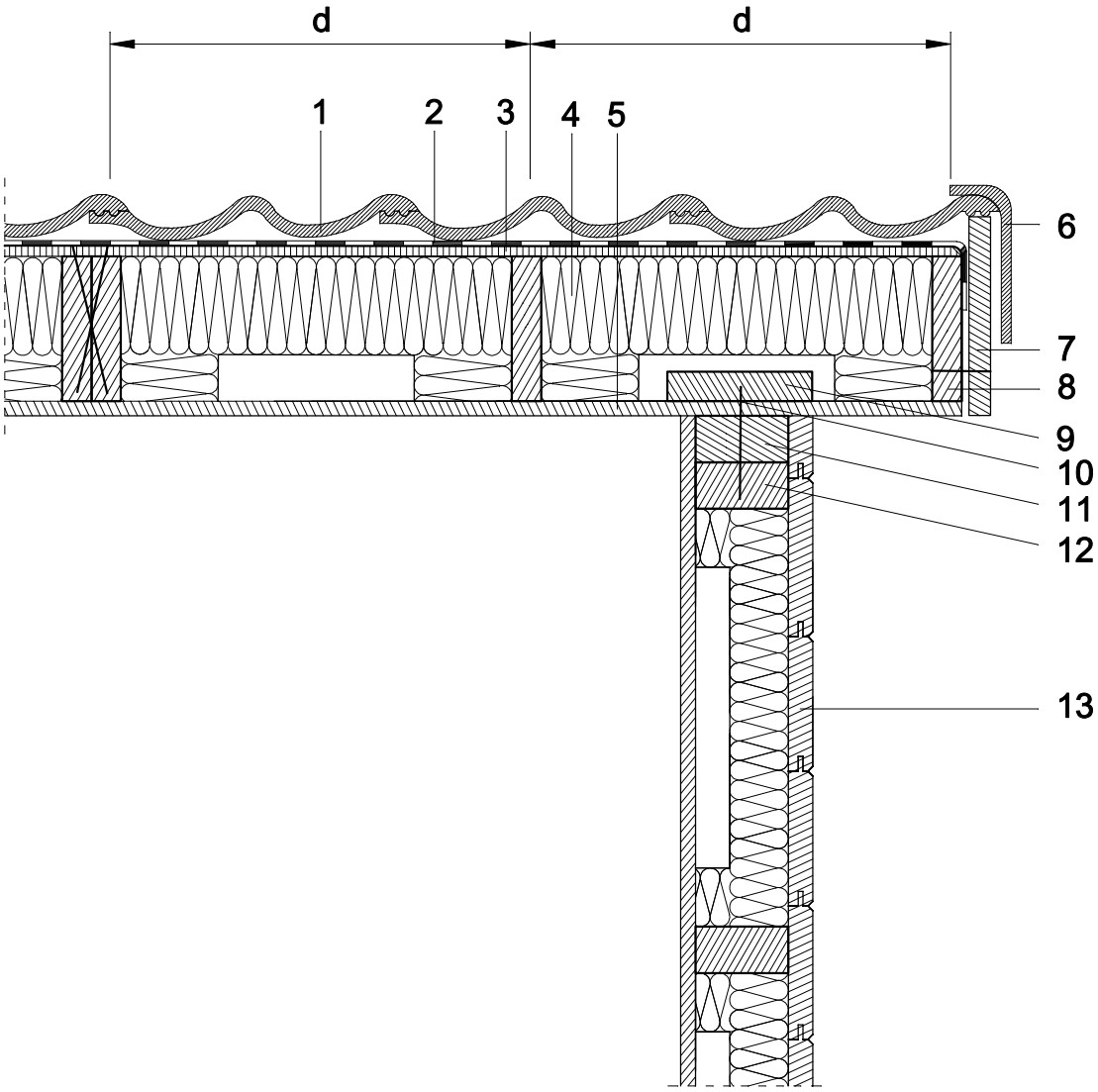
1 Stud (98x48 mm)
2 Top plate (98x48 mm)
3 Double top plate (alterned joints)
4 Expanded foam sealant joint
5 Plate in the prefabricated roof frame (148x30 mm)
6 Screw (5x90 mm) between prefabricated roof frame and double plate
7 Prefabricated roof frame
8 Roof lining
9 OSB/3 panel (10 mm thick)
10 Mineral wool with vapour control layer (100 mm thick)
11 Tongued and grooved solid wood cladding (15 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.8.a
Name: Vertical cross section of joint between exterior wall and roof	



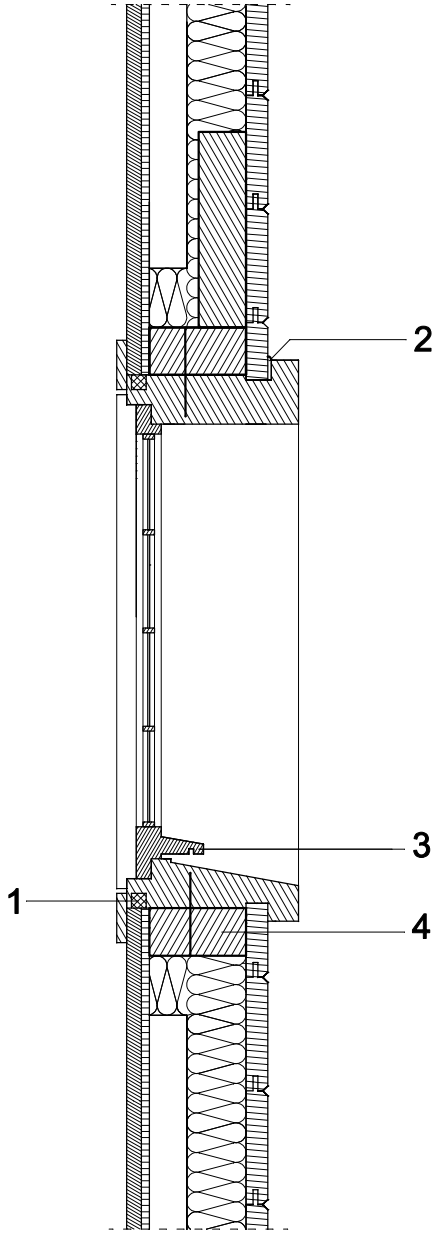
1 Concrete tile roof (screwed)
2 Roof lining
3 OSB/3 panel (10 mm thick)
4 Mineral wool with vapour control layer (100 mm thick)
5 Tongued and grooved solid wood cladding (15 mm thick)
6 End concrete tile
7 Drip plate (197x22 mm)
8 Floor joist (148x30 mm)
9 Screw (5x90 mm) between prefabricated roof frame and double top plate
10 Double top plate (alterned joints)
11 Top plate (98x48 mm)
12 Tongued and grooved solid wood cladding (22 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.8.b
Name: Vertical cross section of joint between exterior gable wall and roof without rafter	



1 Concrete tile roof (screwed)
2 Roof lining
3 OSB/3 panel (10 mm thick)
4 Mineral wool with vapour control layer (100 mm thick)
5 Tongued and grooved solid wood cladding (15 mm thick)
6 End concrete tile
7 Drip plate
8 Floor joist (148x30 mm)
9 Plate in the prefabricated roof frame (148x30 mm)
10 Screw (5x90 mm) between prefabricated roof frame and double top plate
11 Double top plate (alterned joints)
12 Top plate
13 Tongued and grooved wolid wood cladding (22 mm thick)

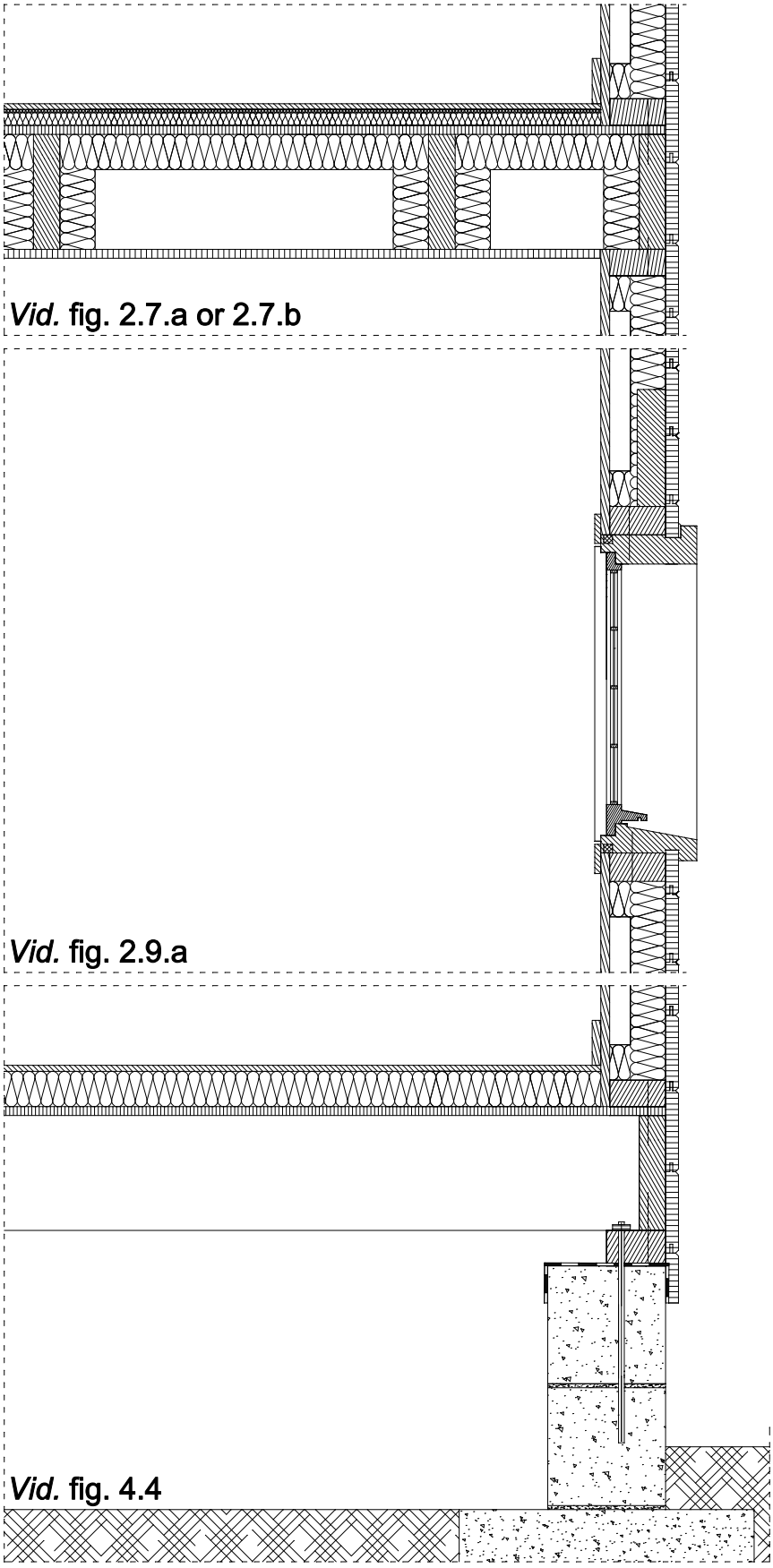
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.8.c
Name: Vertical cross section of joint between exterior gable wall and roof with rafter	



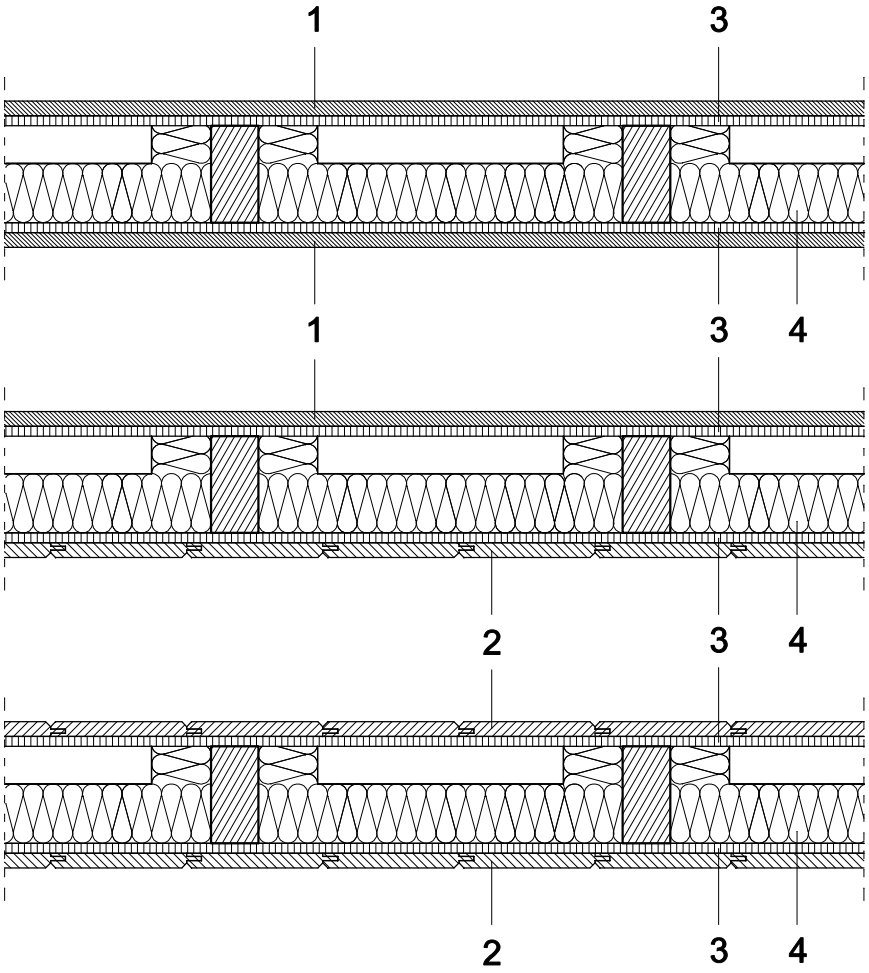
Timber cladding

1 Sealed joint between the opening frame and wall frame, expanded foam (section of 5x10 mm)
2 Sealed joint between the building envelope and window frame
3 Drip plate
4 Opening frame

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.9.a
Name: Basic design of joints between wall and windows/door -window opening-	

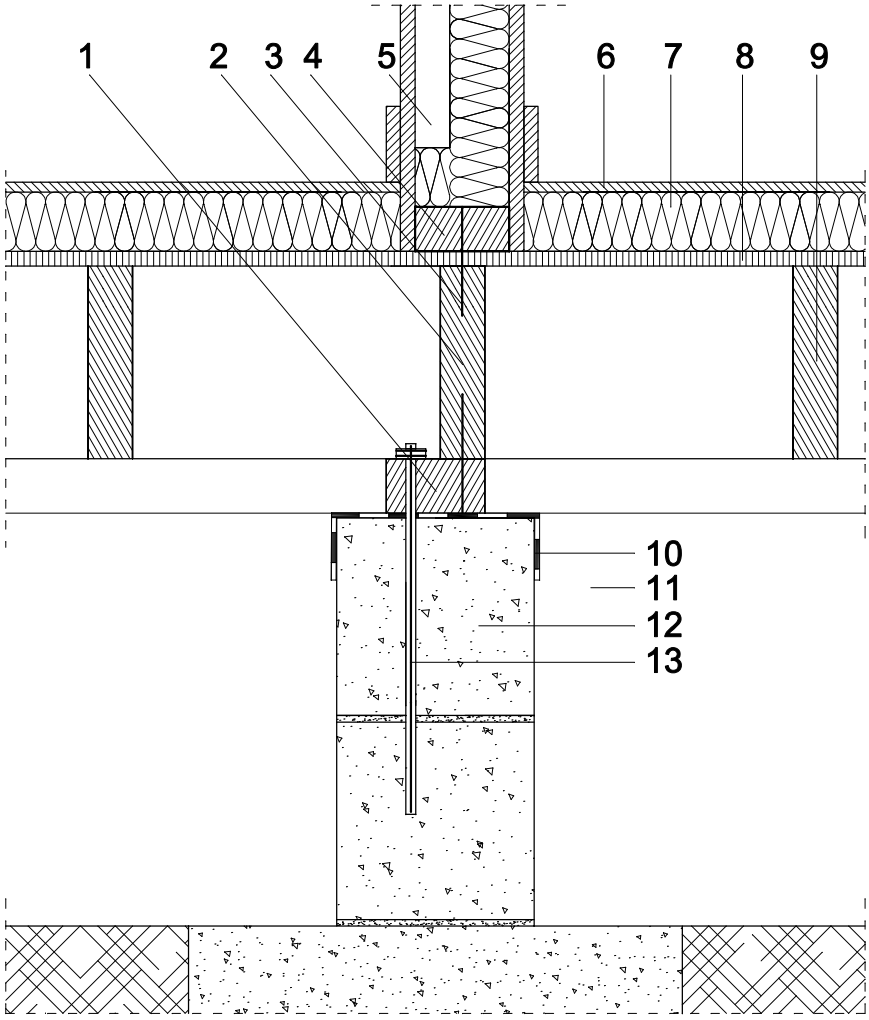


CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 2.9.b
Name: Basic design of joints between wall and windows/door -protection of the lintel-	



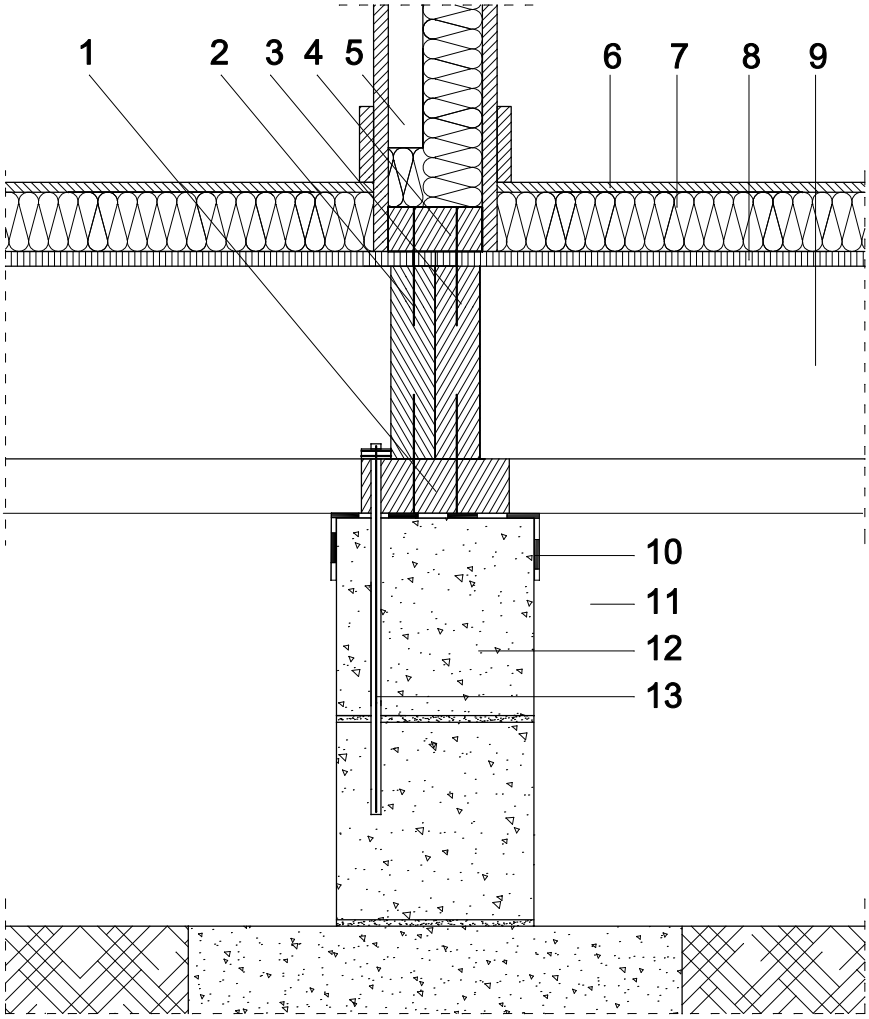
1 Gypsum plasterboard (15 mm thick)
2 Tongued and grooved solid wood cladding (15 mm thick)
3 OSB/3 panel (10 mm thick)(if racking resistance is required)
4 Thermal insulation (if acoustic performance is required)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 3.1
Name: Horizontal cross section -all finishes supported-	



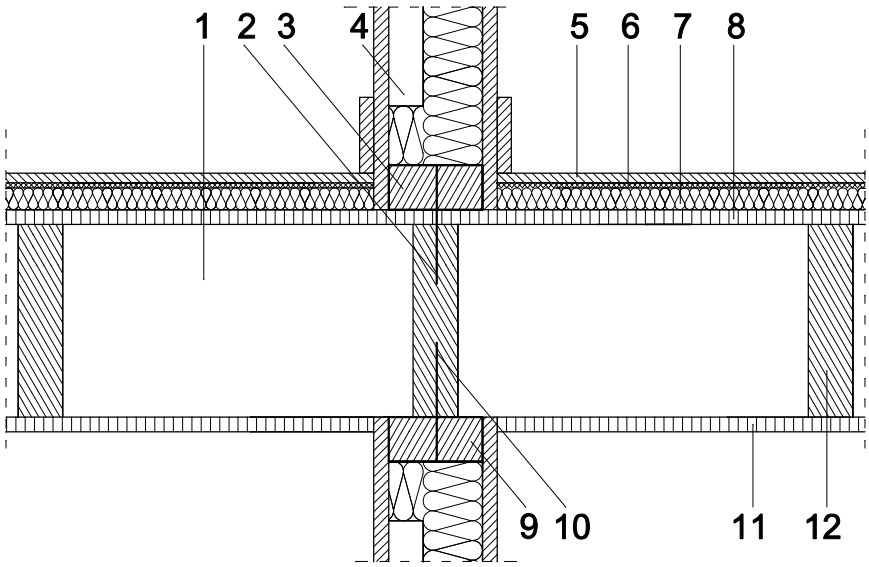
1 Treated bottom plate (98x48 mm)
2 End joist (198x48 mm)
3 Screw (5x90 mm)(each stud)
4 Bottom plate (98x48 mm)
5 Stud (98x48 mm)
6 Flooring
7 Wood fibre panel (60 mm thick)
8 OSB/3 panel (15 mm thick)
9 Floor joist (198x48 mm)
10 Bitouminous felt
11 Ventilated air space
12 Concrete block wall
13 Metal anchor (10 mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 3.2.a
Name: Vertical cross section of joint between interior wall and foundation wall parallel to floor joists	



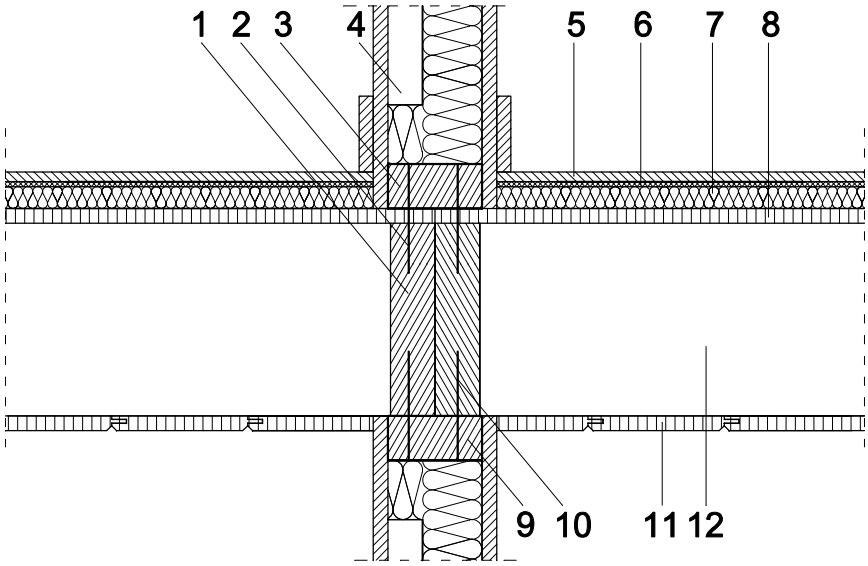
1 Treated bottom plate (148x48 mm)
2 End joist (198x48 mm)
3 Screw (5x90mm)(each stud)
4 Bottom plate (98x48 mm)
5 Stud (98x48 mm)
6 Flooring
7 Wood fibre panel (60 mm thick)
8 OSB/3 panel (15 mm thick)
9 Floor joist (198x48 mm)
10 Bitouminous felt
11 Ventilated air space
12 Concrete block wall
13 Metal anchor (10 mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 3.2.b
Name: Vertical cross section of joint between interior wall and foundation wall perpendicular to floor joists	



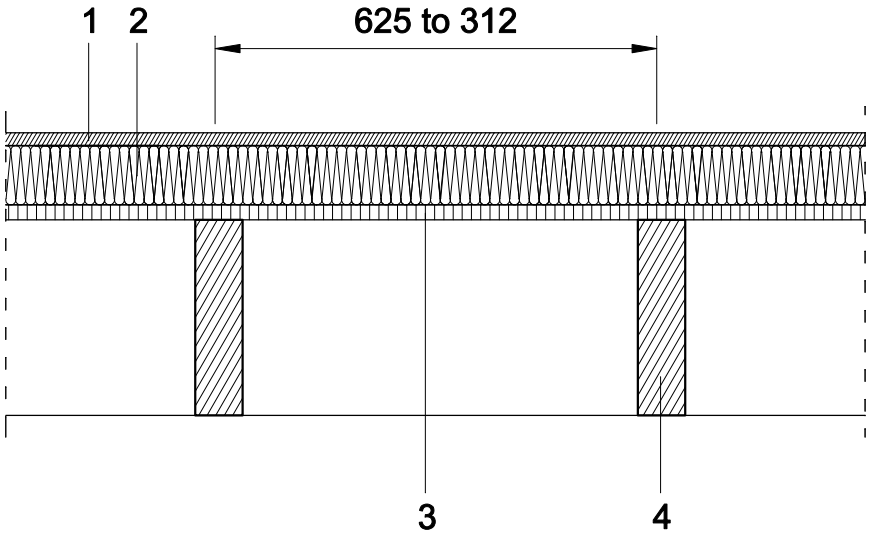
1 End joist (198x48 mm)
2 Screw (5x90 mm)(each stud)
3 Bottom plate (98x48 mm)
4 Stud (98x48 mm)
5 Flooring
6 Expanded polyethylene foam (5 mm thick)
7 High density mineral wool (22 mm thick)
8 OSB/3 panel (15 mm thick)
9 Top plate (98x48 mm)
10 Screw (5x90 mm)(each stud)
11 Tongued and grooved solid wood cladding (15 mm thick)
12 Floor joist (198x48)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 3.3.a
Name: Vertical cross section of joint between interior wall and suspended floor wall parallel to floor joists	



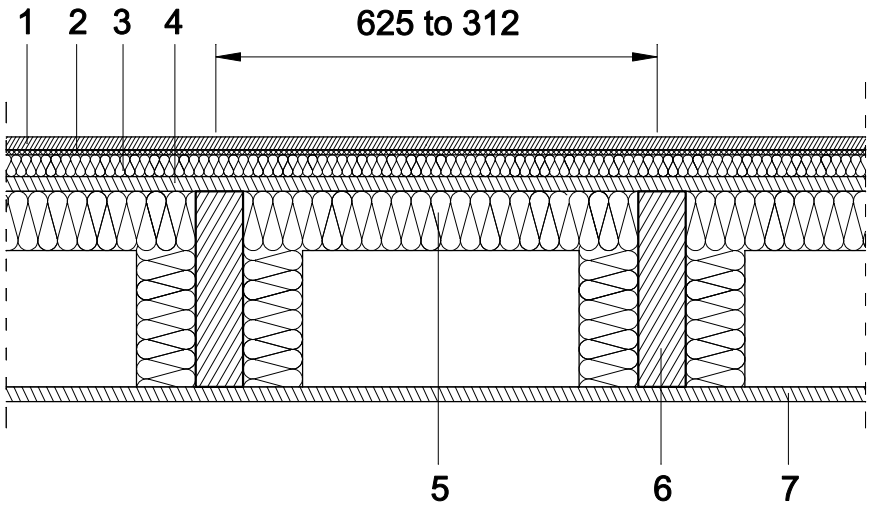
1 End joist (198x48 mm)
2 Screw (5x90 mm)(each stud)
3 Bottom plate (98x48 mm)
4 Stud (98x48 mm)
5 Flooring
6 High density mineral wool (22 mm thick)
7 Expanded polyethylene foam (5 mm thick)
8 OSB/3 panel (15 mm thick)
9 Top plate (98x48 mm)
10 Screw (5x90 mm)(each stud)
11 Tongued and grooved solid wood cladding (15 mm thick)
12 Floor joist (198x48)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 3.3.b
Name: Vertical cross section of joint between interior wall and suspended floor perpendicular to floor joists	



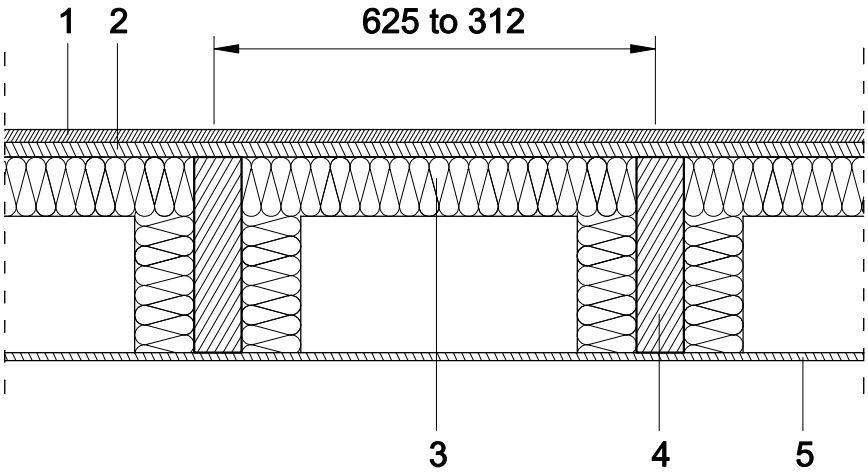
1 Flooring (13 mm thick)
2 Wood fibre panel (60 mm thick)
3 OSB/3 panel (15 mm thick)
4 Floor joist (198x48 mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.1.a
Name: Vertical cross section of the floors -basement floor with air space-	



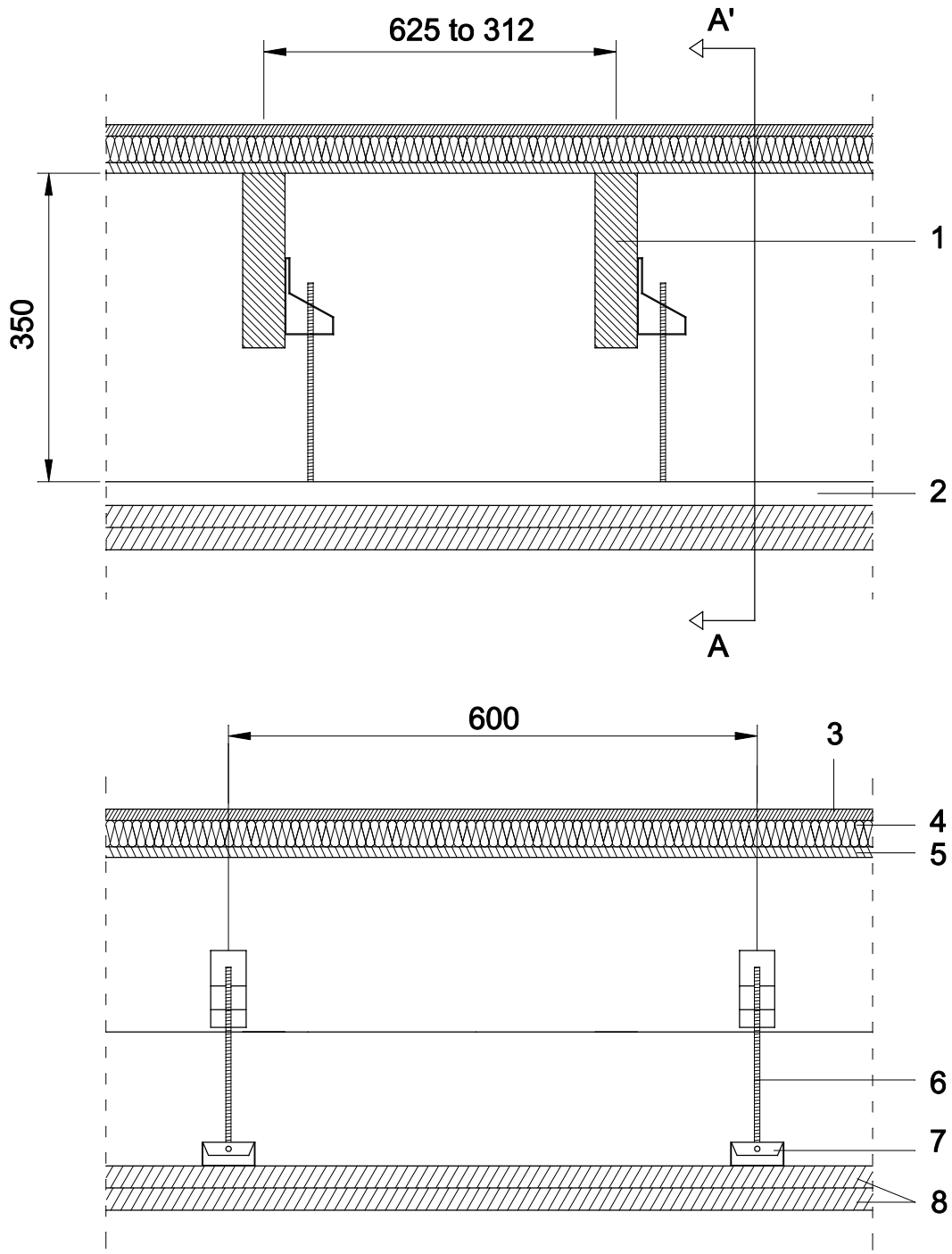
1 Flooring (13 mm thick)
2 Expanded polyethylene foam (5 mm thick)
3 High density mineral wool (22 mm thick)
4 OSB/3 panel (15 mm thick)
5 Mineral wool (60 mm thick)
6 Floor joist (198x48 mm)
7 Lining: tongued and grooved solid wood cladding (15 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.1.b
Name: Vertical cross section of the floor -floor plan-	



1 Flooring (13 mm thick)
2 OSB/3 panel (15 mm thick)
3 Mineral wool (60 mm thick)
4 Floor joist (198x48 mm)
5 Lining: OSB/3 panel (10 mm thick)

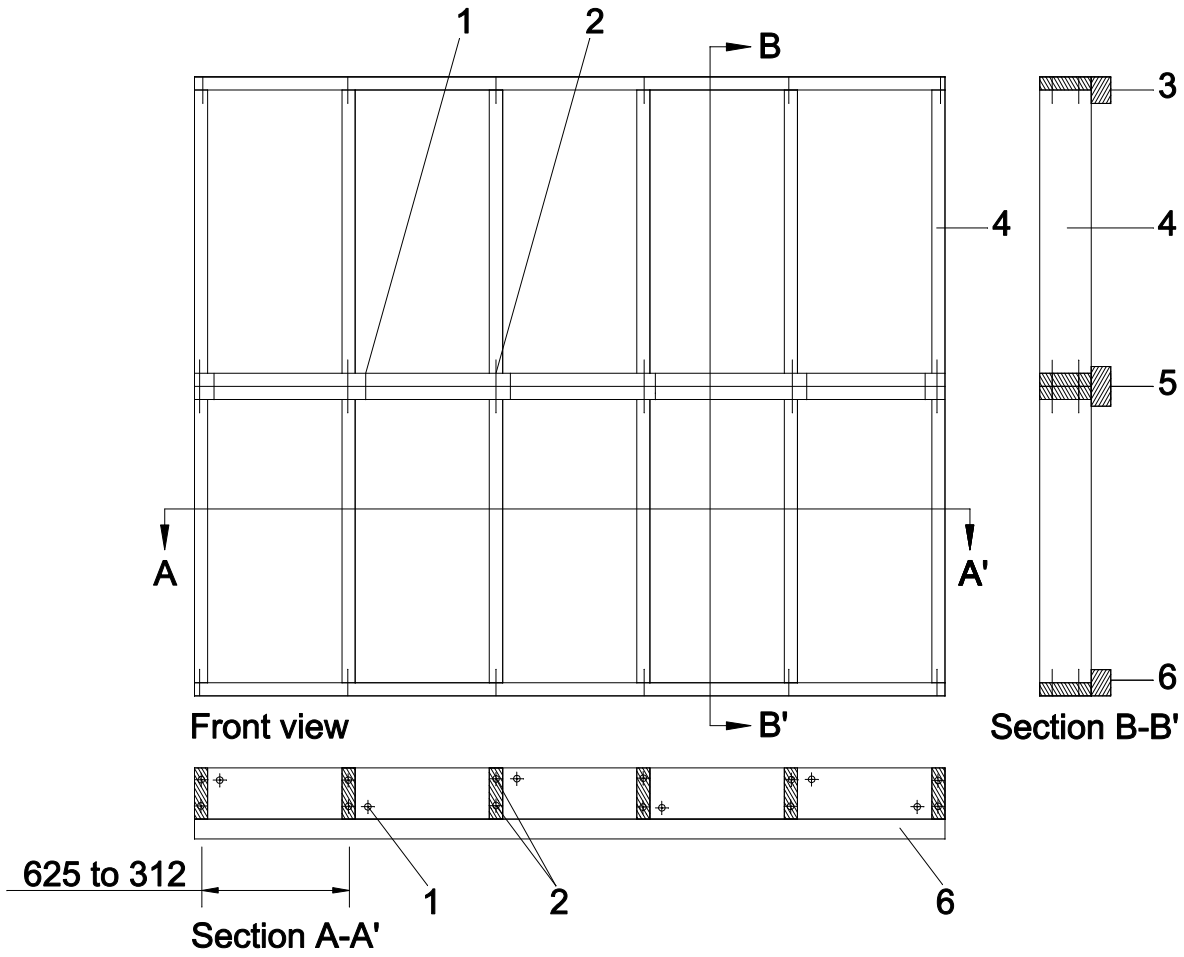
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.1.c
Name: Vertical cross section of the floors -floor plant between exterior and non heated room.	



Section AA'

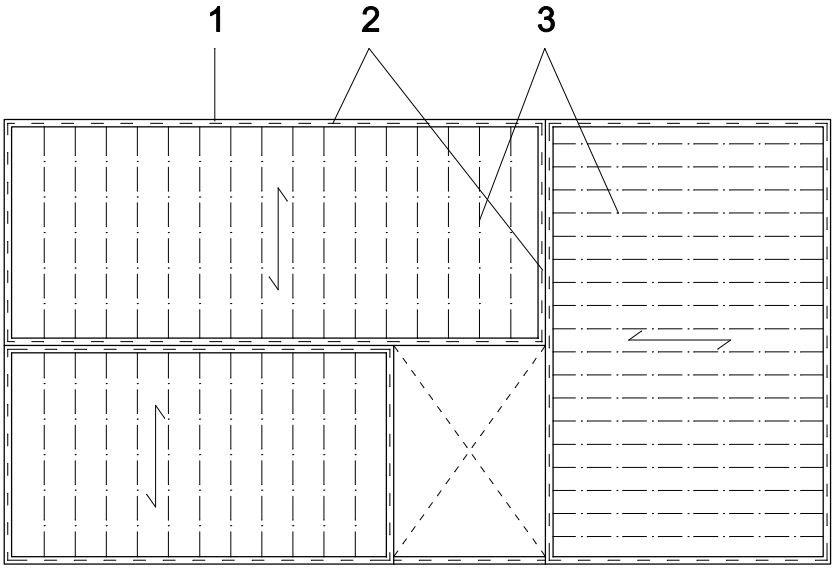
1 Floor joist (198x48 mm)
2 Galvanised steel channel T-60
3 Flooring (13 mm thick)
4 Wood fibre panels (30 mm thick)
5 OSB/3 Panel (12 mm thick)
6 Threaded bolt M60
7 Profile T-60
8 Calcium silicate boards Promatect® 100 (2x25mm)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.1.d
Name: Vertical cross section of the floor -basement floor between floor and basement-	



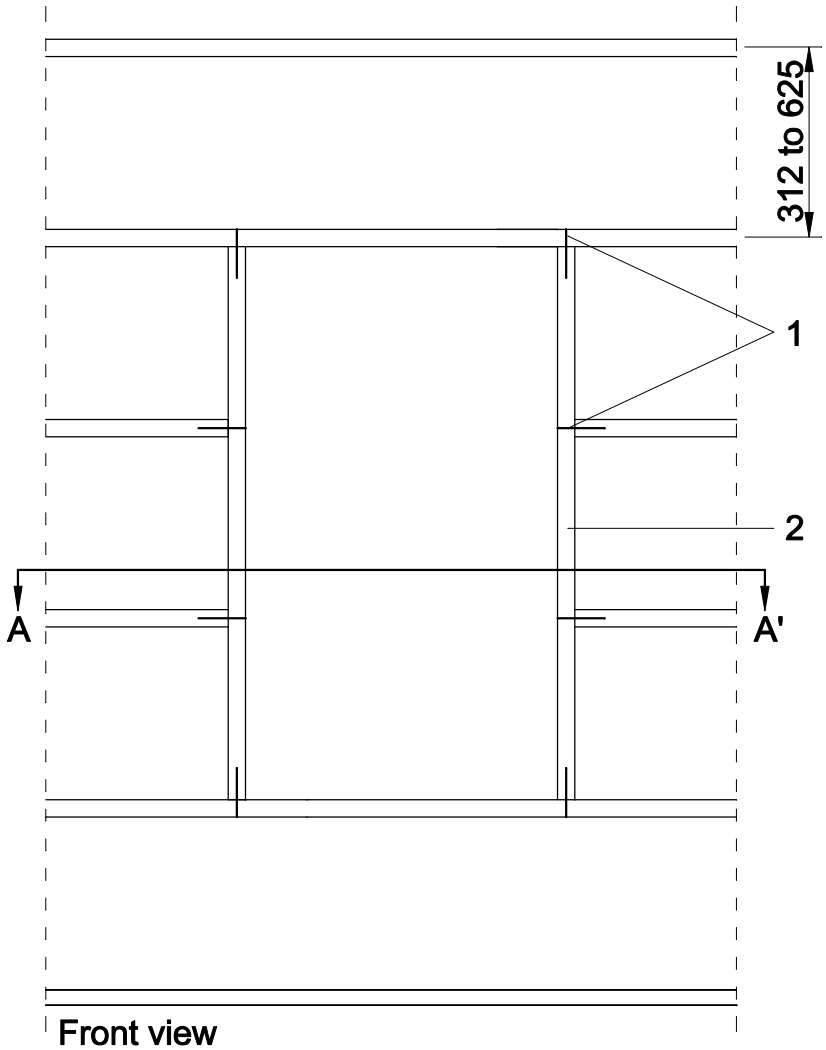
1 Screwed of 1 screw (5x80 mm) face to face between end joists
2 Screwed of 2 screws (5x80 mm) face to height between joists and end joists
3 Bottom plate (98x48 mm)
4 Joist (198x48 mm)
5 Bottom plate (148x48 mm)
6 Bottom plate (according to anchor (*vid*. fig. 2.6 and fig. 2.7))

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.2.a
Name: Horizontal plan of structural system with positions of suspended floor elements -join between joists and floors-	



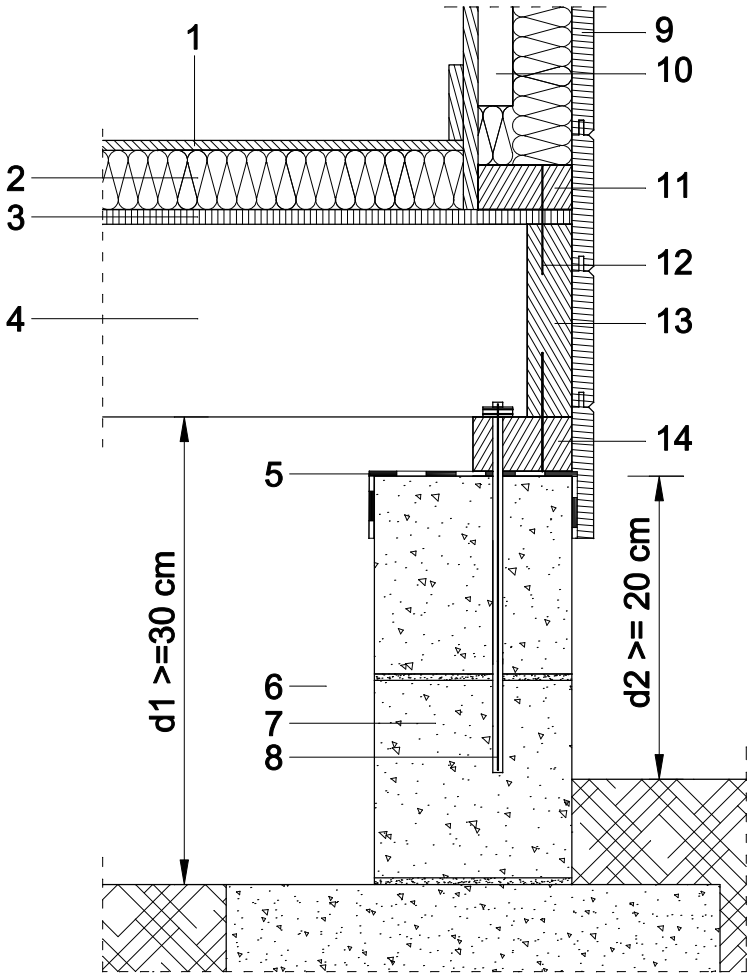
1 Girder (198x48 mm) screwed of a screw (5x80 mm) face to face between end joists (*vid.* fig. 4.2.a)
2 End joists layout
3 Joists (198x48 mm) screwed of 2 screws (5x80 mm) face to height between joists and end joist (*vid.* fig. 4.2.a)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.2.b
Name: Horizontal plan of structural system with positions of the joists of the floor	



1 Screws (same as the floor type and layout)
2 Joist

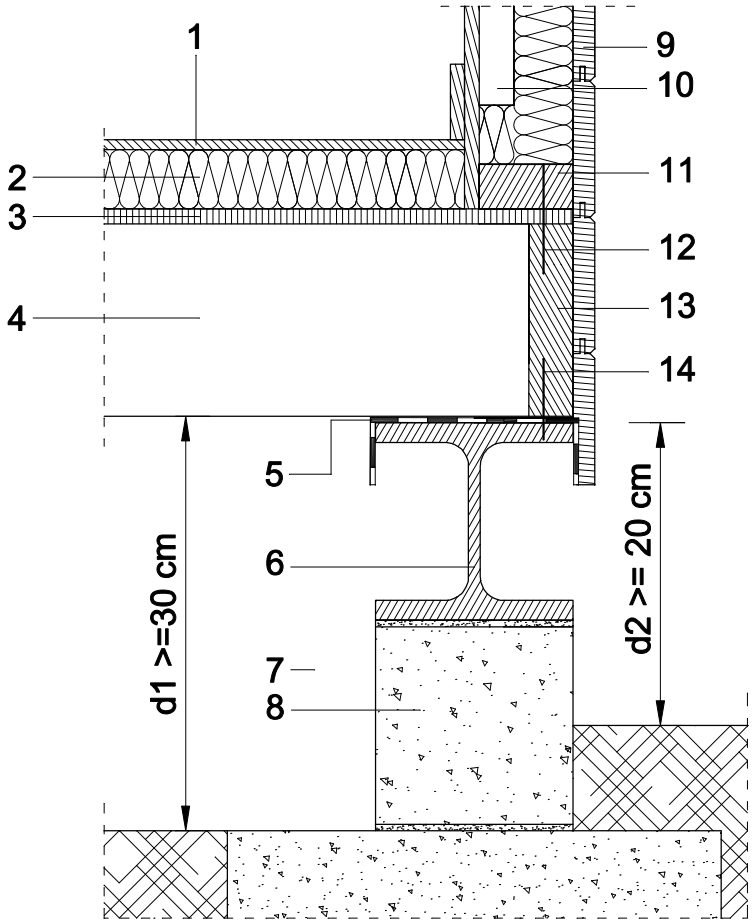
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.3
Name: Structural system for floor openings	



1 Flooring
2 Wood fibre panel (60 mm thick)
3 OSB/3 panel (15 mm thick)
4 Floor joist (198x48 mm)
5 Bituminous felt
6 Ventilated air space
7 Concrete block wall
8 Metal anchor (10 mm)
9 Tongued and grooved solid wood cladding (120x22 mm thick)
10 Stud (98x48 mm)
11 Botton plate (98x48 mm)
12 Screw (5x90 mm) (each stud)
13 End joist (198x48 mm)
14 Treated botton plate (98x48 mm)

d1 Distance between the basement level and the lower side of the floor
d2 Distance between the ground level and the beginning of the structure

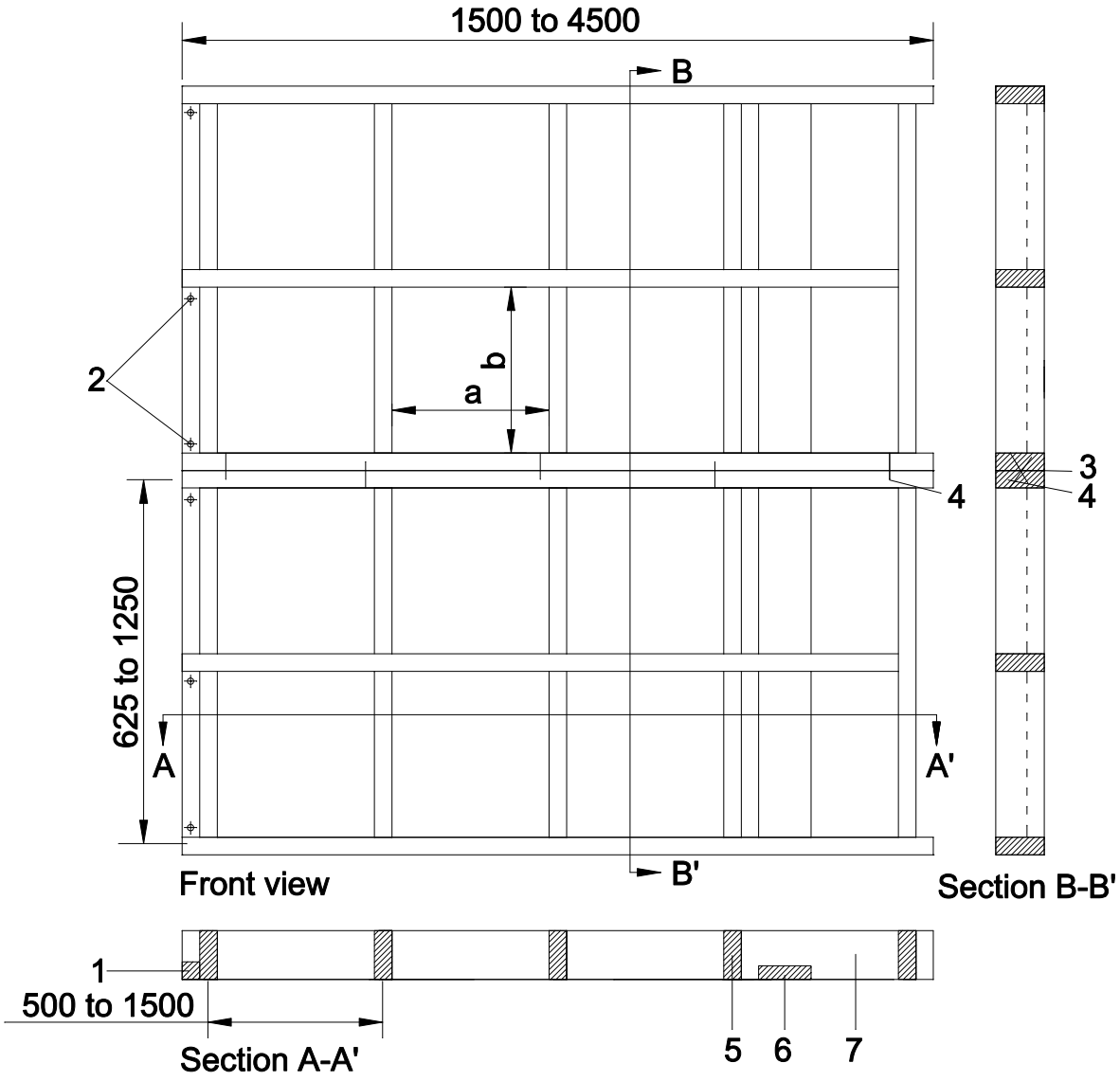
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.4.a
Name: Vertical cross section of support details on foundations and walls -block-	



1 Flooring
2 Wood fibre panel (60 mm thick)
3 OSB/3 panel (15 mm thick)
4 Floor joist (198x48 mm)
5 Bituminous felt
6 UPN or IPN steel beam according to the particular project
7 Air space
8 Concrete block wall
9 Tongued and grooved solid wood cladding (120x22 mm thick)
10 Stud (98x48)
11 Botton plate (98x48 mm)
12 Screw (5x90 mm) (each stud)
13 End joist (198x48 mm)
14 Screw (5x60 mm)

d1 Distance between the basement level and the lower side of the floor
d2 Distance between the ground level and the beginning of the structure

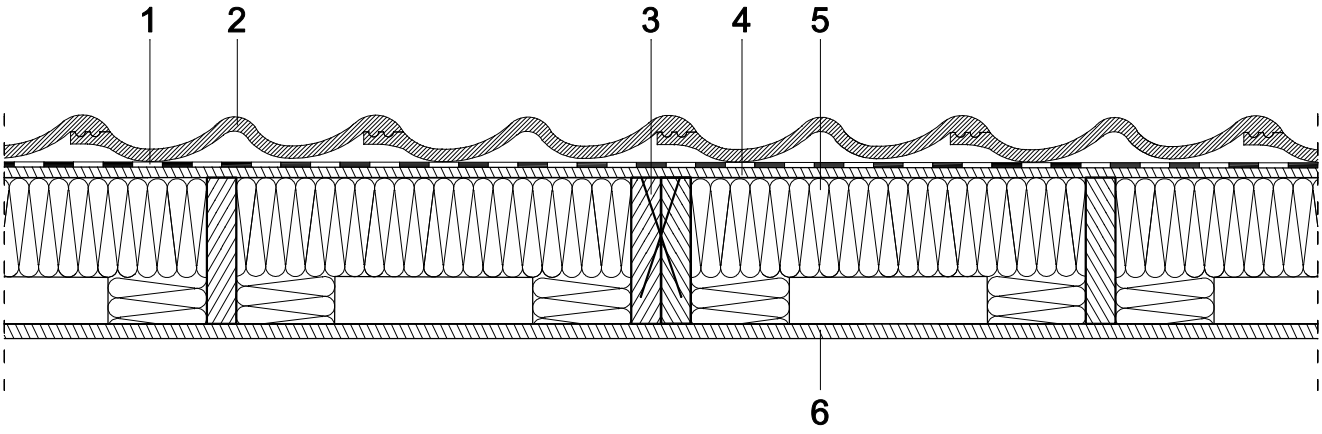
CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 4.4.b
Name: Vertical cross section of support details on foundations and walls -profile-	



1 Slat
2 Screw (5x80 mm)(in each joist)
3 Double joist (148x60 mm)
4 Screwed in staggered parallel rows with screws (5x80 mm) each 400 mm
5 Nogging (148x30 mm)
6 Plane joist (148x30 mm)
7 Roof joist (148x30 mm)

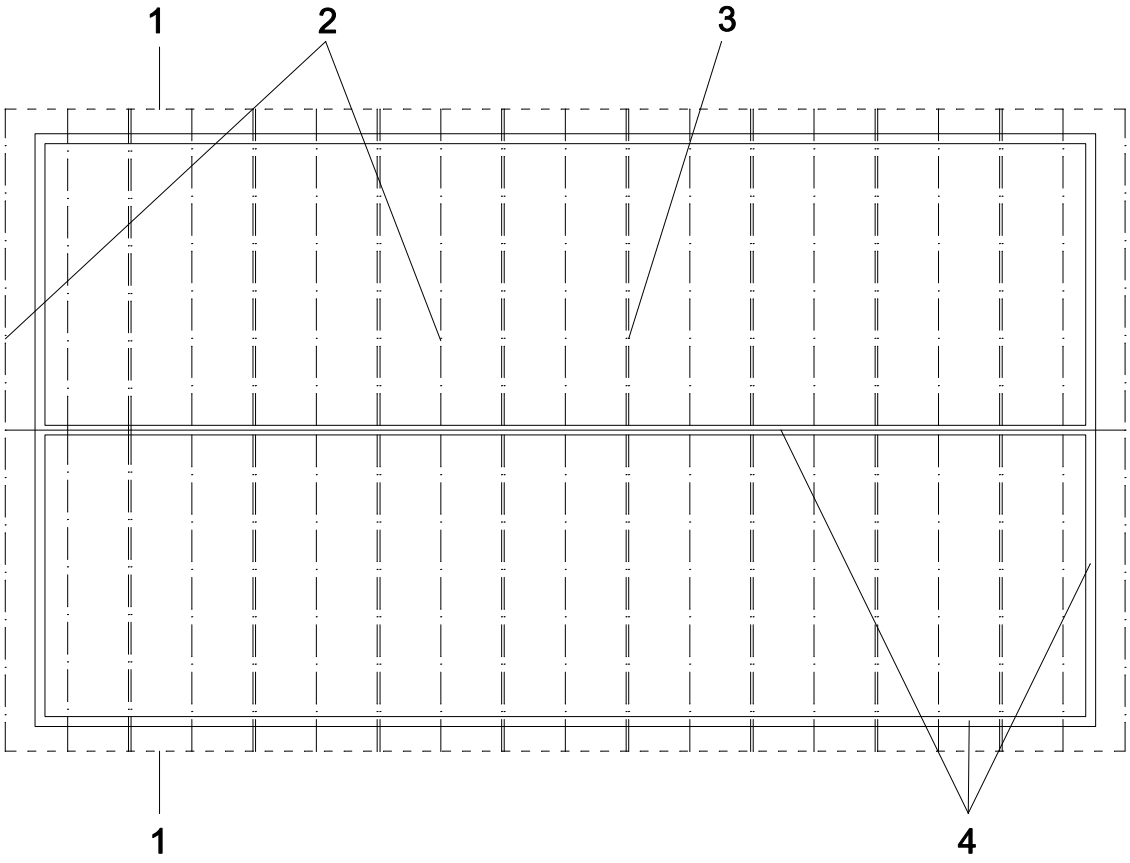
axb Maximum dimension 4,000 cm²

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.1.a
Name: Vertical cross section of complete roof structure -disposition and fixing of prefabricated frame-	



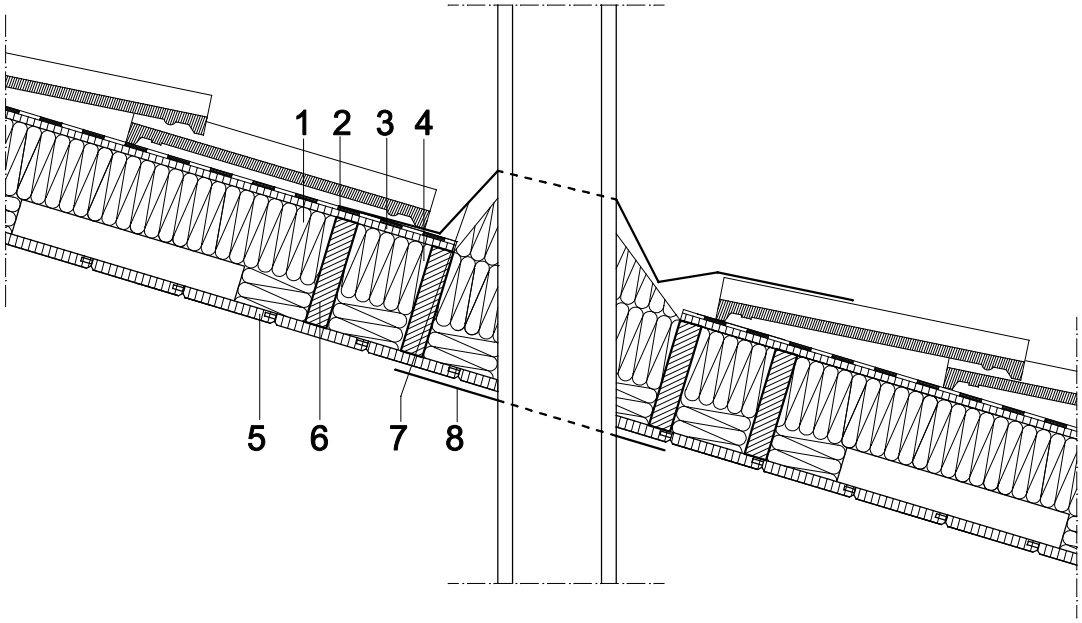
1 Roof lining
2 Concrete tile roof (screwed)
3 Screwed in staggered parallel rows with screws (5x80 mm) each 400 mm
4 OSB/3 panel (10 mm thick)
5 Mineral wool with vapour control layer (100 mm thick)
6 Tongued and grooved solid wood cladding (15 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.1.b
Name: Vertical cross section of complete roof structure -vertical cross section of the roof-	

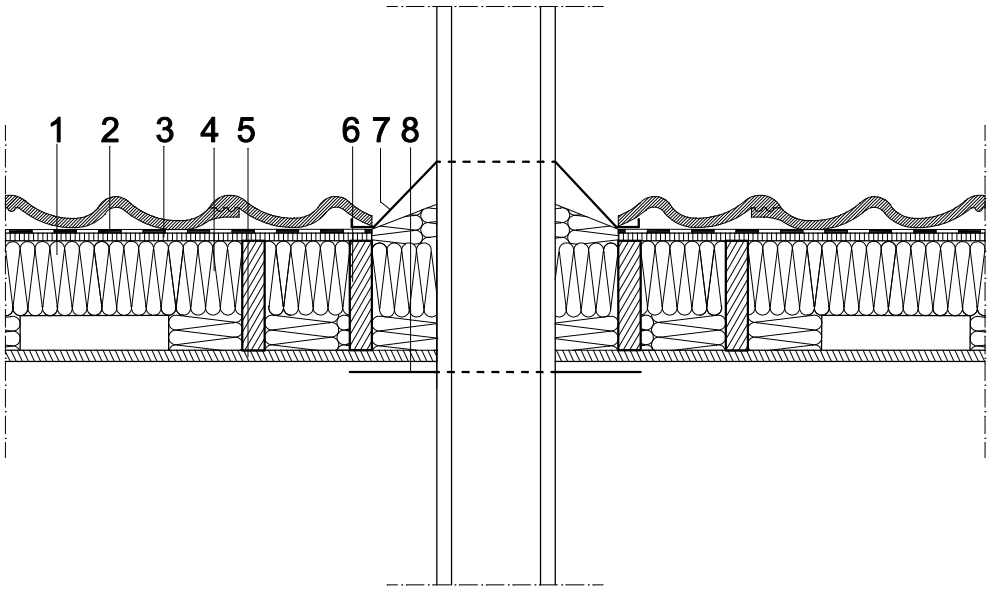


1 Eave
2 Joist (148x30 mm) as a part of the prefabricated roof frame
3 Doubled joist (148x60 mm) screwed in staggered parallel rows with screws (5x80 mm) each 400 mm (*vid.* fig. 5.1.a)
4 Timber frame supporting the prefabricated roof frame

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.2
Name: Plan of structural system with positions of structural elements	



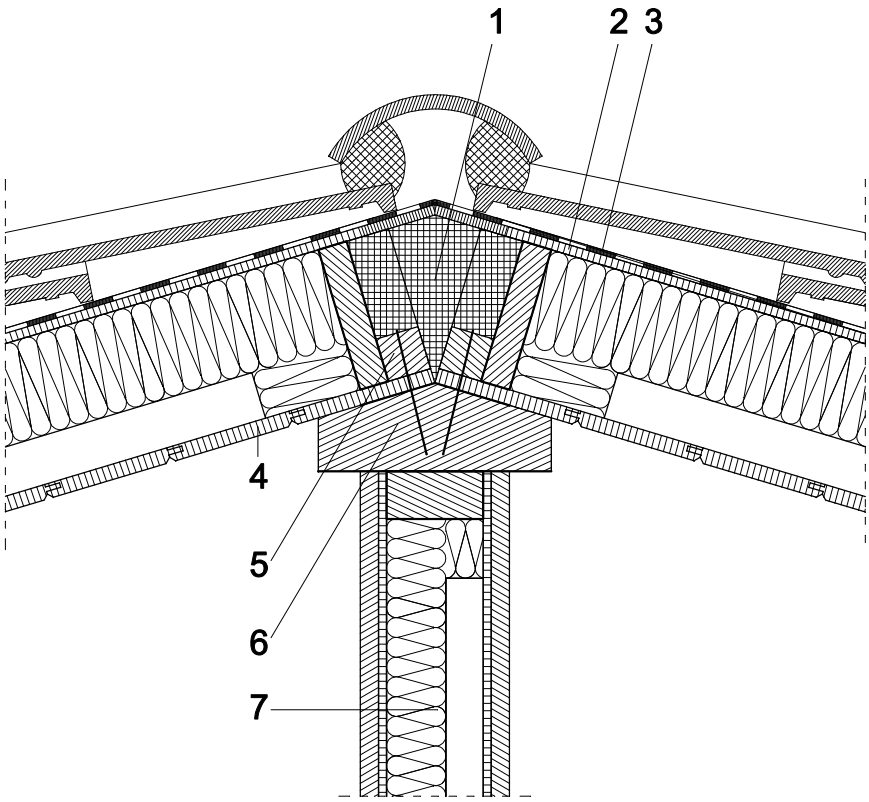
Vertical cross section parallel to the roof joist



Vertical cross section perpendicular to the roof joist

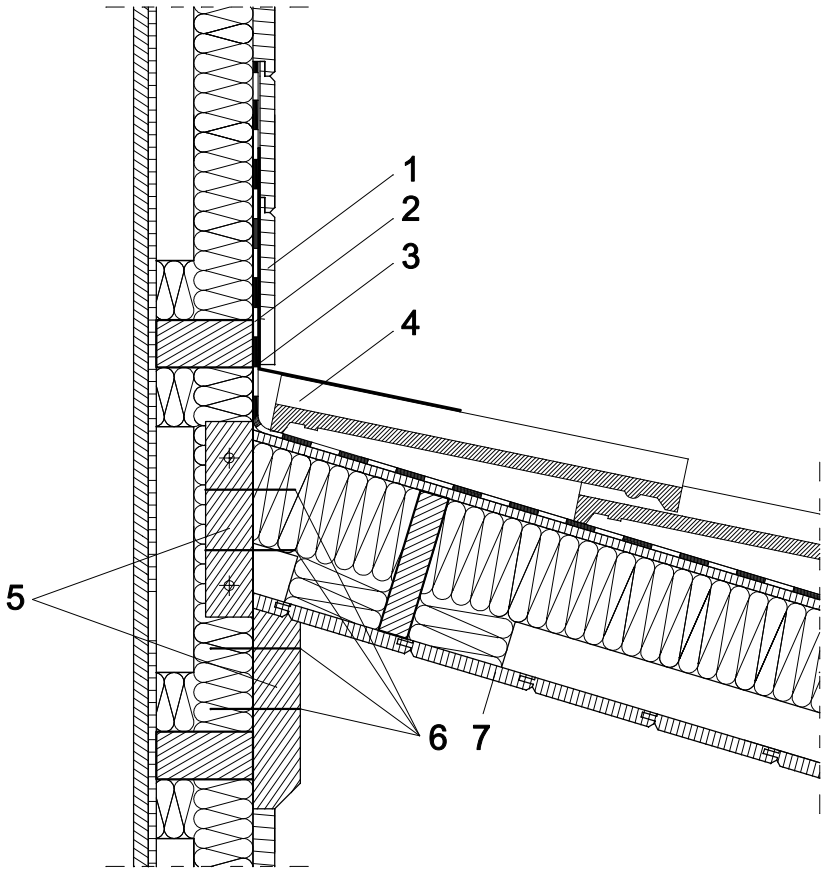
1 Prefabricated roof frame
2 Roof lining
3 OSB/3 panel (10 mm thick)
4 Mineral wool with vapour control layer (100 mm thick)
5 Tongued and grooved solid wood cladding (15 mm thick)
6 Floor joist (148x30 mm)
7 Flashing
8 Diffuser

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.3
Name: Basic design around ducts, pipes, chimneys, etc. penetrating the roof	



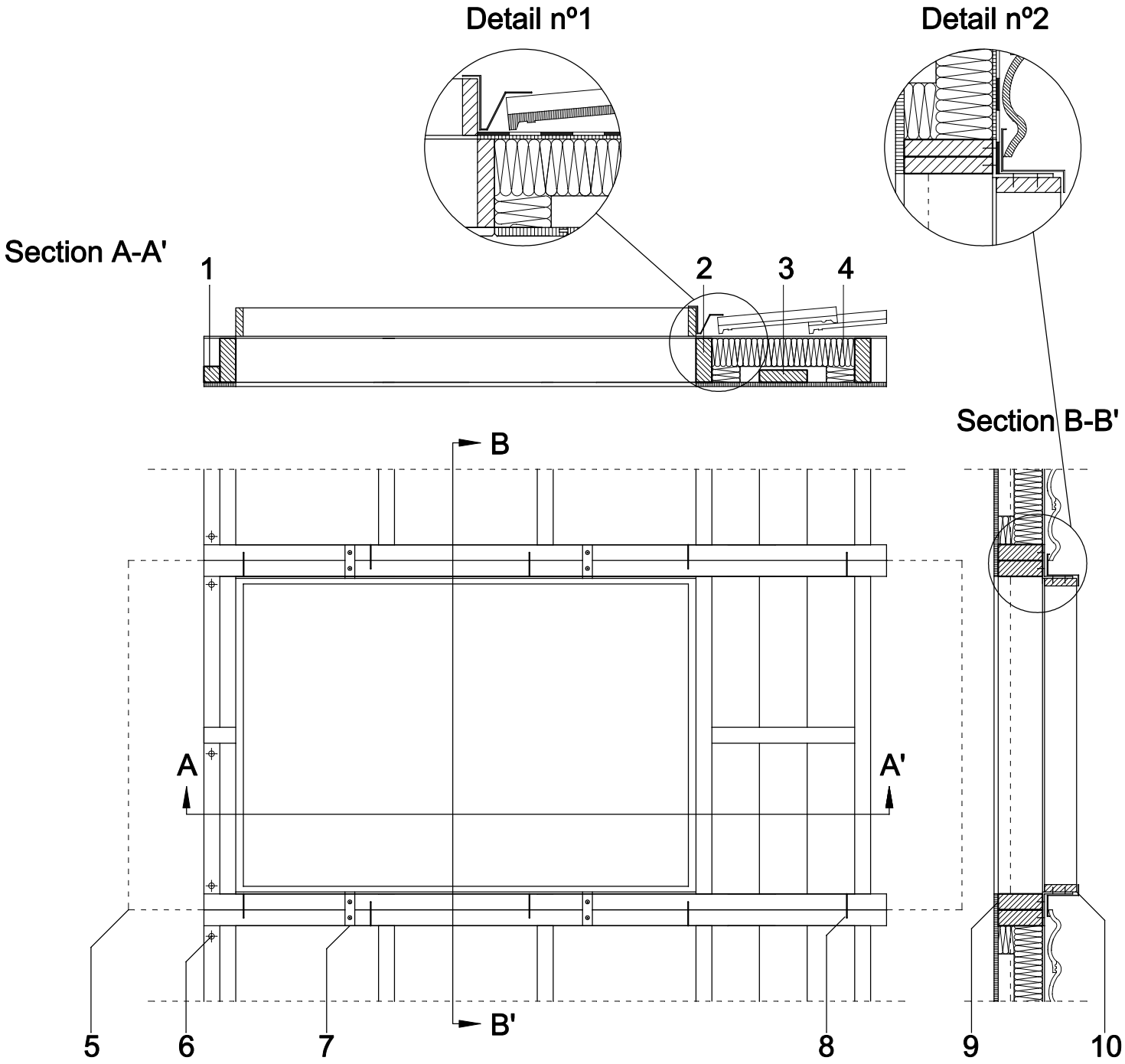
1 Mineral wool
2 OSB/3 panel (10 mm thick) roof finishing
3 Roof lining
4 Tongued and grooved solid wood cladding (15 mm thick)
5 Slat
6 Canted girder with a continuous bead
7 Wall (according to the internal design of the dwelling)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.4.a
Name: Vertical cross section of ridge -roof ridge fixing-	



1 External wall finishing
2 Roof lining
3 Corner profile
4 Concrete tile
5 Anchors (198x48 mm)
6 Screw (5x90 mm)
7 Tongued and grooved solid wood cladding (15 mm thick)

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.4.b
Name: Vertical cross section of ridge -join between façade walls and roof without ridge-	



1 Slat
2 Nogging (148x30 mm)
3 Plane joist (148x30 mm)
4 Roof joist (148x30 mm)
5 Prefabricated roof window frame
6 Screw (5x80 mm)(in each joist)
7 L steel profile
8 Screwed in staggered parallel rows with screws (5x80 mm) each 400 mm
9 Double joist (148x60 mm)
10 Slat provided by window supplier

CANADIAN NORDIC HOUSE	**Date:** December 2008
	Code: 5.5
Name: Basic design of joints between roof and roof windows	