

04.03_PH-SUMMER SCHOOL

LIGHT CONSTRUCTIONS

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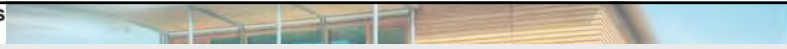
04.03.06 PH-details: Outside wall / Mono-pitched roof

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What are lightweight / wooden constructions?

Types

Types of timber construction systems

- Timber-frame construction
- Balloon frame construction (timber stud construction)
- Frame construction
- Panel construction
 - Light panel construction
 - Massive timber panel construction
- Platform frame construction
- Log construction

Source:

What are lightweight / wooden constructions?

Types of timber construction systems

- Timber-frame construction

Timber framing, framework or half-timbering, is the method of creating structures utilizing heavy timbers jointed via pegged mortise and tenon joints.

A well known traditional construction system.

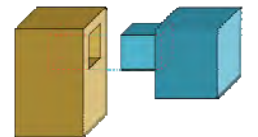
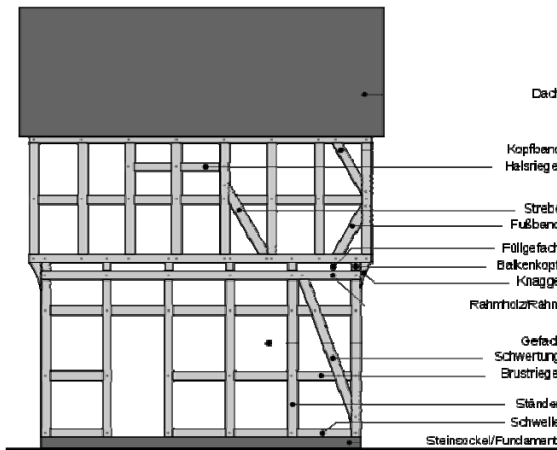
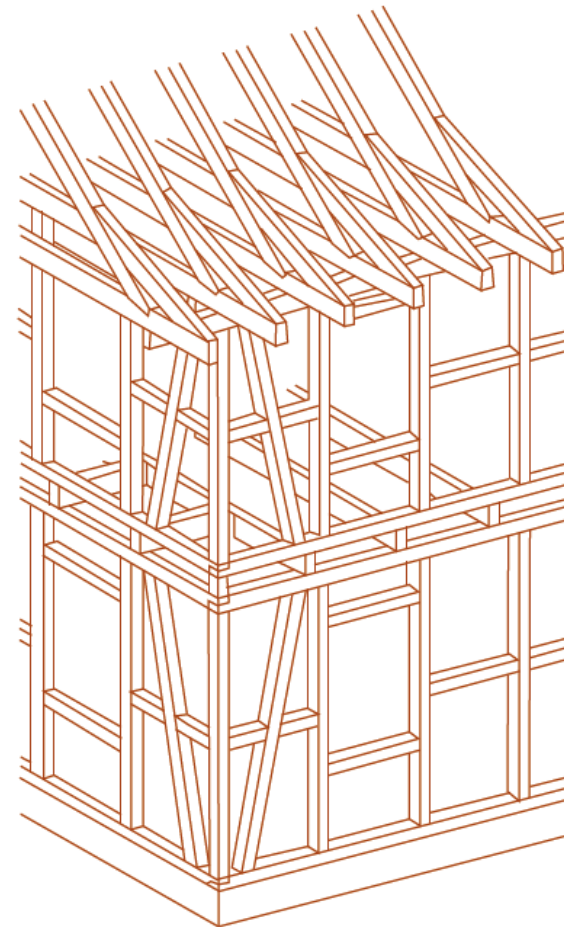


Diagram of a mortise and tenon joint



http://en.wikipedia.org/wiki/Mortise_and_tenon

Source: <http://de.wikipedia.org/wiki/Fachwerkhaus>

http://en.wikipedia.org/wiki/Timber_frame_construction

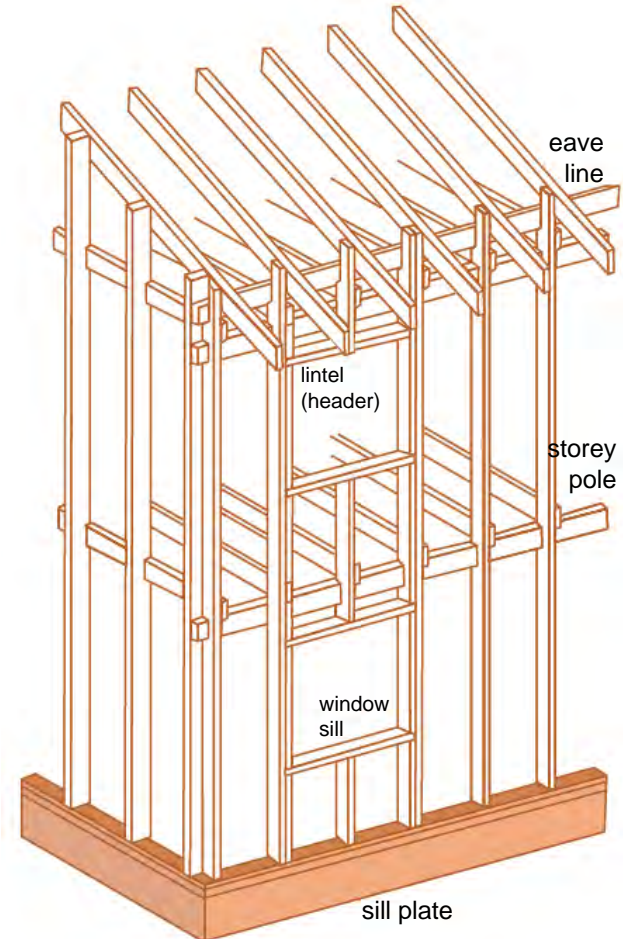
Massachusetts Institute of Technology – Architecture MIT OCV

What are lightweight / wooden constructions?

Types of timber construction systems

- **Balloon frame construction (timber stud construction)**

Is a method with long continuous framing members (studs) that run from sill plate to eave line with intermediate floor structures nailed to them, with the heights of window sills, headers and next floor height marked out on the studs with a storey pole. Complete wall sections are then raised and put in place.



Source:

Massachusetts Institute of Technology – Architecture MIT OCW

What are lightweight / wooden constructions? Types of timber construction systems

Balloon frame construction



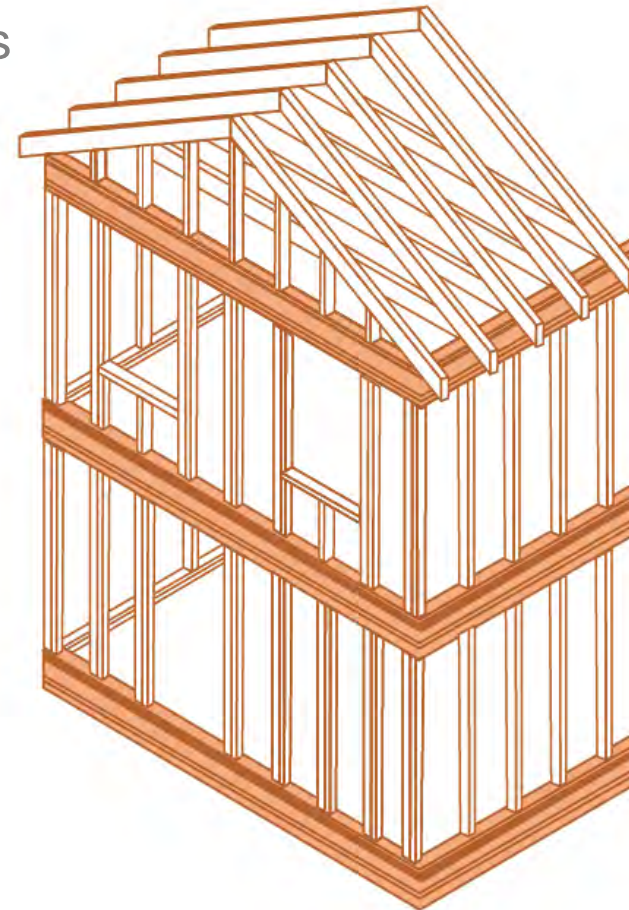
Source:

What are lightweight / wooden constructions?

Types of timber construction systems

- **Platform frame construction**

The floors, walls and roof of a framed structure are created by assembling (using nails and screws) consistently sized framing elements of dimensional lumber (2x4, 2x6, etc.) at regular spacings (12 in, 16 in, and 24 in on center), forming stud-bays (wall) or joist-bays (floor). The floors, walls and roof are typically made torsionally stable with the installation of a plywood or composite wood skin referred to as sheathing.

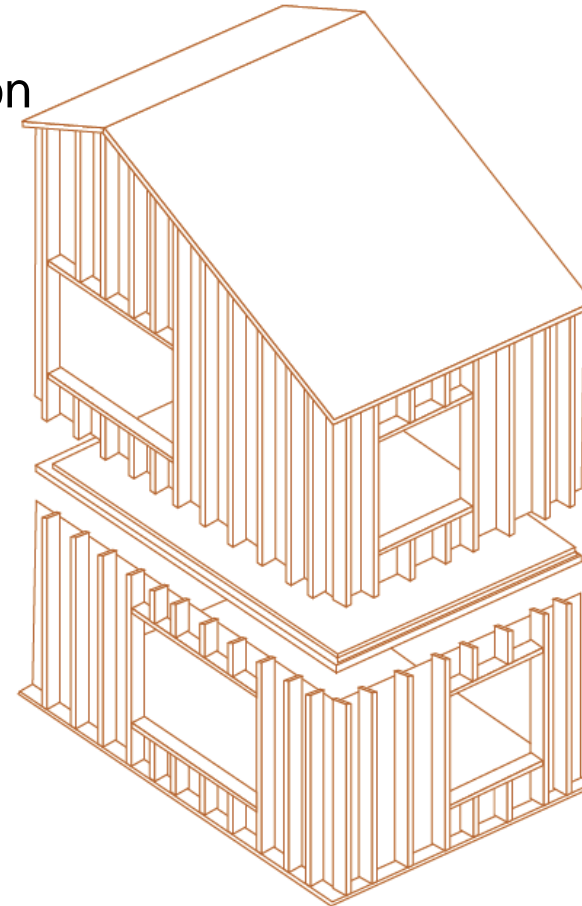
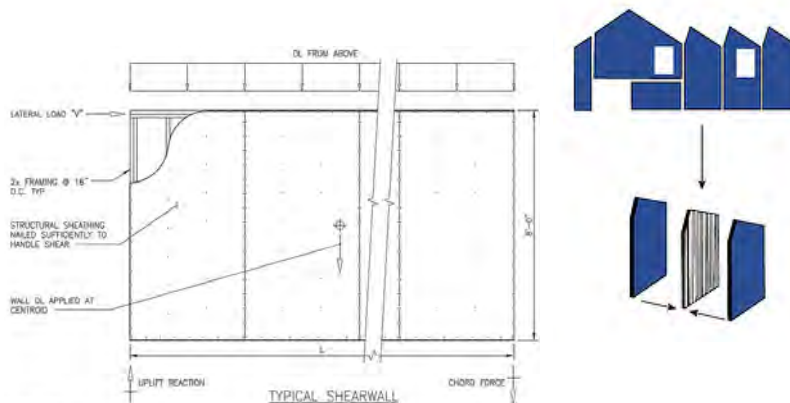


What are lightweight / wooden constructions?

Types of timber construction systems

- **Light panel (shear wall) construction**

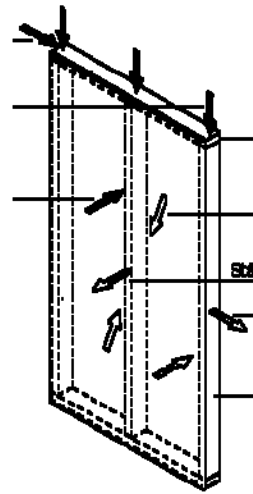
Shear walls are typically wood frame stud walls covered with a structural sheathing material like plywood.



This can be made very well prefabricated.

What are lightweight / wooden constructions? Types of timber construction systems

Light panel construction
Half prefabricated elements



Source: www.infoholz.de/html/f_page.phtml?p1=1132262203&p3=1434

What are lightweight / wooden constructions? Types of timber construction systems

Light panel construction Full prefabricated elements



Floor elements



Roof elements

Wall elements



Source: www.infoholz.de/html/f_page.phtml?p1=1132262203&p3=1434

What are lightweight / wooden constructions?

Types of timber construction systems

Light panel construction

Full prefabricated elements - Structural Insulated Panels (SIPs) are a very economical and efficient construction method.

SIPs, are a composite building material. They consist of an insulating layer of rigid polymer foam sandwiched between two layers of structural board. The board can be sheet metal, plywood, or oriented strand board (OSB) and the foam either expanded polystyrene foam (EPS), extruded polystyrene foam (XPS) or polyurethane foam.

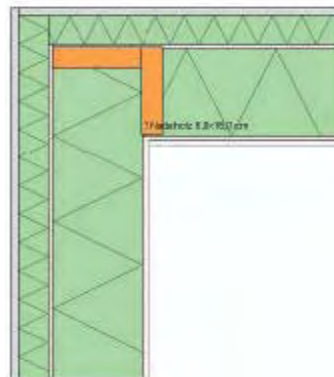
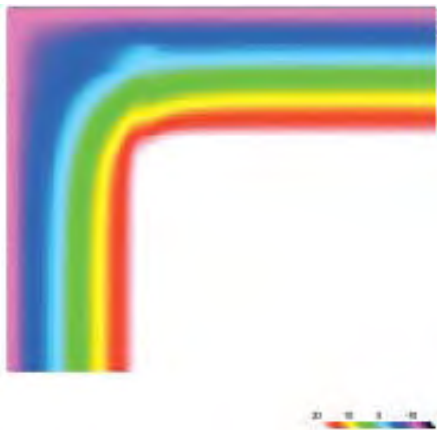


Special elements are “Structural Insulated Panels“.

What are lightweight / wooden constructions? Types of timber construction systems

Light panel construction

The sandwiched construction gives a very strong and very good thermal insulating panel.



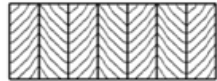
Source: www.isobouw.de

What are lightweight / wooden constructions?

Types of timber construction systems

- Massive timber panel construction

- Vertically-laminated timber panels



- Cross-laminated panels (German KLH)



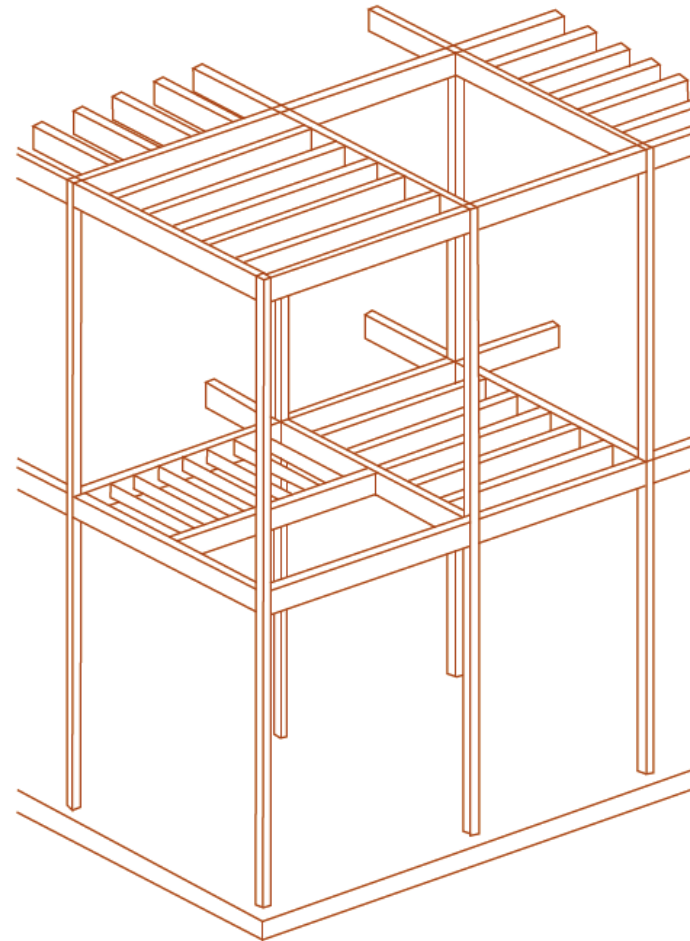
Horizontally and vertically load bearing panels



Foto: Heule-Rösler

What are lightweight / wooden constructions? Types of timber construction system

- **Frame / skeleton construction**
Horizontally and vertically load bearing studs forms the construction structure. Not load bearing wall elements are added.

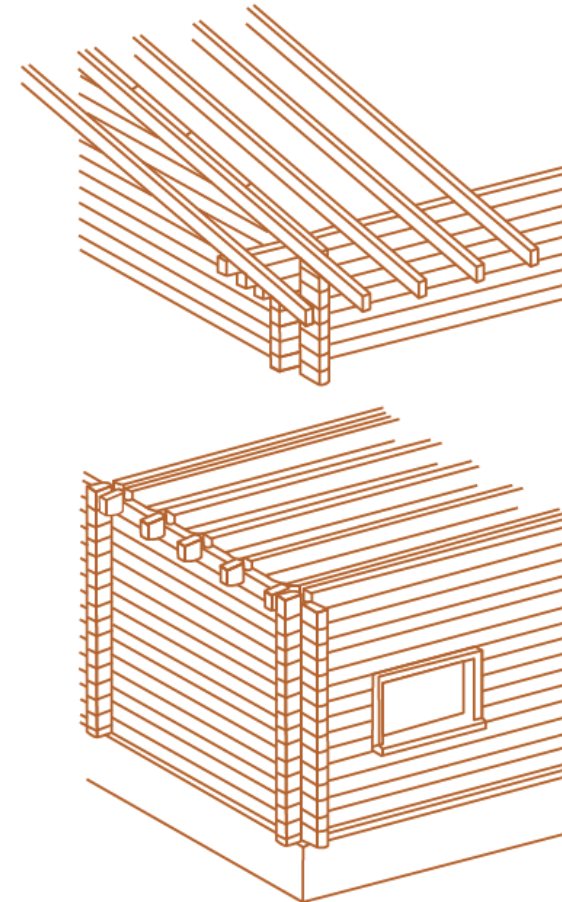


Source:

Massachusetts Institute of Technology – Architecture MIT OCW

What are lightweight / wooden constructions? Types of timber construction systems

- Log construction
In the traditional way a small usage.



Source: Massachusetts Institut of Technology – Architecture MIT OCW

PH-details

Passive House construction details for light/wooden constructions.

Much of them are from “Details for Passive House, A catalogue of Ecologically Rated Constructions” from IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007, a „Building of Tomorrow“- project supported by the Austrian Federal Ministry for Transport, Innovation and Technology.

Source:



PH-details: Foundation / Outside wall

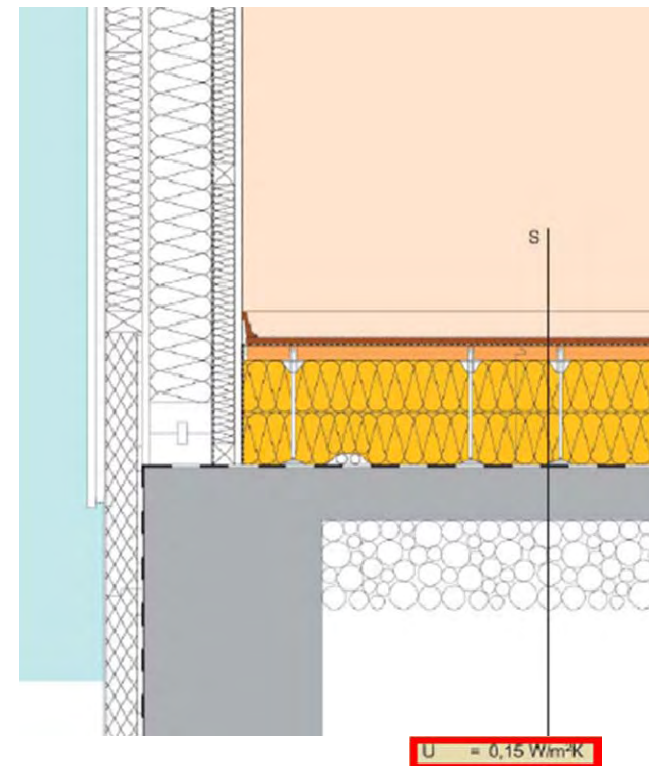
Foundation / Outside wall

Source:

PH-details: Foundation / Outside wall

Stacked wood outside wall, rear ventilation /

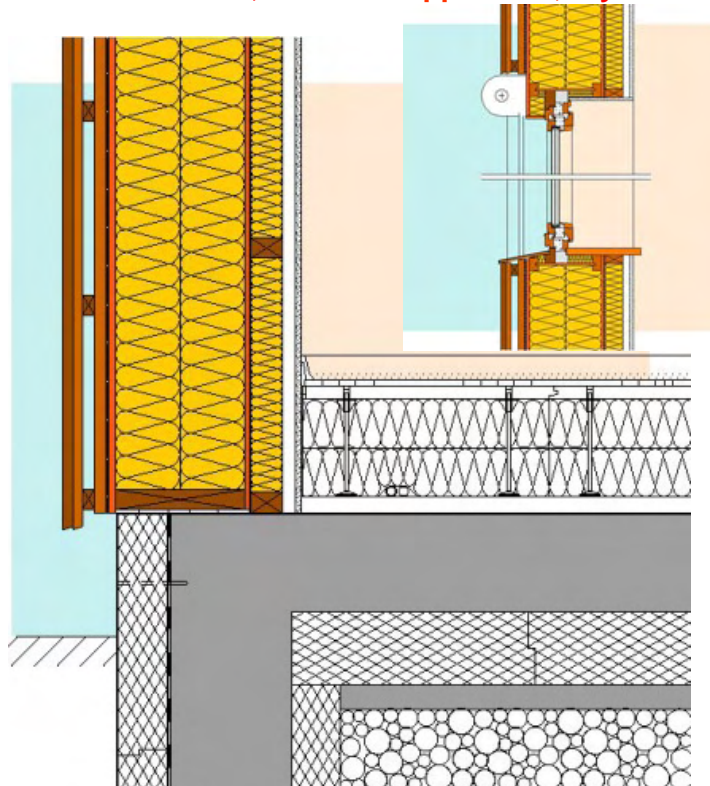
Foundation slab, insulated upper side, dry raised screed with distance feet



Source: www.isover.ro/images/pdf/Tema%202005.pdf

PH-details: Foundation / Outside wall

Timber framework wall with timber I-section beams , in-between insulation, ventilated /
Foundation slab, insulated upper side, dry raised screed with distance feet



cm	Composition
1,5	Plaster board fire-protection board
3,0	Counter battens 3/5
8,0	ISOVER ULTIMATE insulation between counter battens 5/8
	- Vapour barrier (Isover Vario KM Duplex)
1,2	Chipboard board
16,0	Lightweight glass wool between I-section beams
16,0	Lightweight glass wool between I-section beams
1,6	Chipboard board
	- Layer of vapour diffusion-permeable spun-bonded web
3,0	Ventilation area
3,0	Formwork
2,4	Framework boarding
2,4	Framework boarding

U = 0,10 W/m²K

R_w ≥ 45 dB

REI 30

Ψ = 0,0 W/mK

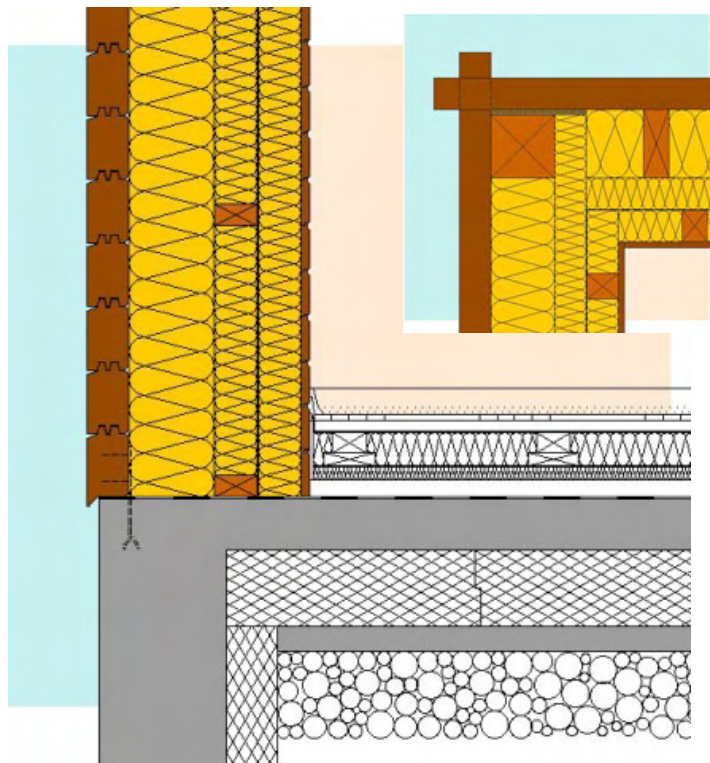
Link for different values: Architektenordner online

http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=20

PH-details: Foundation / Outside wall

Interior insulation of a woodblock wall, (Mineral wool) /
Slab foundation, insulated lower side, dry screed



cm	Composition
1,9	Framework boarding
10,0	Lightweight glass wool between wooden rafters
-	Vapour barrier (Isover Vario KM Duplex)
10,0	Lightweight glass wool between rafters
20,0	Lightweight glass wool between rafters
10,0	Woodblock wall

$U = 0,10 \text{ W/m}^2\text{K}$

$R_w \geq 45 \text{ dB}$

REI 30

$\psi = 0,0 \text{ W/mK}$

Link for different values: Architektenordner online

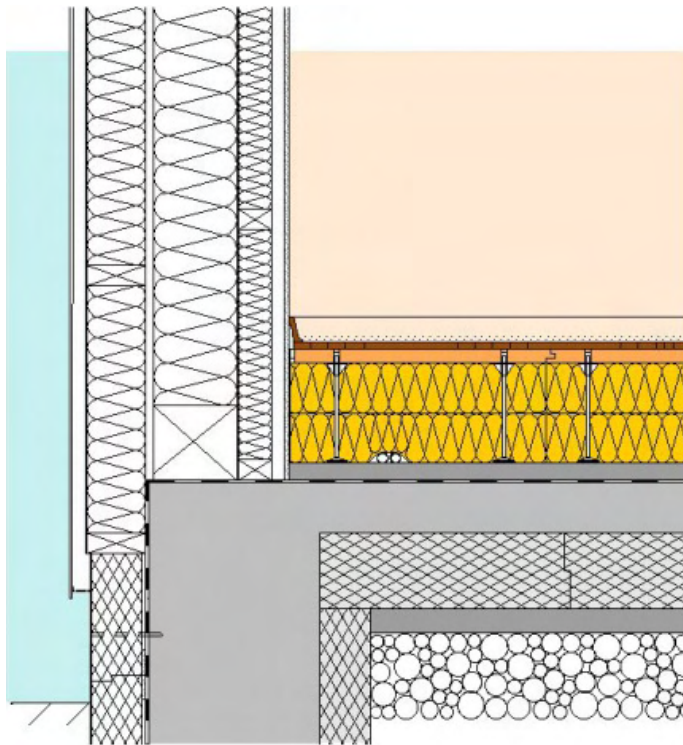
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Source: www.isover.com/SiteContent/view.do?navId=20

PH-details: Foundation / Outside wall

Timber framework outer wall with exterior facade cladding (board) /

Foundation slab, insulated upper side, dry raised screed with distance feet



Raised floor, above ground

cm Composition

- 1,5 Parquet floating layer
- Vapour barrier
- 3,2 "Distansol" chipboard panel with distance feet
- 12,0 Glass wool panel
- 12,0 Glass wool panel
- 4,0 Sub-concrete
- Separating layer
- 0,5 Non-porous membrane
- 12,0 Sub-concrete
- Separating layer
- 18,0 Extruded Polystyrene
- Protective concrete
- Round gravel

$$U = 0,10 \text{ W/m}^2\text{K}$$

$$R_w \geq 66 \text{ dB}$$

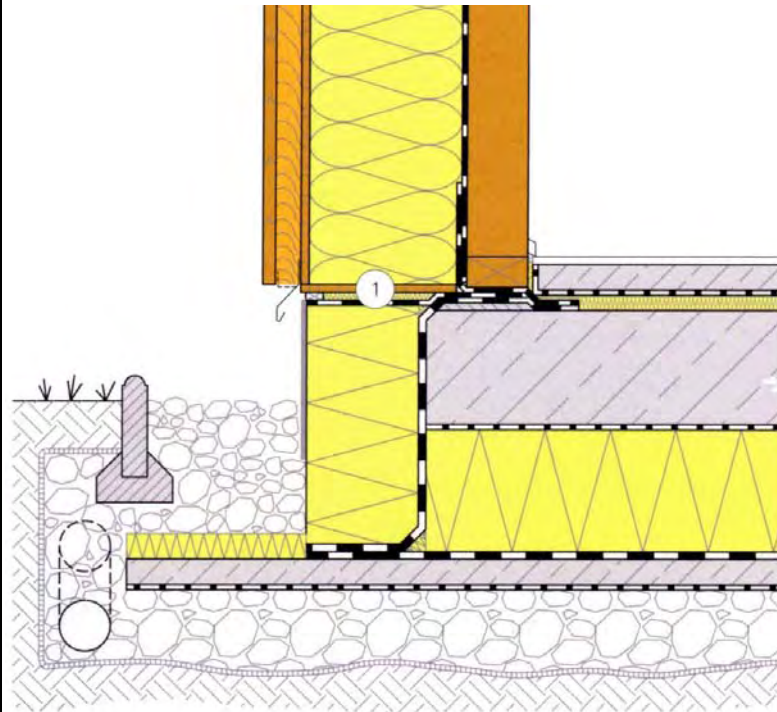
Link for different values: Architektenordner online

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Source: www.isover.com/SiteContent/view.do?navId=21 (05.09.2008 11:30)

PH-details: Foundation / Outside wall

Stacked wood outside wall, rear ventilation / Slab foundation, insulated lower side, wet screed



1 OSB-Platte / OSB panel

Building physics

linear thermal bridge coefficient ψ -0.013 W/mK

Technical description

Suitability

- For floors that are above the level of the adjoining ground
- For ground conditions that do not require strip foundations
- For any type of ground (also rock and binding loamy grounds)

Construction process

- Drainage pipes (if required) should be laid higher than the foundation level in all building segments
- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Seal the polymer bitumen sheet stripe visible between the base insulation and insulation of the raising wall tightly (e.g. torch applying) on the wall surface, close the joint with a long-lasting elastic seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Cover the ventilation opening, which should be as large as possible, with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)
- The connection of the vapour barrier to the floor slab should be flow-sealed. Perform the blower door test before building the floor surface structure to check for existing leaks and close them.

Maintenance

- Clean the drainage system regularly (if one exists)
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

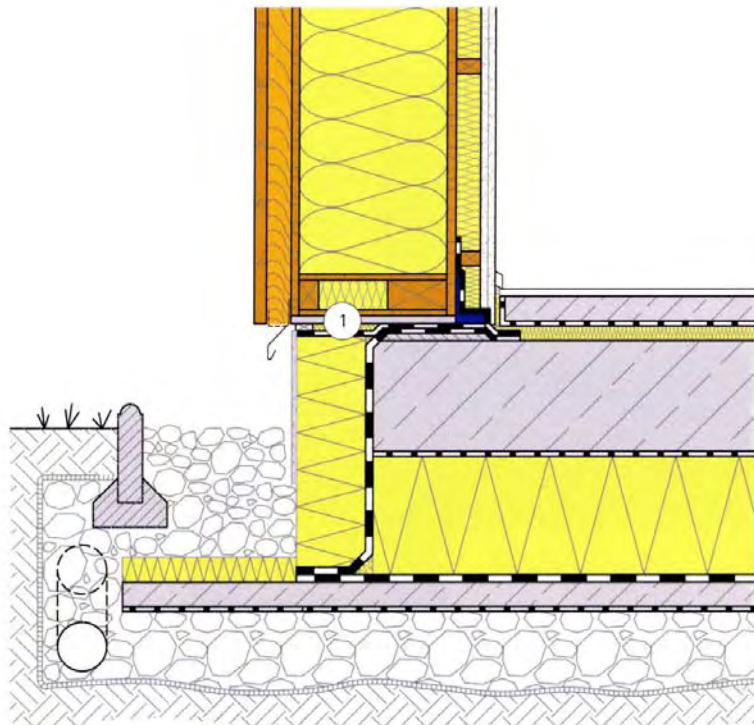
Structural discussion

- The construction requires maintenance and care completion, especially of the seals

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Foundation / Outside wall

Box beam outside wall, rear ventilation / Solid foundation, insulated lower side, wet screed



Building physics

linear thermal bridge coefficient ψ 0.009 W/mK

Technical description

Suitability

- For floors that are above the level of the adjoining ground
- For ground conditions that do not require strip foundations
- For any type of ground (also rock and binding loamy grounds)

Construction process

- Drainage pipes should be laid above the foundation level in all areas
- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Seal the polymer bitumen sheet stripe visible between the base insulation and insulation of the raising wall tightly (e.g. torch applying) on the wall surface, cover the joint with a long-lasting elastic seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Cover the ventilation opening, which should be as large as possible, with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)
- Make sure the connection between the OSB panel and the floor slab is flow-sealed. Perform the blower door test before assembling the floor structure to close existing leaks.

Maintenance

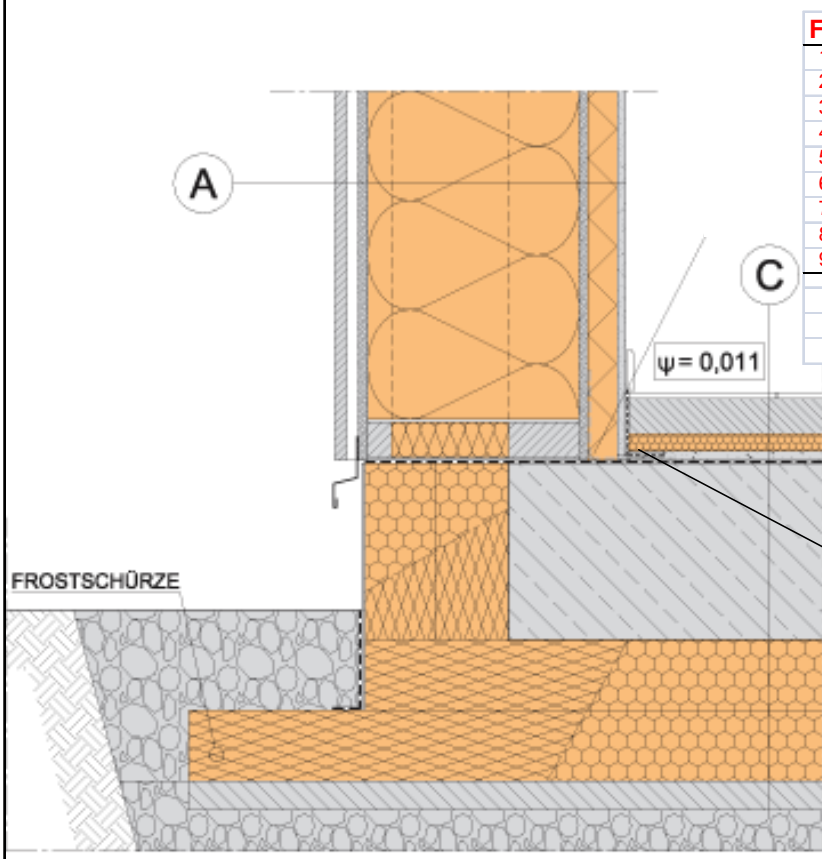
- Clean the drainage system regularly (if required)
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

Structural discussion

- Special technical skills and great care are required to achieve long lasting effectiveness of sealed connection.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Foundation / Outside wall
Ground floor without basement



Floor construction			Lambda	Rt-value
1	1,0	flooring		
2	6,0	floating floor screed	1,400	0,043
3		interlayer (vapour barrier)		
4	3,0	sound insulation EPS-T 650 33/30	0,044	0,682
5	2,0	bounded filling	0,700	0,029
6	30,0	foundation slab	2,100	0,143
7		construction foil		
8	24,0	heat insulation XPS-G or EPS-P	0,035	6,857
9		granular sub base		
sum thermal resistances				7,754
heat transmission resistances				0,170
heat transmission coefficient (U-value)				0,126

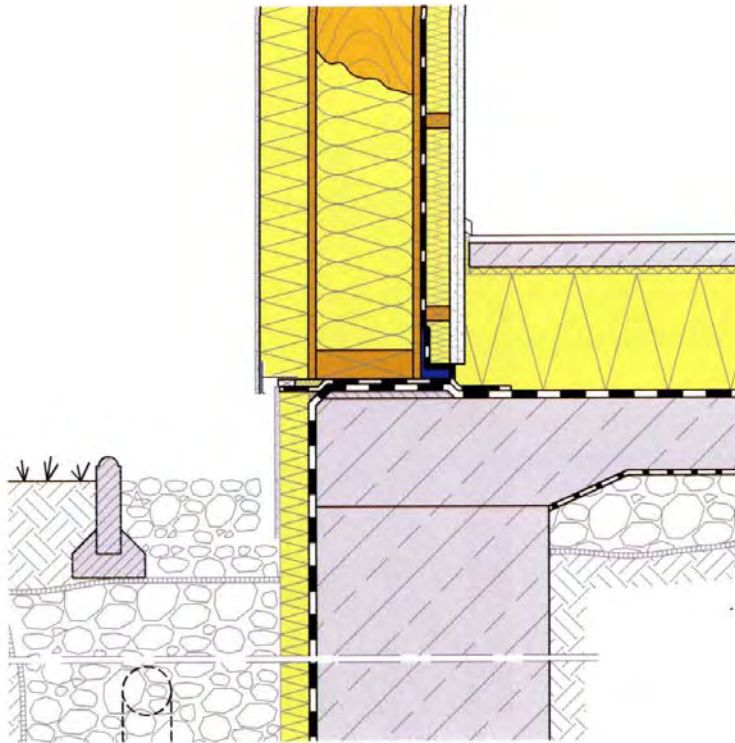
airtight joint

Source:

PH-details: Foundation / Outside wall

Wood post outside wall with ETICS /

Slab foundation, insulated upper side, wet screed



Technical description

Suitability

- For floors that are above the level of the adjoining ground
- For ground conditions that require strip foundations
- Especially suitable for onsite assembly
- Only in the case of ground with low thermal conductivity (e.g. gravel)

Construction process

- Drainage pipes should be laid above the foundation level in all areas
- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Cover the front edge joint of the horizontal seal with a long-lasting seal
- Connect the vapour barrier with an air tight seal. perform the blower door test before assembling the floor structure to seal existing leaks.
- Be careful to avoid ruptures and other leaks in the sealing layer since post-construction repairs are difficult and complex.
- The gypsum plasterboard panels on the inside ought not touch the floor slab due to the possibility of condensation damage. A lower thermal insulation layer is advisable.

Maintenance

- Clean the drainage system regularly
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

Structural discussion

- The construction is easy to assemble with basic technical skills and allows for a largely thermal bridge-free structure
- Placing parts of the thermal insulation beneath the foundation slab increases moisture safety considerably.

Building physics

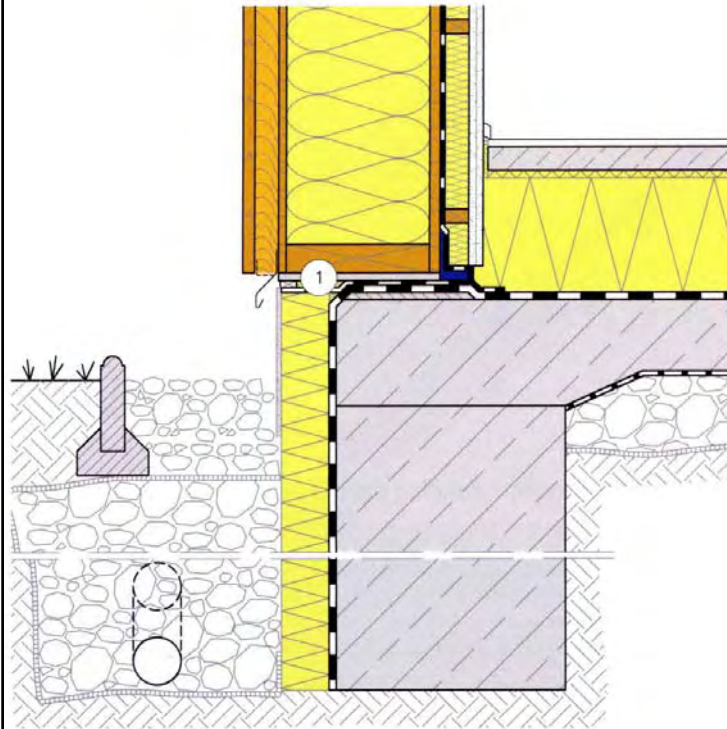
linear thermal bridge coefficient $\psi = -0.051 \text{ W/mK}$

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Foundation / Outside wall

Double T-beam outside wall, rear ventilation /

Slab foundation, insulated upper side, wet screed



Building physics

linear thermal bridge coefficient ψ -0.040 W/mK

Technical description

Suitability

- For floors/floor slabs that are above the level of the adjoining ground
- For ground conditions that require strip foundations
- Especially suitable for prefabrication
- Only in the case of ground with low thermal conductivity (e.g. gravel)

Construction process

- Drainage pipes should be laid above the foundation level in all areas
- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Cover the front edge joint of the horizontal seal between foundation slab and raising wall with a long-lasting seal
- Be careful to avoid ruptures and other leaks in the sealing layer since post-construction repairs are difficult and complex.
- Connect the vapour barrier with an air tight seal. perform the blower door test before assembling the floor structure to seal existing leaks.
- The gypsum plasterboard panels on the inside cannot touch the floor slab due to the possibility of condensation damage. A lower thermal insulation layer is advisable.
- Cover the ventilation opening, which should be as large as possible, with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2

Maintenance

- Clean the drainage system regularly
- Keep afflux openings free
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid all influences that can cause long-term moisture penetration at the wall base (e.g. remove accumulated snow)
- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

- Special care is required for an effective long term vapour barrier, especially in corner areas.
- Placing parts of the thermal insulation beneath the foundation slab increases moisture safety considerably.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

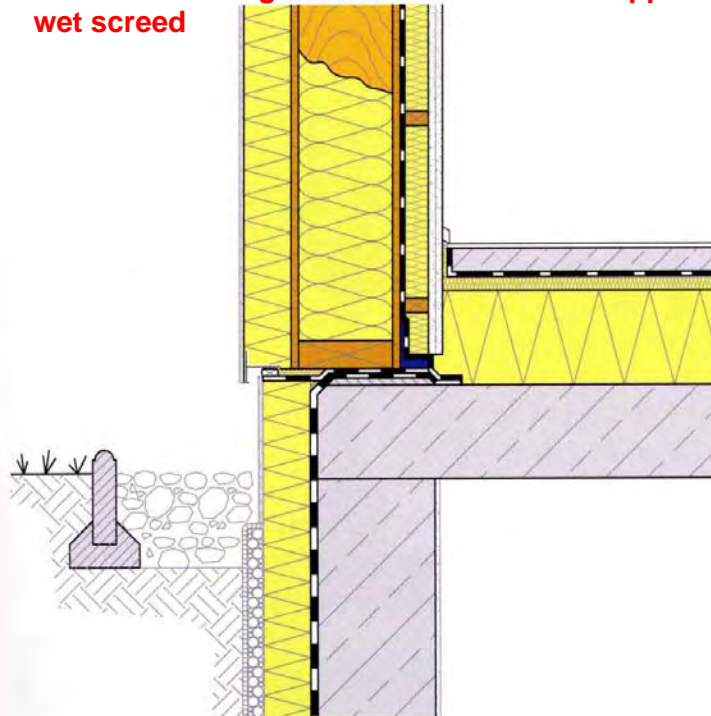
Outside wall and ceiling / Cold cellar

Source:

PH-details: Outside wall and ceiling / Cold cellar

Wood post outside wall with ETICS /

Basement ceiling slab with insulation on upper sides, wet screed



Building physics

linear thermal bridge coefficient ψ	
- outside air	-0.036 W/mK
- basement	-0.029 W/mK

Technical description

Suitability

- For floors or basement ceiling slabs that are above the level of the adjoining ground
- For colder and possibly ventilated basement rooms (e.g. underground garages)

Construction process

- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Cover the front edge joint of the horizontal seal between floor slab and the raising wall with a long-lasting seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Connect the vapour barrier to the reinforced concrete ceiling slab with an air tight seal. Perform the blower door test before assembling the floor structure to seal existing leaks.
- The gypsum plasterboard panels on the inside ought not touch the floor slab due to the possibility of condensation damage. A lower thermal insulation layer is advisable.

Maintenance

- Clean the drainage system regularly
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

Structural discussion

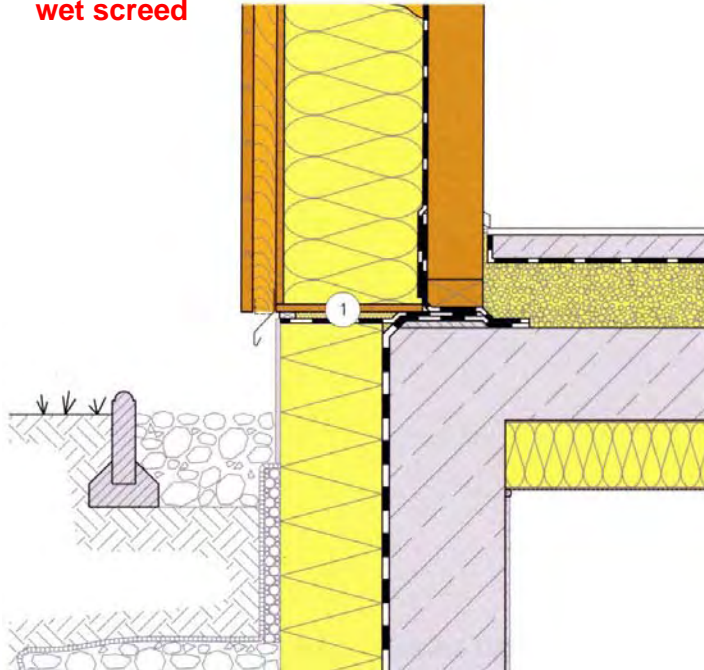
- The construction contains thermal bridges which may be of only minor importance in terms of the building's heat balance, but can be critical with regard to damage to the wood and gypsum parts of the outside wall.
- Placing the thermal insulation beneath the reinforced concrete ceiling slab is useful to increase temperatures within the wall base.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

Stacked wood outside wall, rear ventilation /

Basement ceiling slab with insulation on both sides, wet screed



Technical description

Suitability

- For floors that are above the level of the adjoining ground
- For basement conditions that do not lead to condensation build up in the ceiling

Construction process

- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Seal the polymer bitumen sheet stripe visible between the base insulation and insulation of the raising wall tightly (e.g. torch applying) on the wall surface, close the joint with a long-lasting elastic seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Cover the ventilation opening, which should be as large as possible, with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)
- The connection of the vapour barrier to the basement ceiling slab should be flow-sealed. Perform the blower door test before completing the floor to check for existing leaks and close them.

Maintenance

- Clean the drainage system regularly (if one exists)
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

Structural discussion

- The construction contains thermal bridges the effect of which depends on the construction in the basement
- The construction requires maintenance and care completion, especially of the seals

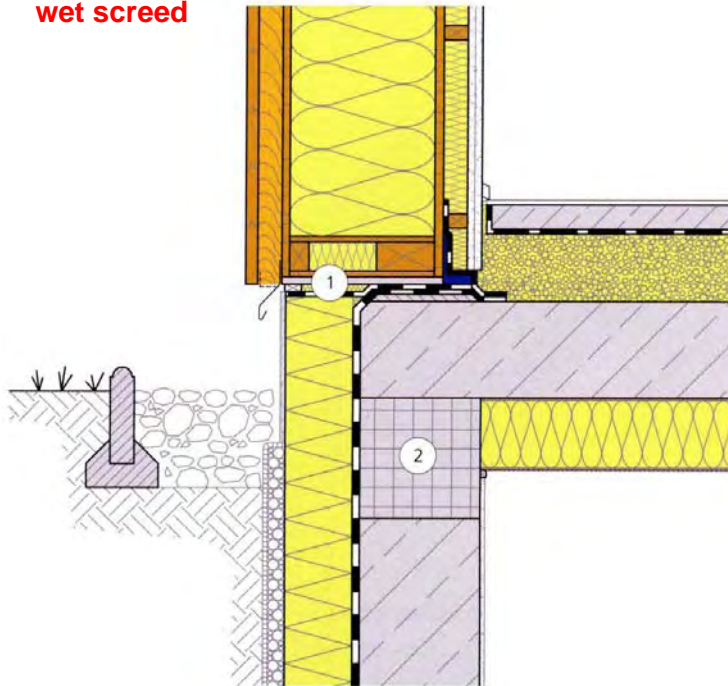
Building physics

linear thermal bridge coefficient ψ	
- outside air	-0.035 W/mK
- basement	0.072 W/mK

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

Box beam outside wall, rear ventilation / Basement ceiling slab with insulation on both sides, wet screed



Building physics

linear thermal bridge coefficient ψ	
- outside air	-0.018 W/mK
- basement	-0.036 W/mK

Technical description

Suitability

- For floors that are above the level of the adjoining ground
- For basement conditions that do not lead to condensation build up in the ceiling

Construction process

- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Seal the polymer bitumen sheet stripe visible between the base insulation and insulation of the raising wall tightly (e.g. torch applying) on the wall surface, close the joint with a long-lasting elastic seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Cover the ventilation opening, which should be as large as possible, with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)
- Make sure the connection between the vapour barrier to the basement ceiling is flow-sealed. Perform the blower door test before assembling the floor structure to close existing leaks.

Maintenance

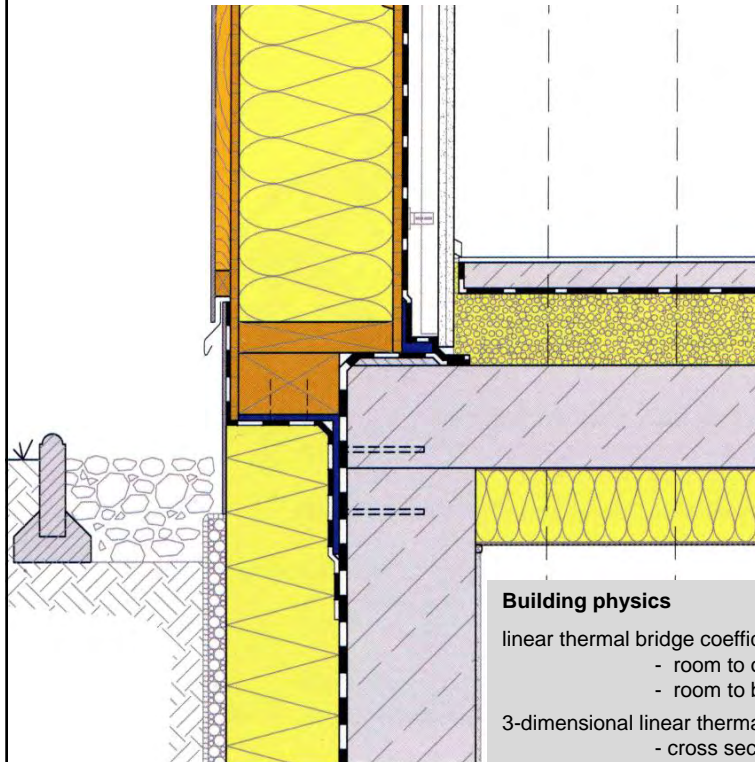
- Clean the drainage system regularly (if one exists)
- Ensure proper care and maintenance of the wood cladding along the base. The lowest two boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wood cladding or blockage of the back ventilation (e.g. remove accumulated snow)

Structural discussion

- The construction contains thermal bridges the effect of which depends on the construction in the basement
- Special technical skills and great care are required to achieve long-lasting effectiveness of sealed connection.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar
Laminated wood post outside wall, no rear ventilation /
Basement ceiling slab with insulation on both sides



Technical description

Suitability

- For floors/basement ceilings that are above the level of the adjoining ground
- For basement conditions that do not lead to condensation build up in the basement ceiling

Construction process

- Drainage pipes should be laid higher than the foundation level in all building segments.
- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- The ECB foil in the corner area should not be glued to the ground
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- The connection between the wall vapour barrier to the reinforced concrete ceiling should be flow-sealed. The sealing tape should be able to absorb movement. Perform the blower door test before mounting the facing shell and assembling the floor surface structure to check for existing leaks and close them.

Maintenance

- Clean the drainage system regularly
- Avoid longer periods of moisture penetration of the wall base (e.g. remove accumulated snow)

Structural discussion

- the construction requires special technical skills and especially careful assembly.

Building physics

linear thermal bridge coefficient ψ

- room to outside air 0.016 W/mK
- room to basement 0.019 W/mK

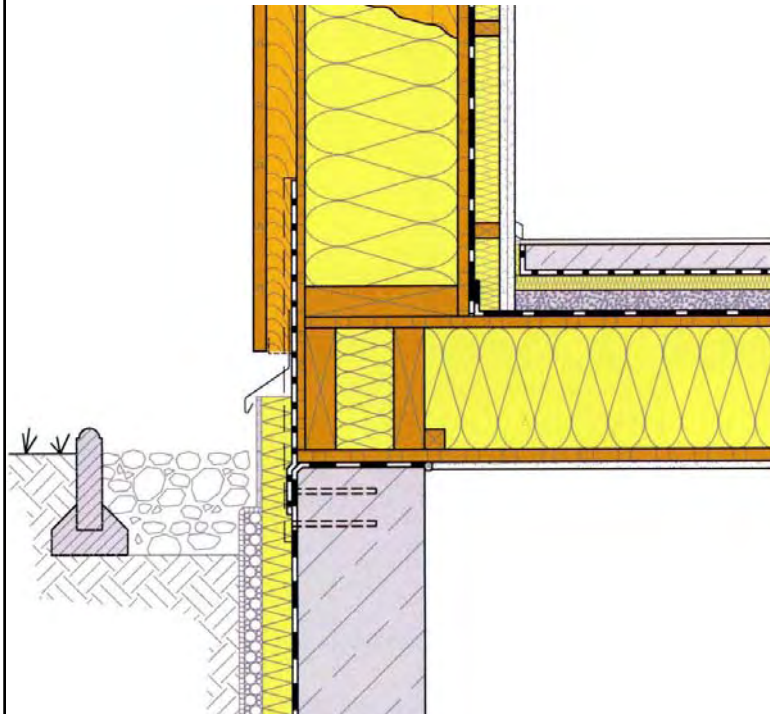
3-dimensional linear thermal bridge coefficient χ

- cross section of the supports:
- 20 x 20 cm 0.136 W/K
- 20 x 40 cm 0.247 W/K
- 20 x 60 cm 0.357 W/K

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

Double T-beam outside wall, rear ventilation / Lightweight basement ceiling slab



Building physics

linear thermal bridge coefficient ψ	
- outside air	-0.012 W/mK
- basement	-0.026 W/mK

Technical description

Suitability

- For floors/basement ceiling slabs that are above the level of the adjoining ground
- For basement rooms with normal climate conditions
- Not for basement with special fire protection requirements (e.g. garages – depending on the local building regulations)

Construction process

- make sure the moisture seal extends above the basement wall and below the lightweight basement ceiling, seal the connection between the ECB layer on the outside with the vertical moisture seal (prevents vertical capillary moisture build up)
- Laminated wood wall ribs have to be placed instead of double T-beams in the area along the base anchors that extend beyond the threshold.
- The connection of the vapour barrier to the basement ceiling should be flow-sealed. Perform the blower door test before building the floor surface structure and facing shell to check for existing leaks and close them.

Maintenance

- Keep all afflux openings free
- Avoid longer periods of moisture penetration of the wall base (e.g. remove accumulated snow)
- The lowest two boars of the facade should be mounted to allow easy exchange.
- No chemical wood protection is required if the guidelines for structural wood protection are followed.

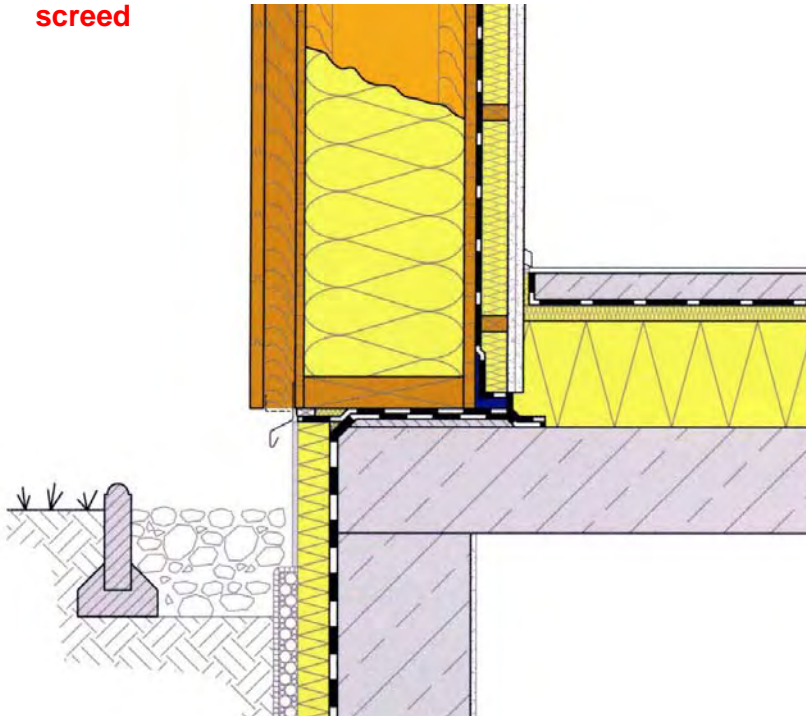
Structural discussion

- the construction minimises susceptibility to damage due to condensation along the inside walls
- Assembly requires special knowledge and care.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

Double T-beam outside wall, rear ventilation / Basement ceiling slab insulated upper side, wet screed



Building physics

linear thermal bridge coefficient ψ	
- outside air	-0.040 W/mK
- basement	-0.023 W/mK

Technical description

Suitability

- For floor slabs/basement ceiling slabs that are above the level of the adjoining ground
- For cold, also and possibly ventilated basement spaces (e.g. underground garages)

Construction process

- Use washed drainage gravel (without fines)
- Line drainage gravel bed with PP filter fleece on all sides, be careful to avoid mixing the gravel with soil during the construction
- Cover the front edge joint of the horizontal seal between floor slab and the raising wall with a long-lasting seal
- Be careful to avoid ruptures in the sealing layer since post-construction repairs are difficult and complex
- Connect the vapour barrier to the reinforced concrete ceiling slab with an air tight seal. Perform the blower door test before assembling the floor structure to seal existing leaks.
- The gypsum plasterboard panels on the inside ought not touch the floor slab due to the possibility of condensation damage. A lower thermal insulation layer is advisable.
- Cover the afflux opening of the wall rear ventilation with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)

Maintenance

- Clean the drainage system regularly
- Keep all afflux openings free
- Ensure proper care and maintenance of the wood cladding along the base. The lower boards of the facade should be mounted to allow easy exchange.
- Avoid longer periods of moisture penetration of the wall base (e.g. remove accumulated snow)

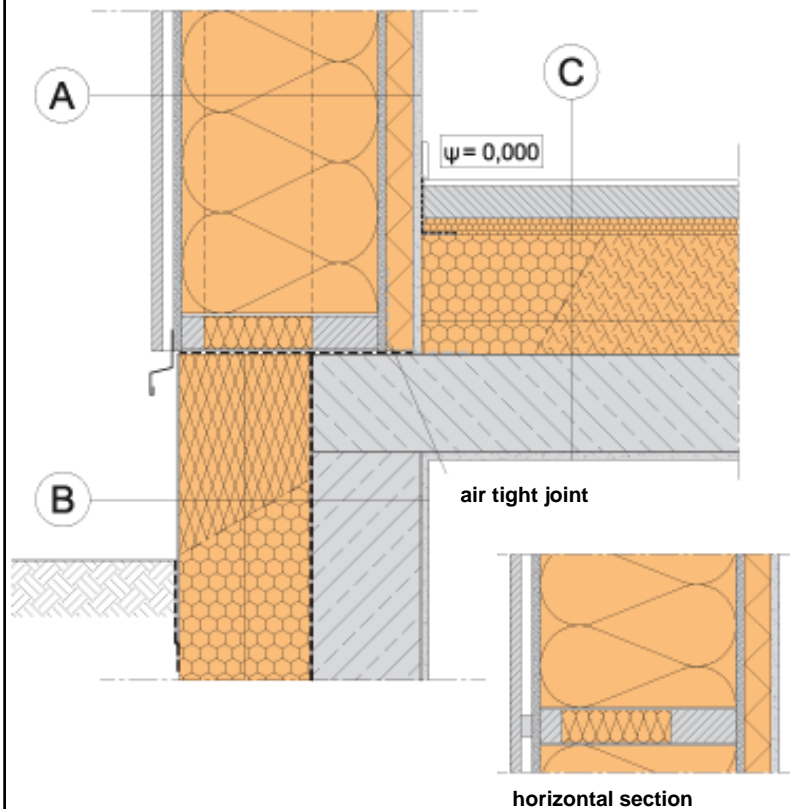
Structural discussion

- The construction contains thermal bridges which may be of only minor importance in terms of the building's heat balance, but can be critical with regard to damage to the wood and gypsum parts of the outside wall.
- Special care is required to construct an effective long term vapour barrier and seals.
- Placing the thermal insulation beneath the reinforced concrete ceiling slab is useful to increase temperatures within the wall base.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall and ceiling / Cold cellar

Ground floor with basement



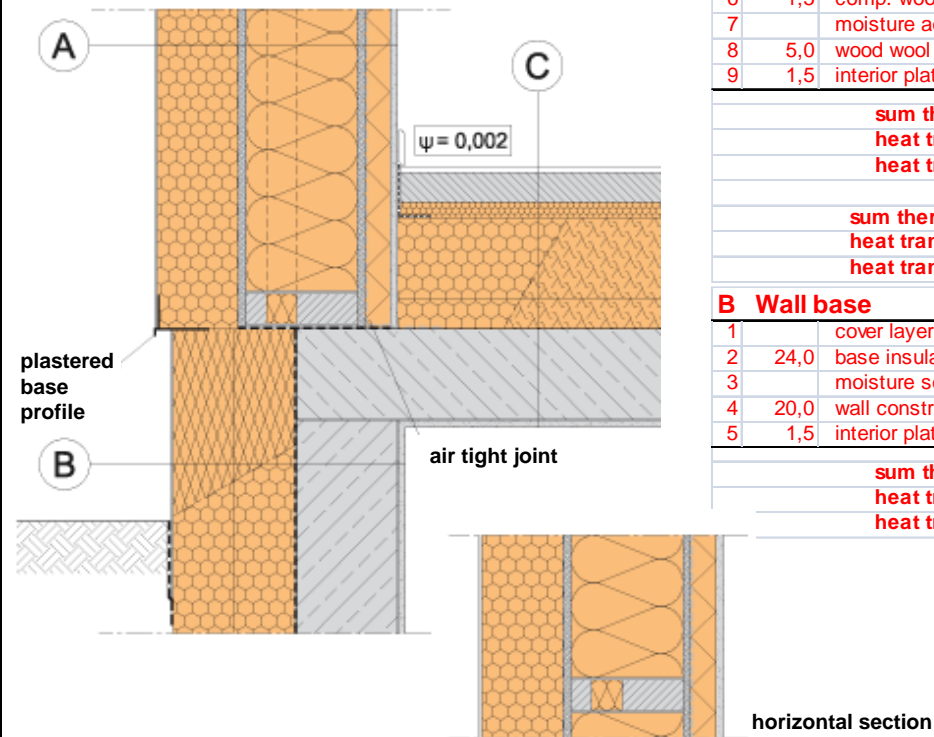
A Exterior wall			
B Wall base		Lambda	Rt-value
1	covering layer		
2	24,0 base insulation XPS-R or EPS-P	0,035	6,857
3	moisture sealing		
4	20,0 wall construction	2,100	0,095
5	1,5 internal plaster	0,870	0,017
sum thermal resistances			6,969
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,140

C Ceiling			
		Lambda	Rt-value
1	1,0 flooring		
2	6,0 floating floor screed	1,400	0,043
3	interlayer (vapour barrier)		
4	3,0 sound insulation EPS-T 650 33/30	0,044	0,682
5	16,0 heat insulation EPS-W 20	0,038	4,211
or	11,0 heat insulation PUR-DD	0,025	
6	6,0 heat insulation EPS-W 20	0,038	1,579
or	4,0 heat insulation PUR-DD	0,025	
7	18,0 reinforced concrete ceiling	2,100	0,086
8	1,5 interior plater	0,87	0,017
sum thermal resistances			6,618
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,147

Source:

PH-details: Outside wall and ceiling / Cold cellar

Ground floor with basement



A Exterior wall		Lambda	Rt-value
1	cover layer of the ETICS		
2	16,0 ETICS with EPS-F	0,040	4,000
3	1,6 composite wood board, vapour permeable	0,290	0,055
4	box-beam: outside 6x4 cm, inside 6x12cm, e=62,5cm		
5	22,0 heat insulation MW-W betw. beams 91%	0,039	5,133
6	1,5 comp. wood board as air tight layer	0,290	0,052
7	moisture adaptive vapour barrier		
8	5,0 wood wool insulation board, installation layer	0,090	0,556
9	1,5 interior plater	0,87	0,017

sum thermal resistances	9,813
heat transmission resistances	0,170
heat transmission coefficient (U-value)	0,100

sum thermal resistances without installation layer	9,257
heat transmission resistances	0,170
heat transmission coefficient (U-value)	0,106

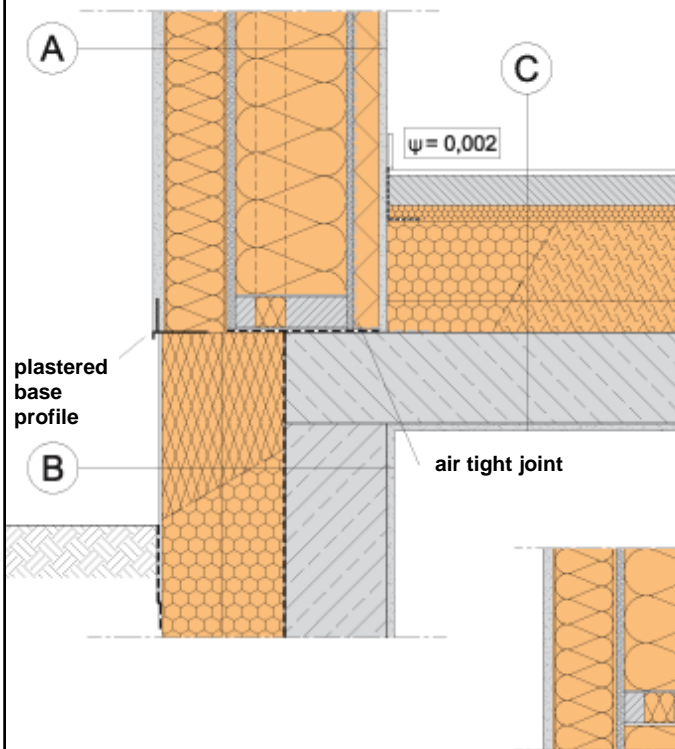
B Wall base		Lambda	Rt-value
1	cover layer		
2	24,0 base insulation XPS-R or EPS-P	0,035	6,857
3	moisture sealing		
4	20,0 wall construction	2,100	0,095
5	1,5 interior plater	0,870	0,017

sum thermal resistances	6,969
heat transmission resistances	0,170
heat transmission coefficient (U-value)	0,140

Source:

PH-details: Outside wall and ceiling / Cold cellar

Ground floor with basement



A Exterior wall		Lambda	Rt-value
1	cover layer of the ETICS		
2	12,5 wood wool-multi layer insulation	0,044	2,841
3	1,6 composite wood board, vapour permeable	0,290	0,055
4	box-beam: outside 6x4 cm, inside 6x12cm, e=62,5cm		
5	22,0 heat insulation MW-W betw. beams 91%	0,039	5,133
6	1,5 comp. wood board as air tight layer	0,290	0,052
7	5,0 wood wool slab as insulated installation layer	0,090	0,556
8	1,5 interior plater	0,87	0,017
sum thermal resistances			8,654
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,113
sum thermal resistances without installation layer			8,098
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,121
B Wall base		Lambda	Rt-value
1	cover layer		
2	24,0 base insulation XPS-R or EPS-P	0,035	6,857
3	moisture sealing		
4	20,0 wall construction	2,100	0,095
5	1,5 interior plater	0,870	0,017
sum thermal resistances			6,969
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,140

Source:



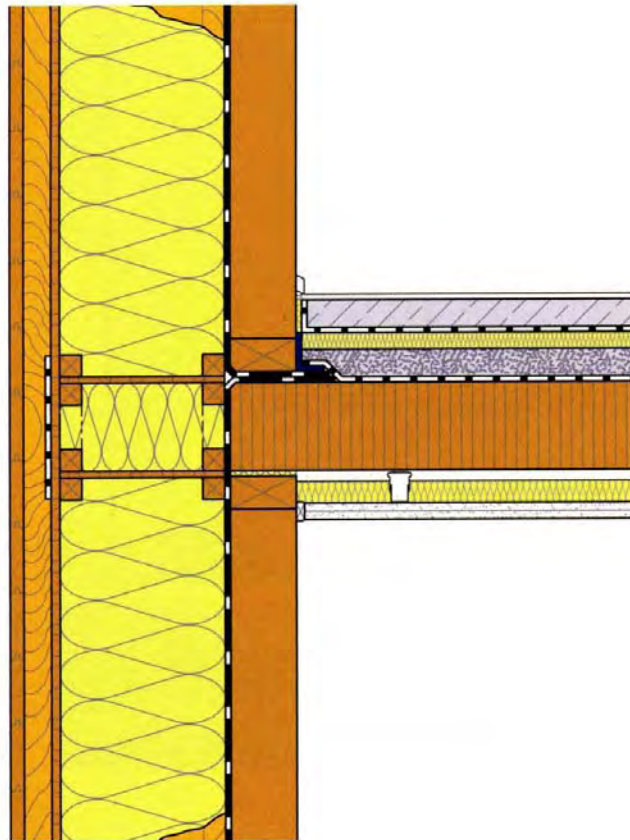
PH-details: Outside wall / Ceiling

Outside wall / Ceiling

Source:

PH-details: Outside wall / Ceiling

Stacked wood outside wall, rear ventilation / Intermediate stacked board floor, wet screed



Technical description

Suitability

- For intermediate floors between two levels with similar thermal conditions built using the same solid wood construction method
- For floor connections built at greater height from the ground level
- Specially suitable for prefabrication

Construction process

- Plan high quality acoustic separation between the lower wall by using sylomer beds or absorbing forces via acoustic separation pins.
- Fold the air tight sheet inward after assembling the ceiling and seal it to the air tight foil of the wall section above.
- Perform the blower door test before assembling the floor structure to close existing leaks.

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

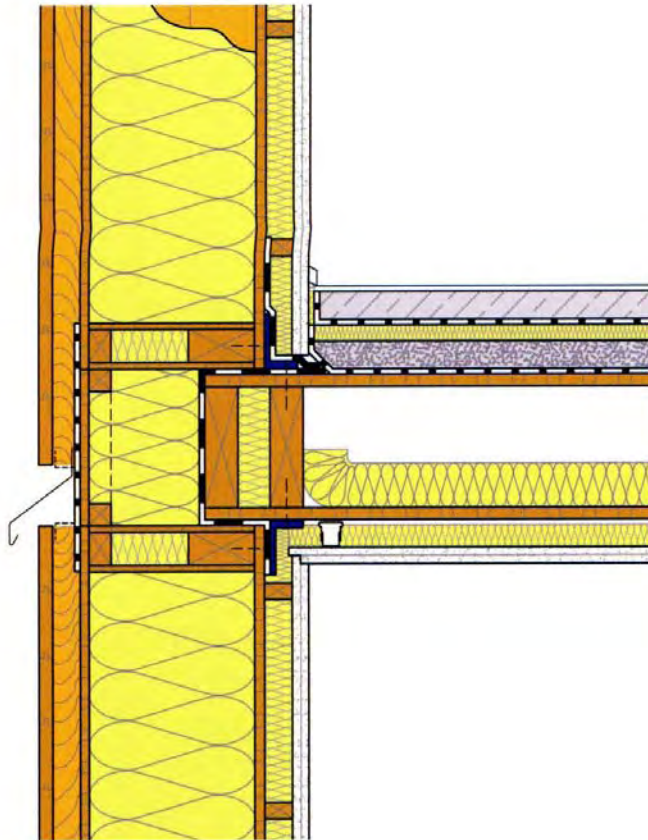
Building physics

linear thermal bridge coefficient $\psi = 0.013 \text{ W/mK}$

PH-details: Outside wall / Ceiling

Box beam outside wall, rear ventilation /

Lightweight (or joist) intermediate floor, wet screed



Technical description

Suitability

- For intermediate floors between two levels with similar thermal conditions built using the same lightweight construction method
- For floor connections built at greater height from the ground level
- Specially suitable for prefabrication

Construction process

- Bond the air tight foil to the OSB panel along the lower wall element. Fold the air tight sheet inwards after assembling the ceiling and seal it to the OSB panel on the wall section above.
- Bond the OSB panel joints with an air tight seal, and then connect them across the floor levels with air tight foil, since it is difficult to locate and repair faulty areas after assembly. Perform the blower door test before assembling the floor structure and face work.

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

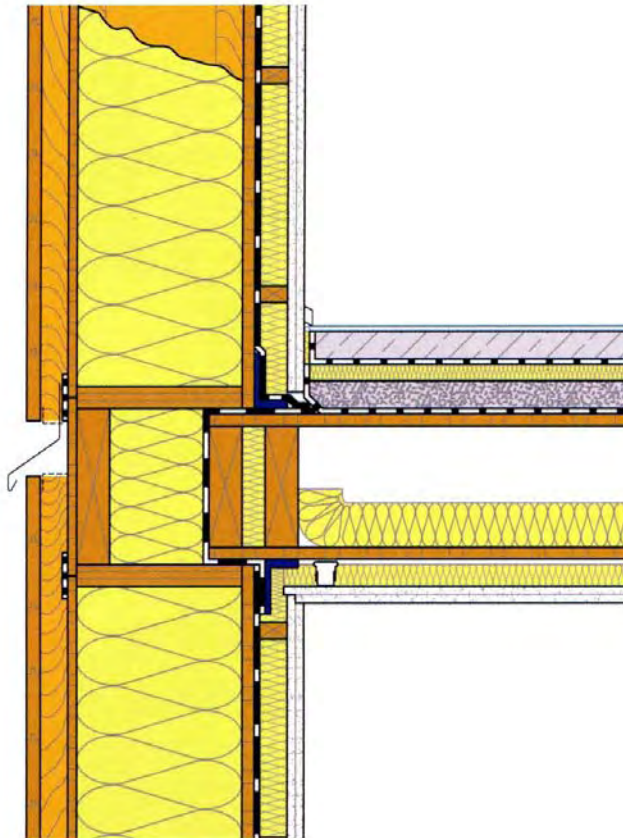
- The construction requires especially careful assembly of the internal flow-sealing plane.

Building physics

linear thermal bridge coefficient $\psi = 0.030 \text{ W/mK}$

PH-details: Outside wall / Ceiling

Double T-beam outside wall, rear ventilation / Lightweight (or joist) intermediate floor, wet screed



Technical description

Suitability

- For intermediate floors between two levels with similar thermal conditions built using the same lightweight construction method
- For floor connections built at greater height from the ground level
- Specially suitable for prefabrication

Construction process

- Bond the air tight foil to the vapour barrier along the lower wall element. Fold the air tight sheet inwards after assembling the ceiling and seal it to the vapour barrier of the wall section above.
- Bond the joints of the vapour barriers to form an air tight seal and connect them across the floors with air tight seal, since it is difficult to locate and repair faulty areas after construction. Perform the blower door test before assembling the floor structure and facing shell to seal existing leaks.
- Cover the rear ventilation opening with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2)

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

- The construction requires especially careful assembly of the internal flow-sealing plane.

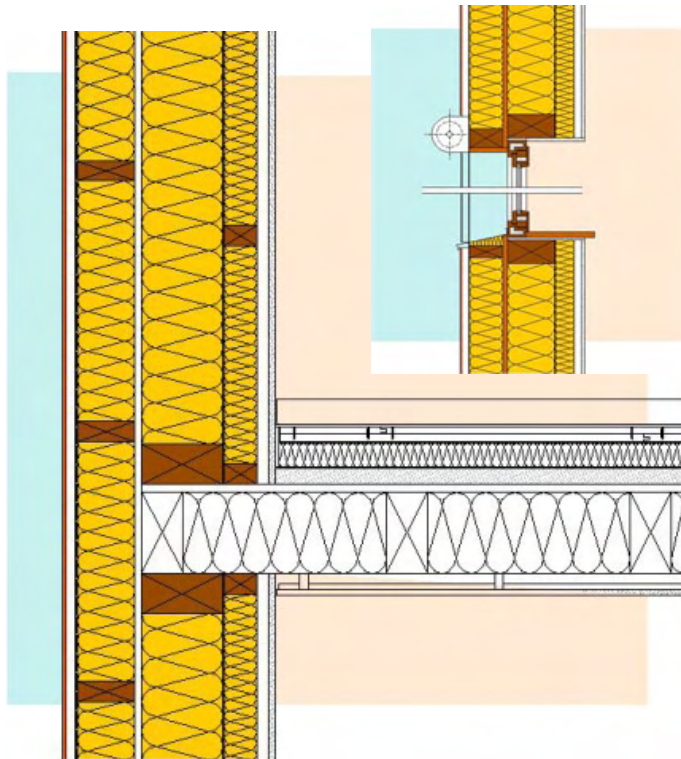
Building physics

linear thermal bridge coefficient $\psi = 0.025 \text{ W/mK}$

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Ceiling

Ventilated timber framework outer wall with exterior facade cladding (board), (Mineral wool) /
 Framework floor ceiling, dry screed



cm	Composition
1,5	Gypsum fire protection board
3,0	Counter battens 3/5
8,0	Lightweight glass wool between squared timber 5/8
-	Water vapour barrier (Isover Vario KM Duplex)
20,0	Lightweight glass wool between rafters
1,9	wood-span board
14,0	Facade insulation board between timber construction
-	Water vapour permeable wind protection layer
3,0	Ventilation space
0,8	Exterior facade board or 2,4 cm wooden weather boarding

U = 0,10 W/m²K

Rw ≥ 45 dB

REI 30

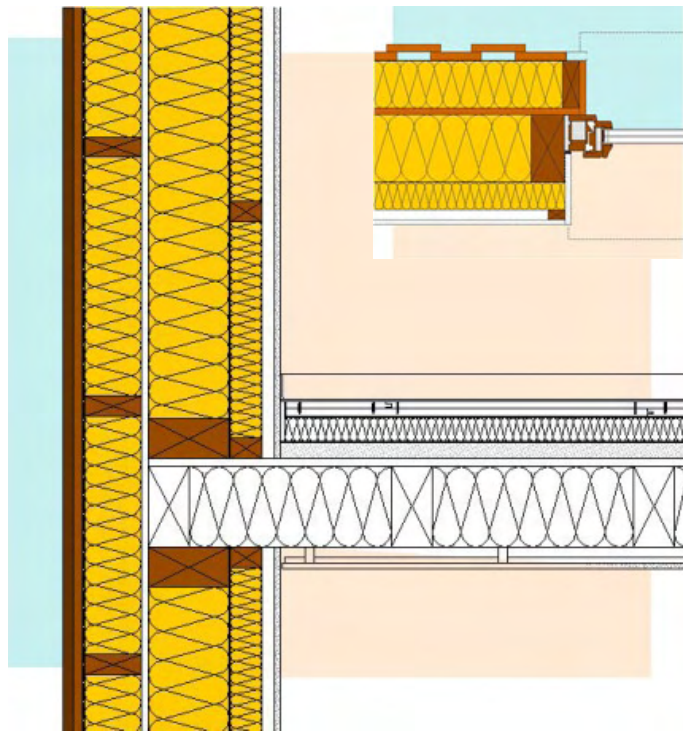
Link for different values: Architektenordner online

http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=20

PH-details: Outside wall / Ceiling

Timber framework wall with timber boarding and ISOVER ULTIMATE insulation, (Mineral wool) /
Framework floor ceiling, dry screed



Ventilated outer wall with exterior façade-cladding (board)

cm	Composition
1,5	Plaster board fire protection board
3,0	Counter battens 3/5
8,0	ISOVER ULTIMATE insulation between counter battens 5/8
-	- Water vapour barrier (Isover Vario KM) Duplex
20,0	ISOVER ULTIMATE insulation between rafters
1,9	Chipboard board
14,0	ISOVER ULTIMATE insulation between rafters
-	- Layer of vapour diffusion-permeable spun-bonded web
2,4	Framework boarding
2,4	Framework boarding

$$U = 0,10 \text{ W/m}^2\text{K}$$

$$R_w \geq 45 \text{ dB}$$

$$REI 30$$

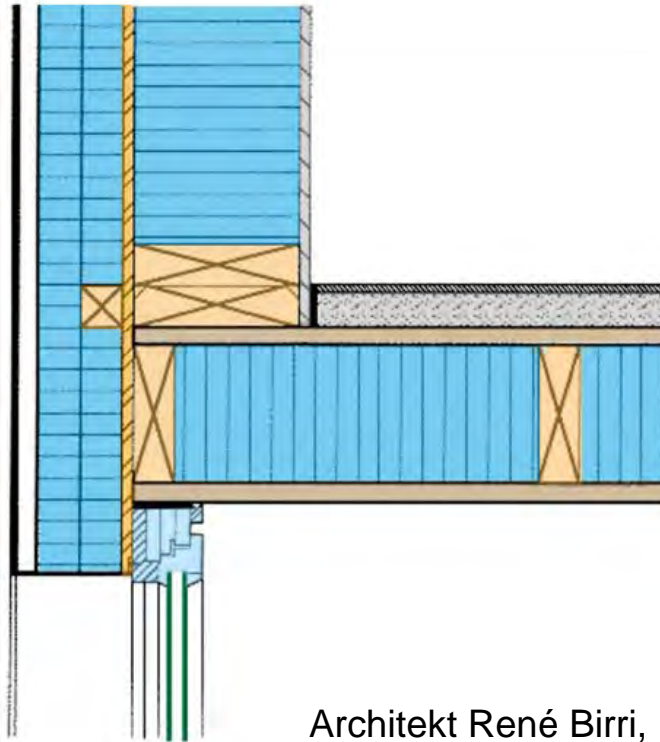
$$\Psi = 0,0174 \text{ W/mK}$$

Link for different values: Architektenordner online
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=20

PH-details: Outside wall / Ceiling

Timber framework wall with timber boarding and /
Framework floor ceiling, dry screed

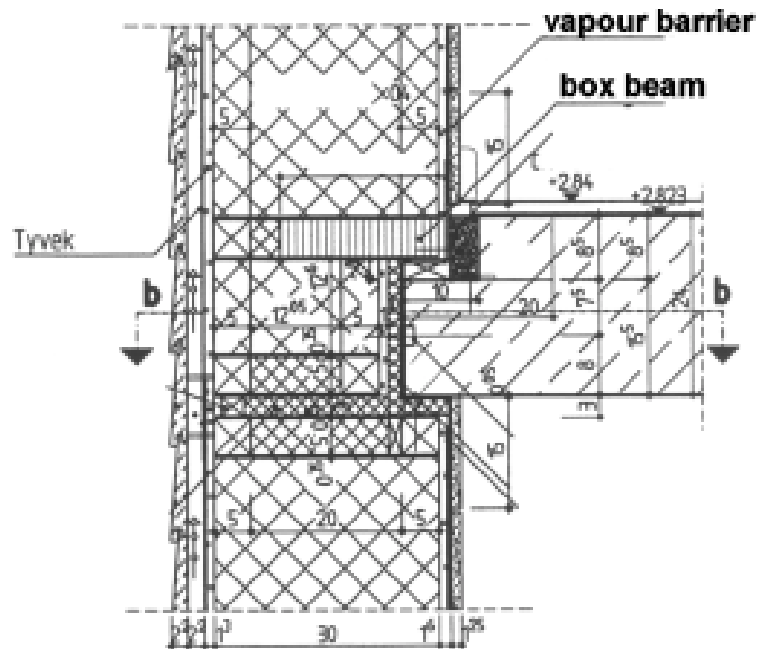


Architekt René Birri, Reihenhäuser Rüchlig, www.birri.ch

Source: Quelle: Tagungsband 6. Europäischer Passivhaustagung, FHBB S 249-252

PH-details: Outside wall / Ceiling

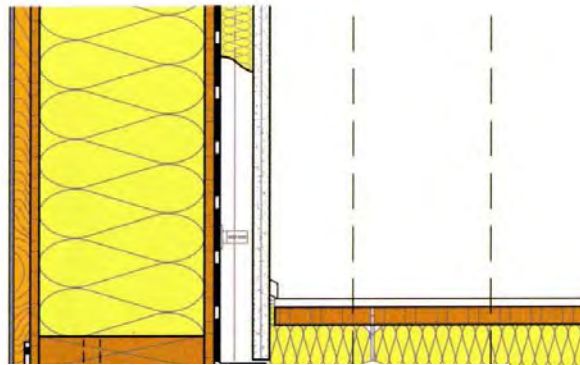
Timber framework wall with box beam, timber boarding, insulation in-beteeen, ventilation /
Reinforced concrete intermediate floor slab



**Concrete floor level between
 the ground floor and first floor
 (north side)**

PH-details: Outside wall / Ceiling

Laminated wood post outside wall, no rear ventilation / Reinforced concrete intermediate floor slab, spacer floor



Bauphysik / Building physics

	Einheit / Unit	
Linearer Wärmebrückenkoeffizient Ψ *		
Linear thermal bridge coefficient Ψ	W/mK	0,05



Technical description

Suitability

- For concrete skeleton frame buildings with lightweight facades
- For adjoining rooms with similar interior climates

Construction process

- Take the varying movement between the ceiling and the outer wall into consideration when choosing the fastening method.
- Define very close tolerance for the construction of the reinforced concrete skeleton frame.
- The connection between the wall vapour barrier and the reinforced concrete ceiling should be flow-sealed. The sealing tape should be able to absorb the maximum expected movement between outer wall and ceiling. Perform the blower door test before mounting the facing shell and the floor construction to check for existing leaks and close them.
- Plan the fire protection measures according to the construction height and the local building code guidelines.

Maintenance

- No special measures.

Structural discussion

- Measures that prevent crack development are required due to the differing ceiling slab and outside wall movement.
- Special training and increased care are required for this construction.
- Combines the advantages of high storage mass on the inside (low overheating in summer) with slender walls that nonetheless have good thermal insulation properties.

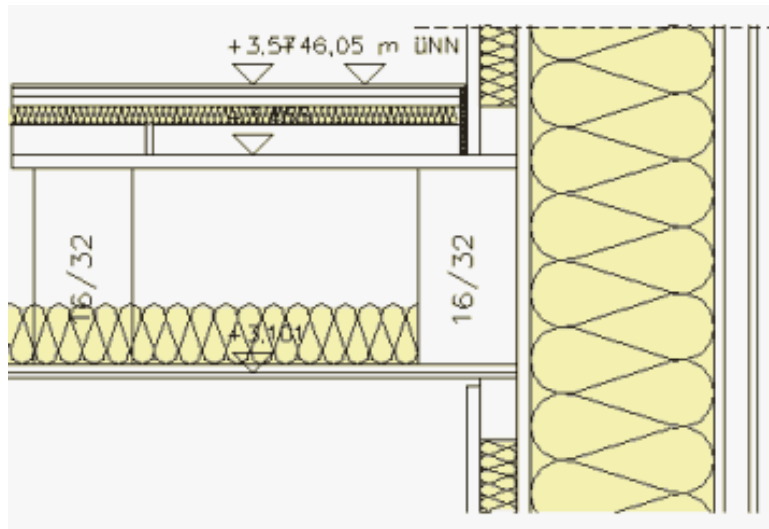
Building physics

linear thermal bridge coefficient $\psi = 0.05 \text{ W/mK}$

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Ceiling

Laminated wood post outside wall, insulation in-between, ventilation /
 Timber framework ceiling with timber boarding, acoustic ceiling

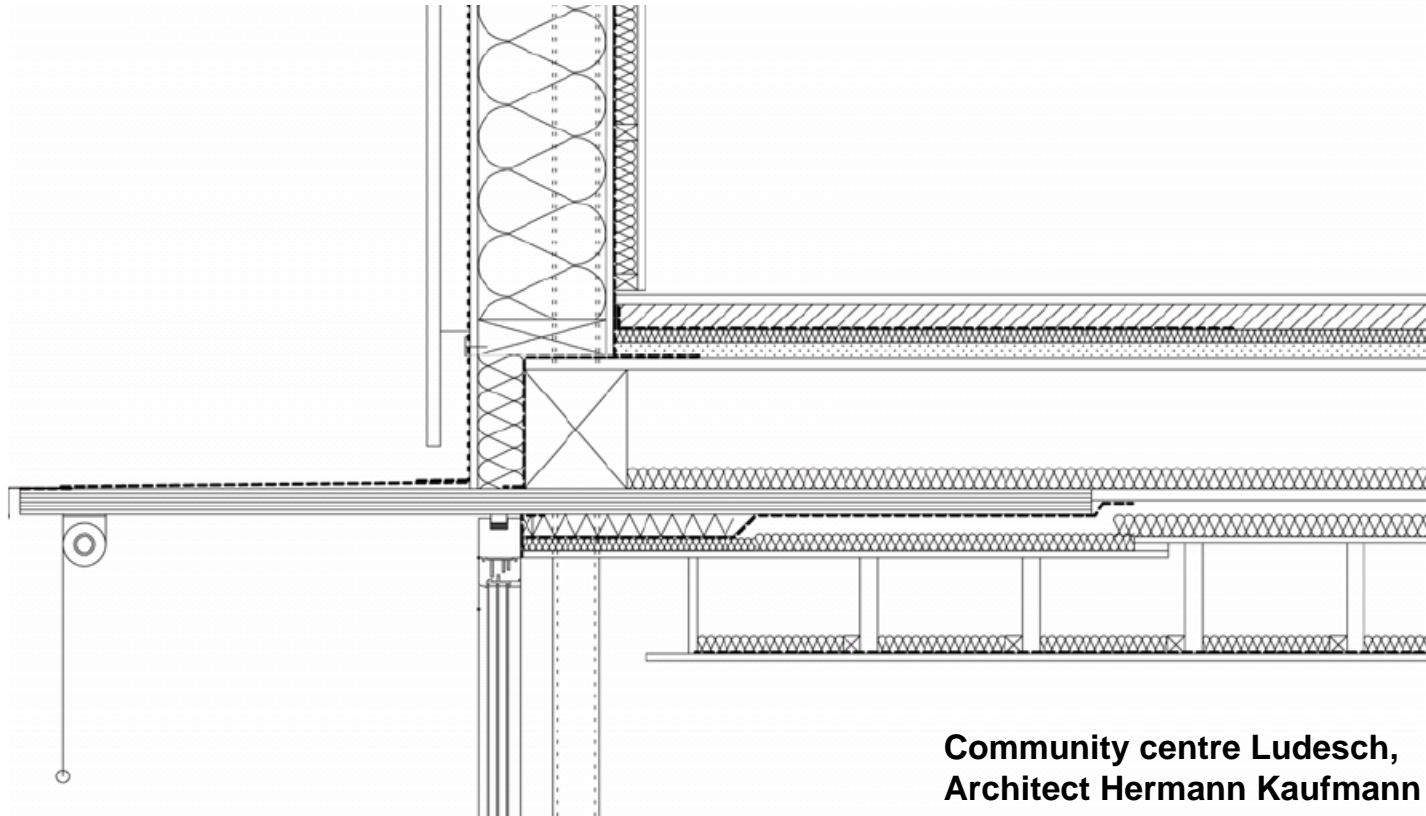


Passive house school in Mölln
Architects: Petersen Pörksen & Partner

Source: http://www.passivhaustagung.de/Passivhaus_D/Passivhaus_Schulen/Schnitt_Passivhausschule_Moelln.png

PH-details: Outside wall / Ceiling

Wood post outside wall, heat insulation in-between, ventilated /
Timber framework ceiling with timber boarding, acoustic ceiling



Community centre Ludesch,
Architect Hermann Kaufmann



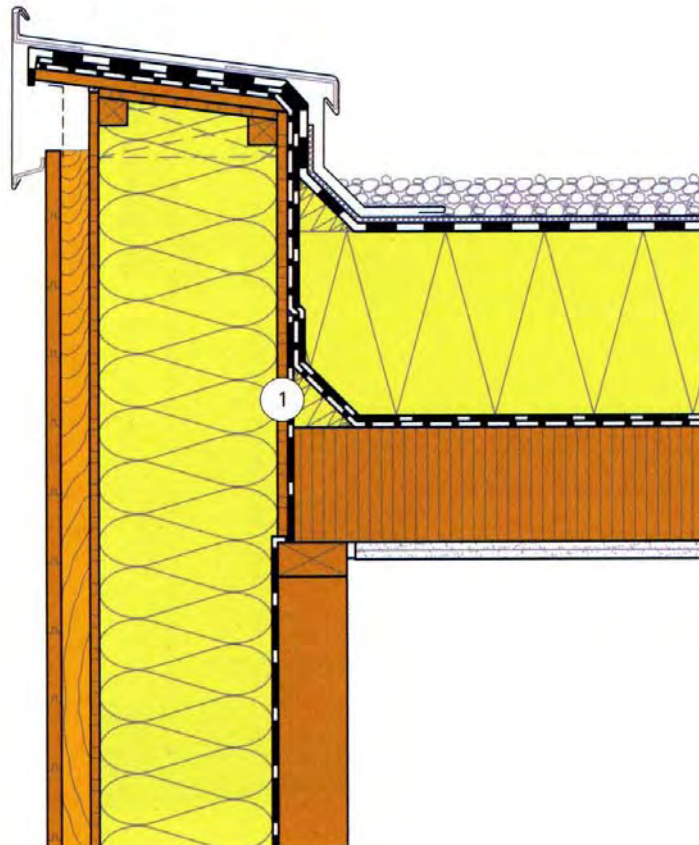
PH-details: Outside wall / Flat roof

Outside wall / Flat roof

Source:

PH-details: Outside wall / Flat roof

Stacked wood outside wall, rear ventilation/ Solid wood flat roof, non-ventilated (warm deck)



Technical description

Construction process

- The rubber granule mat should be continued under the sheet metal cladding to seal the attic
- The side of the parapet facing the roof should be covered with protective metal cladding to protect against UV irradiation and mechanical damage.
- The connection between the vapour barriers of the roof and the wall should be flow-sealed.
- The roof seal should extend to the exterior surface of the outer wall under the sheet metal cladding without any gaps.
- The vapour barrier and vapour pressure compensation layer should extend from the surface of the structural ceiling slab to the outer edge of the parapet without gaps. At the parapet, continue the bitumen-aluminium vapour barrier with a bitumen sealing sheet (aluminium makes a thermal bridge).
- 45° wedges should be inserted under all sheets to avoid ruptures in the transition areas between the horizontal roof and the vertical attic.
- Make sure the parapet's sheet metal cladding extends below the ventilation opening to minimize driving rain penetration.
- Cover the ventilation opening with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2).

Maintenance

- Clean ventilation openings periodically.
- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

- The flow sealing plane is not accessible after assembly. Hence it should be completed with special care.

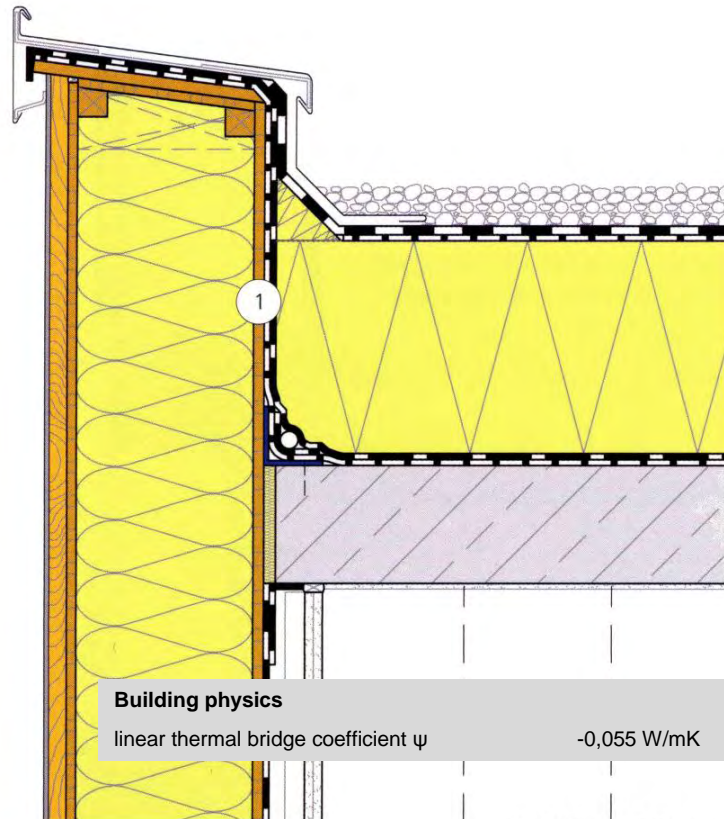
Building physics

linear thermal bridge coefficient $\psi = -0,092 \text{ W/mK}$

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Flat roof

Laminated wooden post outside wall, no rear ventilation / Reinforced concrete flat roof, non-ventilated (warm deck)



Building physics

linear thermal bridge coefficient ψ -0,055 W/mK

1 OSB-Platte / OSB panel

Technical description

Suitability

- For lightweight constructions with high summer overheating prevention requirements.
- For concrete skeleton frame constructions with lightweight facades.

Construction process

- The extended seal at the roof side of the parapet should be covered with protective metal cladding to protect against UV irradiation and mechanical damage.
- The vapour barrier and vapour pressure compensation layer should extend from the upper edge of the ceiling to the outer edge of the parapet without interruption. At the parapet, continue the bitumen-aluminium vapour barrier with a bitumen sealing sheet (aluminium makes a thermal bridge).
- The flat roof seal and the vapour pressure compensation layer should extend completely to the front of the outer walls' outer surface under the sheet metal cladding.
- 45° wedges should be inserted under all sheets to avoid ruptures in the transition areas between the horizontal roof and the vertical attic.
- Assemble the seal in the valley area with synthetic reinforcement and in the transition area close the floor without adhesive bonding.
- Fill the joint between the reinforced concrete and the outer wall element with fibre insulation material.
- The connection between the wall vapour barrier and the reinforced concrete ceiling should be flow-sealed. The sealing tape should be able to absorb the maximum expected movement between outer wall and ceiling. Perform the blower door test before mounting the facing shell to check for existing leaks and close them.

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

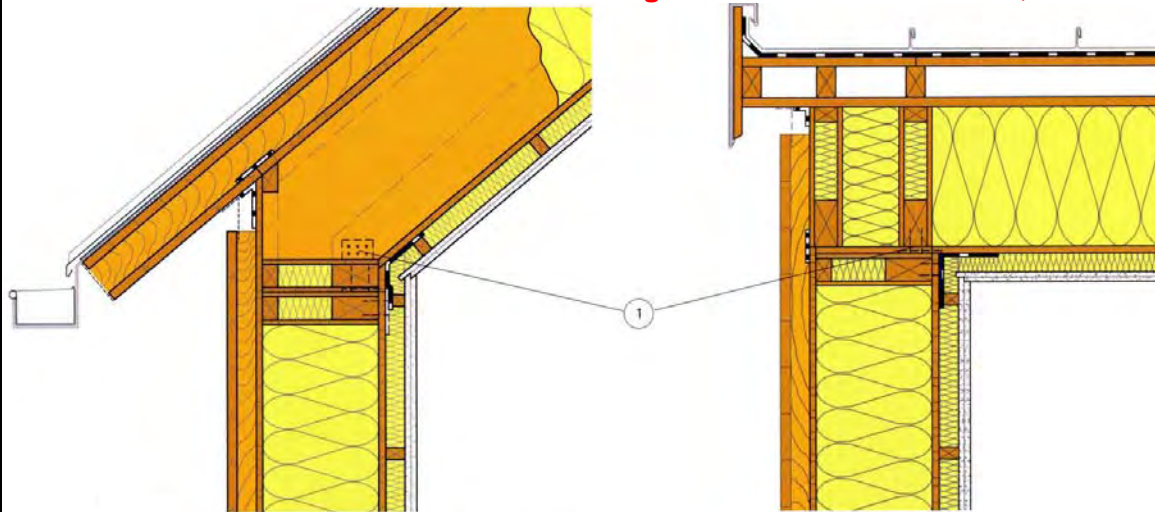
- Measures that prevent crack development are required due to the difference ceiling and outer wall movement.
- Special care and skills are required.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

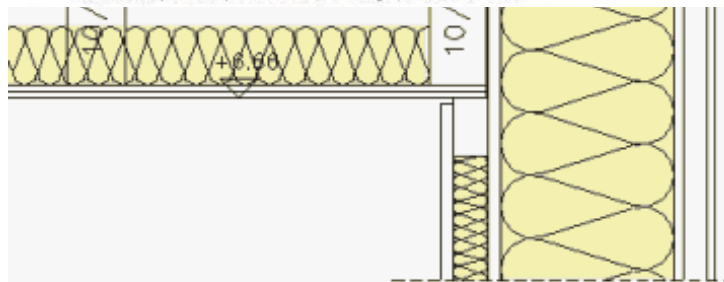
PH-details: Outside wall / Flat roof

Laminated wood post outside wall, ventilation /

Timber framework roof with timber boarding and warm roof insulation, acoustic ceiling



1 Stahlwinkel (horizontal, nicht sichtbar) / Steel angle (horizontal, non-visible)



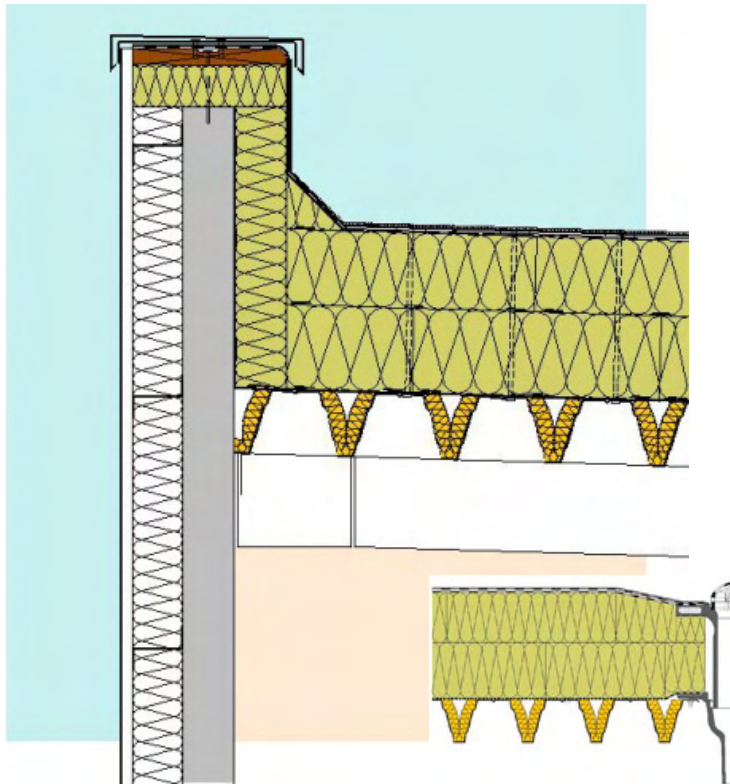
Passive house school in Mölln
Architects: Petersen Pörksen & Partner

Source: http://www.passivhaustagung.de/Passivhaus_D/Passivhaus_Schulen/Schnitt_Passivhausschule_Moelln.png

PH-details: Outside wall / Flat roof

Concrete wall, ETICS /

Trapezoidal metal sheet with warm roof insulation, gravel



Warm roof on trapezoidal metal sheet

cm	Composition
0,5	Surface protection
0,8	Double-layer roof skin, (e.g. polymer bitumen roll roofing, glued); first layer plugged
18,0	Stone wool with mechanical strength, glued
20,0	Stone wool with mechanical strength, glued
	- Vapour barrier
	- Priming coat
	- Trapezoidal metal sheet on load bearing construction

$$U = 0,10 \text{ W/m}^2\text{K}$$

$$R_w \geq 42 \text{ dB}$$

$$\Psi = 0,0026 \text{ W/mK}$$

Link for different values: Architektenordner online

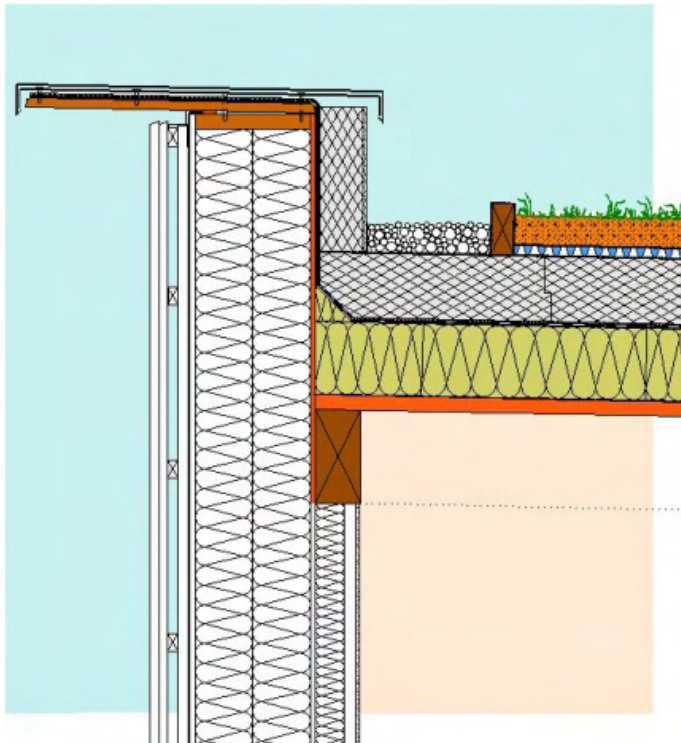
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 14:00)

PH-details: Outside wall / Flat roof

Framework wall, ventilated /

Timber framework roof with timber boarding and duo roof insulation



Duo roof with greening

cm Composition

- Extensive greening
- 8,0 Substrate mixture for extensive greening
(on margin, round gravel 16/32)
- Filter layer (geo-textile fibrous web, non-decaying)
- 2,5 Drainage layer
- Filter layer (geo-textile fibrous web, non-decaying)
- 18,0 XPS-extruded polystyrene foam board
- 0,5 Root confinement layer
- 0,8 Double-layer roof skin (e.g. polymer bitumen roll roofing, glued)
- 20,0 Stone wool with mechanical strength, glued
- Vapour barrier
- Fire protection covering on load bearing construction (sloping)
- 4,0

$$U = 0,10 \text{ W/m}^2\text{K}$$

$$R_w \geq 52 \text{ dB}$$

$$REI 30$$

$$\Psi = 0,0 \text{ W/mK}$$

Link for different values: Architektenordner online

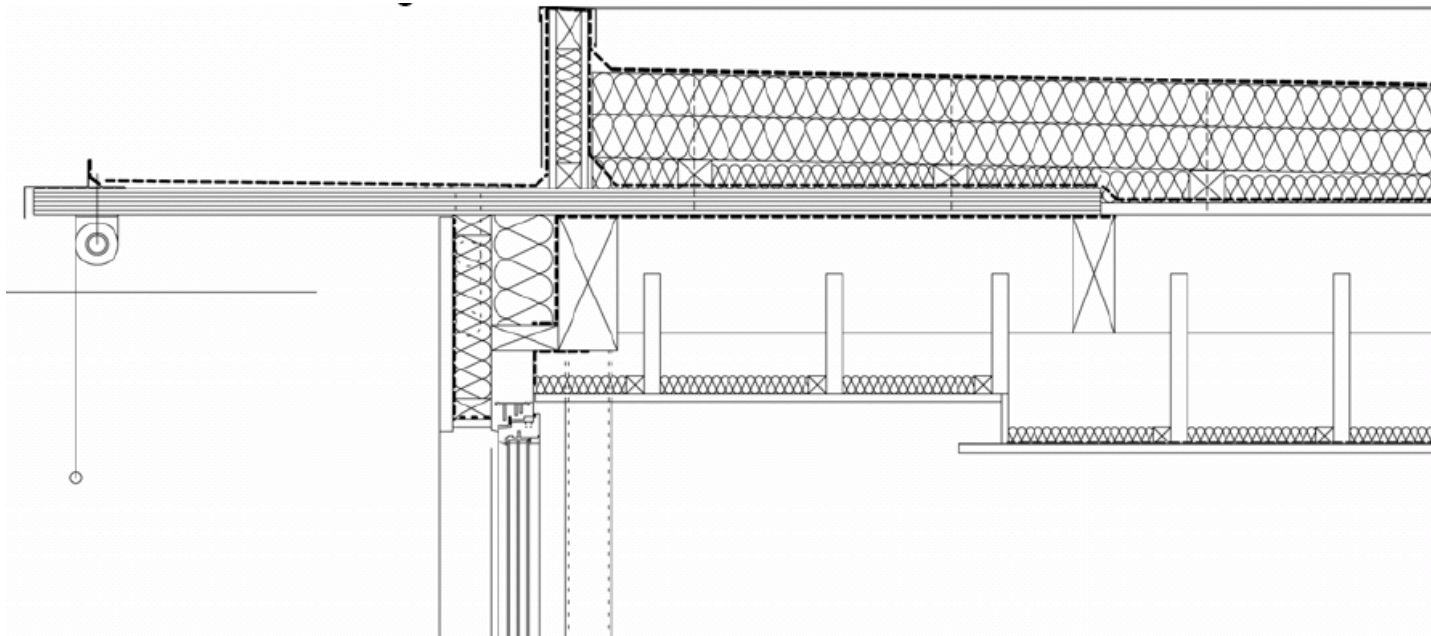
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 14:00)

PH-details: Outside wall / Flat roof

Wood post outside wall, heat insulation in-between, non ventilated /

Timber framework roof with timber boarding and warm roof insulation, acoustic ceiling

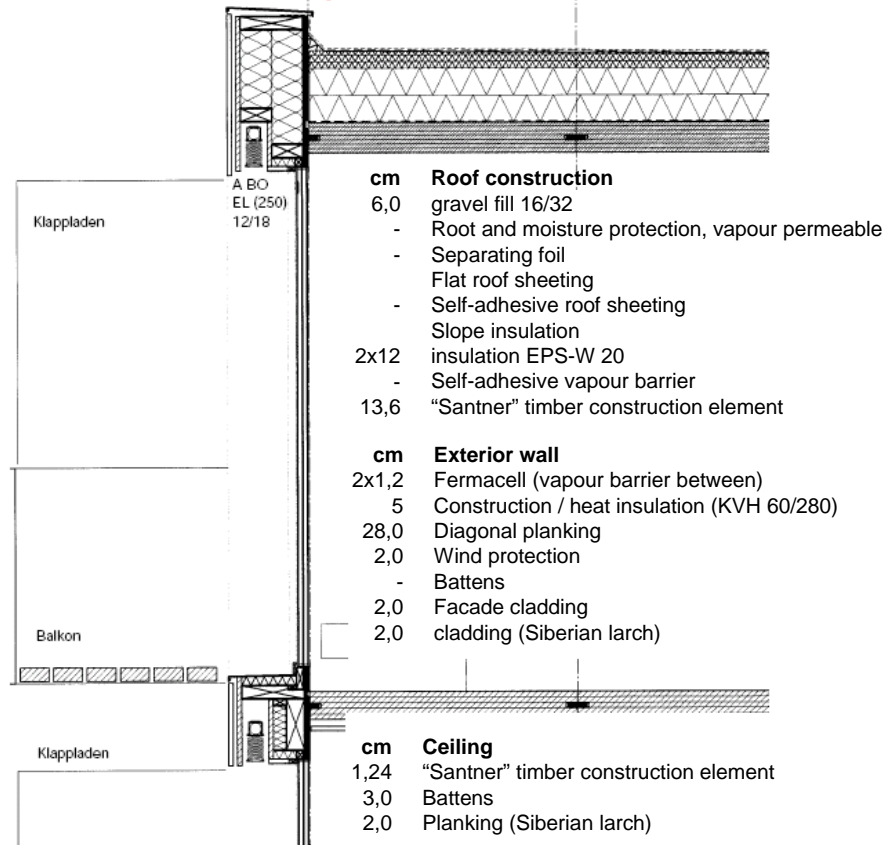


Community centre Ludesch, Architect Hermann Kaufmann

Source: R. Wehinger, K. Torghelle, G. Mötzl, G. Bertsch, B. Weithas, M. Gludovatz, F. Studer, et. al., Neubau ökologisches Gemeindezentrum Ludesch, S 112, Abb. 56

PH-details: Outside wall / Flat roof

Wood post outside wall, heat insulation in-between, non ventilated /
Timber cross-laminated panels with warm roof insulation,



Row houses Dornbirn,
Architect Johannes Kaufmann

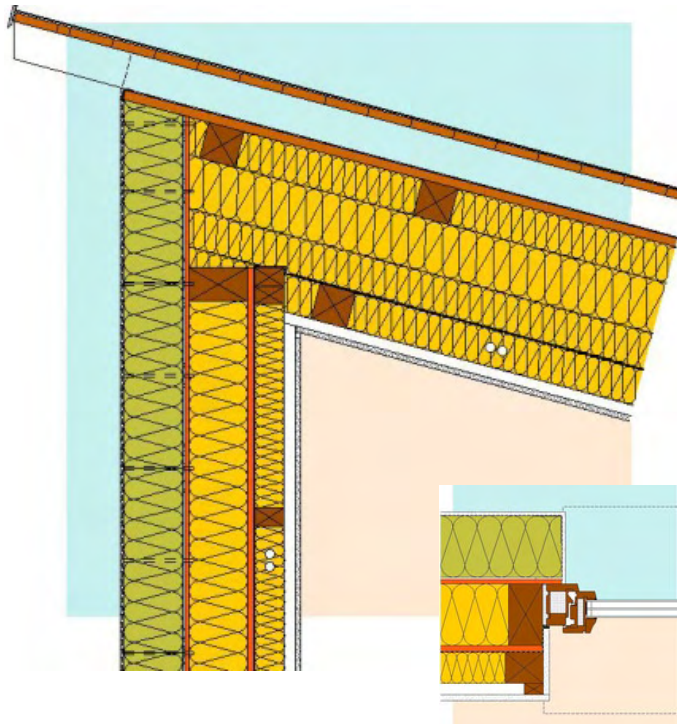
Source:

PH-details: Outside wall / Mono-pitched roof

Outside wall / Mono-pitched roof

Source:

PH-details: Outside wall / Mono-pitched roof
Timber framework outer wall with exterior ETICS facade /
Framework roof, ventilated



Timber framework wall with ETICS consisting of (Sillatherm WVP 1) Plaster baseboard

cm	Composition
1,5	Gypsum fire protection board
3,0	Counter battens 3/5
8,0	Lightweight glass wool between counter battens 5/8
-	Water vapour barrier (Isover Vario KM Duplex)
1,6	Chipboard board
16,0	Lightweight glass wool between rafters wood-span board
1,2	Chipboard board
0,5	Glue layer
16,0	Silatherm WVP 1 16cm (fixed with adhesive and plug anchor)
0,5	Leveling layer with textile reinforced compound layer with undercoat
0,4	Thin layer of external rendering

U = 0,10 W/m²K

Rw ≥ 50 dB

REI 30

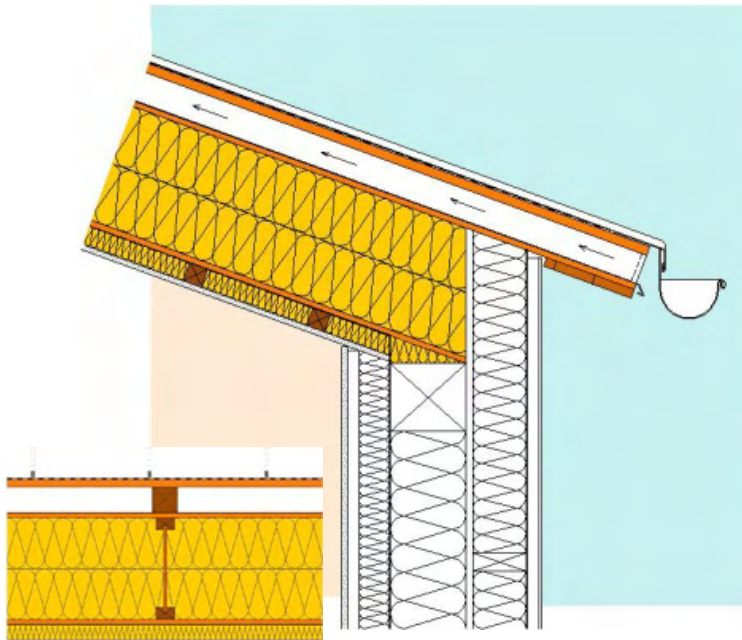
Link for different values: Architektenordner online
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=20

PH-details: Outside wall / Mono-pitched roof

Framework outside wall /

Timber i-section beams, pitched roof, OSB panel, in-between insulation



Timber i-section beams are also ideal for use as roof rafters. Advantages include the low dead weight, the low timber content due to the reduced cross-sectional area, and use as prefabricated roof pane and flooring elements.

Mono-pitch roof structure

cm	Composition
	Tin roof covering
0,3	Layer roof skin (e.g. polymer bitumen roll roofing)
2,4	Rough formwork
8,0	Counter battens min. 8/8
	Layer of vapour diffusion-permeable spun bonded web
1,5	OSB chipboard panel
16,0	Lightweight glass wool between TJI roof framing
16,0	Lightweight glass wool between TJI roof framing
1,5	OSB chipboard panel
	Water vapour barrier (Isover Vario KM Duplex)
	Lightweight glass wool between
5,0	counter battens 5/5
1,5	Plaster board fire protection board

$U = 0,10 \text{ W/m}^2\text{K}$

$R_w \geq 53 \text{ dB}$

REI 30



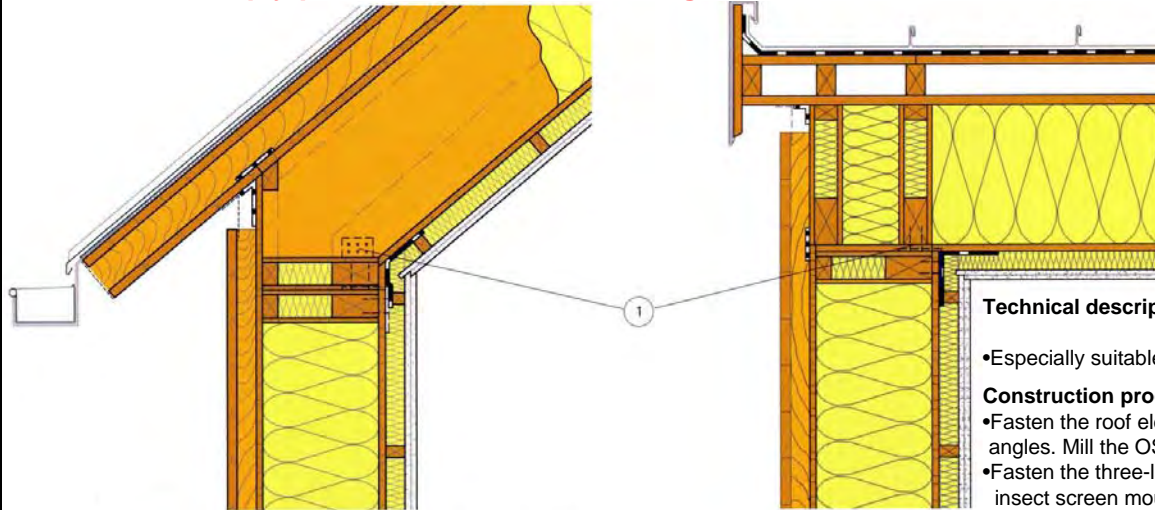
PH-details: Outside wall / Pitched roof

Outside wall / Pitched roof

Source:

PH-details: Outside wall / Pitched roof

Box beam outside wall, rear ventilation / Box beam steeply-pitched roof, eaves and verge



1 Stahlwinkel (horizontal, nicht sichtbar) / Steel angle (horizontal, non-visible)

Building physics

Eaves:

linear thermal bridge coefficient ψ -0,013 W/mK

Verge:

linear thermal bridge coefficient ψ -0,033 W/mK

Technical description / Suitability

- Especially suitable for prefabrication

Construction process

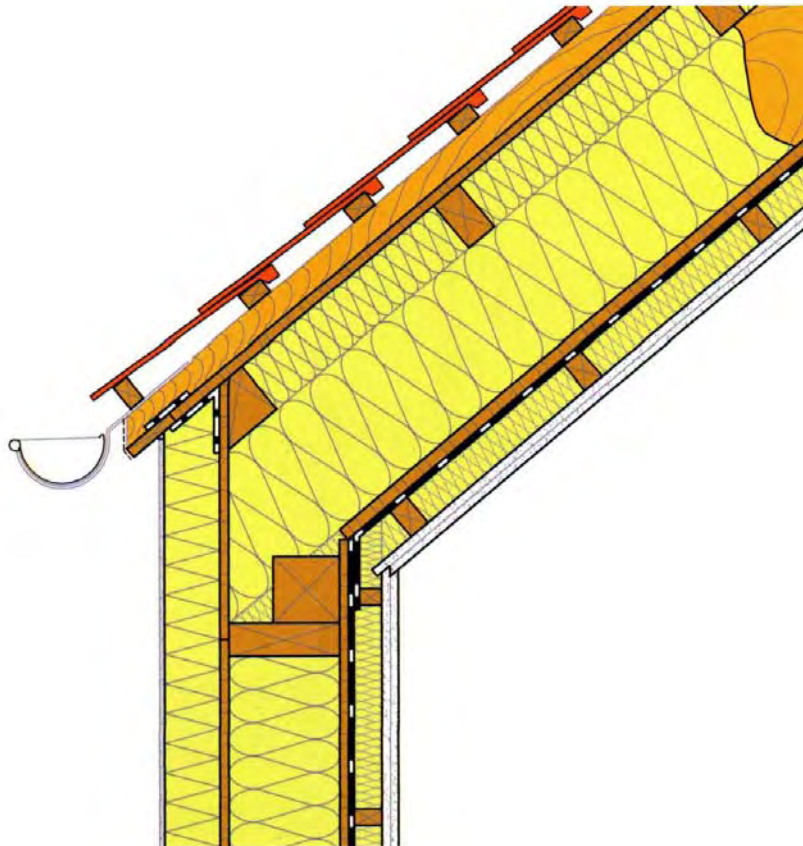
- Fasten the roof element to the wall element with steel angles. Mill the OSB panel to fit the angles.
- Fasten the three-layer panel for the roof soffit and the insect screen mounting points on ceiling lathes of the appropriate size.
- Protect the three-layer panel with an open diffusion roofing sheet.
- Cover the ventilation opening with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2).
- Make sure the connection between the OSB panels of the roof and wall is flow-sealed. Perform the blower door test before mounting the front panel to be able to close existing leaks.

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

PH-details: Outside wall / Pitched roof

Wooden post outside wall with ETICS / Wooden rafter steeply-pitched roof



Technical description

Suitability

- For heated rooms on the uppermost floor without special protection requirements to prevent overheating during summer
- Especially suitable for onsite construction of the roof structure.
- For facades without rear ventilation.

Construction process

- Make sure that no movements between the roof and outside wall are possible that could be damaging to the bonded joints.
- Bond the vapour barriers air tightly. Perform the blower door test before assembling the face work to seal existing leaks.
- Include a solid wood board to fasten insect screens on the second water-carrying level.

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.
- When repairing cracks in the valleys (due to wood aging) check the tightness of the vapour barrier and wind barrier.

Building physics

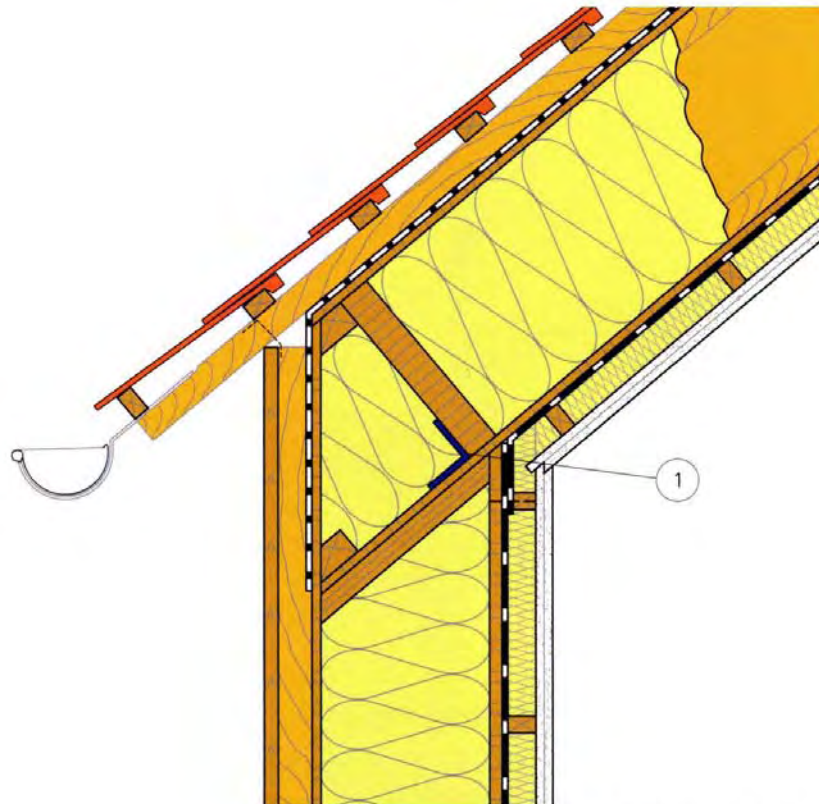
linear thermal bridge coefficient ψ -0,010 W/mK

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Pitched roof

Double T-beam outside wall, rear ventilation /

Double T-beam steeply-pitched roof



1 Stahlwinkel / Steel angle

Technical description

Suitability

- For heated rooms on the uppermost floor without special protection requirements to prevent overheating during summer
- Especially suitable for prefabrication.

Construction process

- Connect the vapour barriers to form an air tight seal, perform the blower door test before assembling the face shell to seal existing leaks.
- Connect the roofing sheet to the wall (air tight layer) with an air tight seal.
- Choose the cross batten thickness to suit the respective projection.
- Cover the ventilation opening with a fine-mesh insect screen (200cm²/m minimum open cross-section with regard to ÖNORM B 8110-2).

Maintenance

- No chemical wood protection is required if the guidelines for structural wood protection are followed.

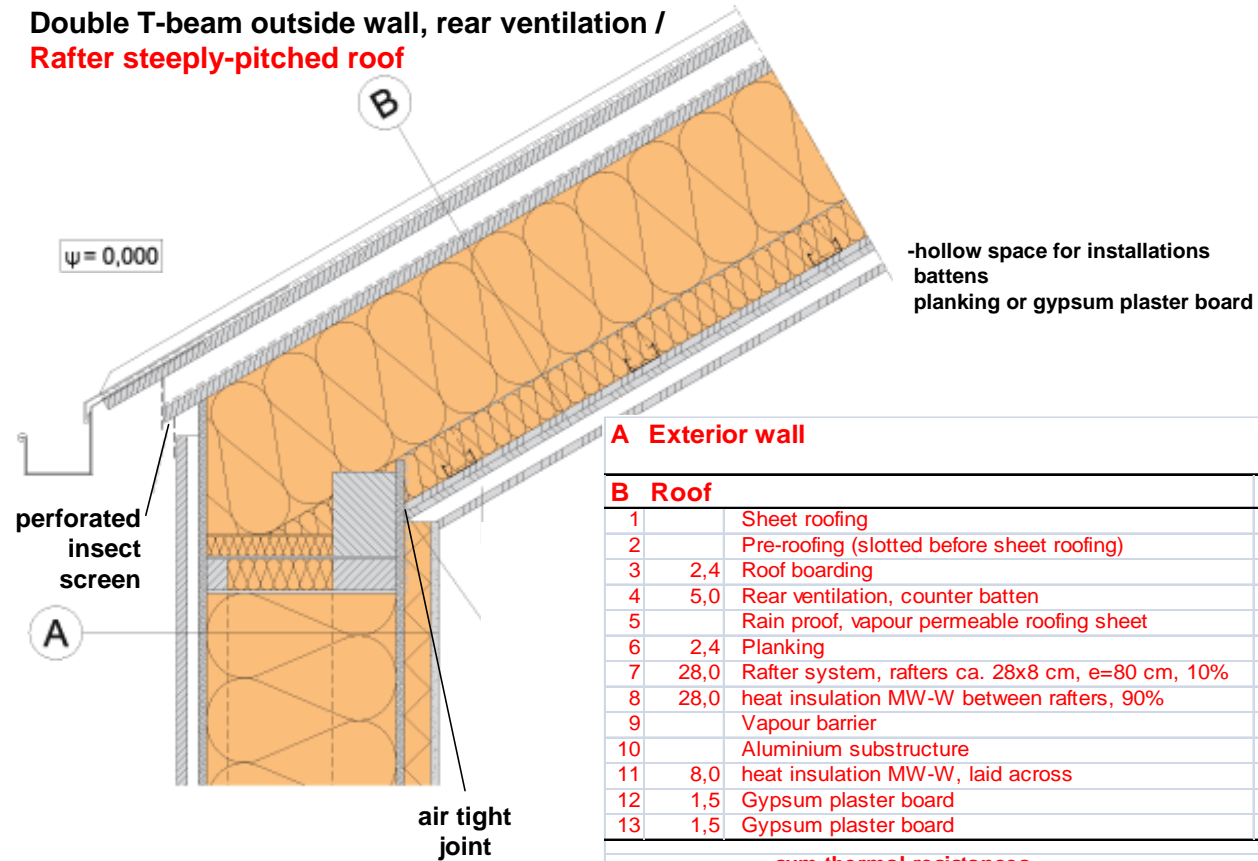
Building physics

linear thermal bridge coefficient ψ -0,006 W/mK

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Pitched roof

Double T-beam outside wall, rear ventilation /
Rafter steeply-pitched roof



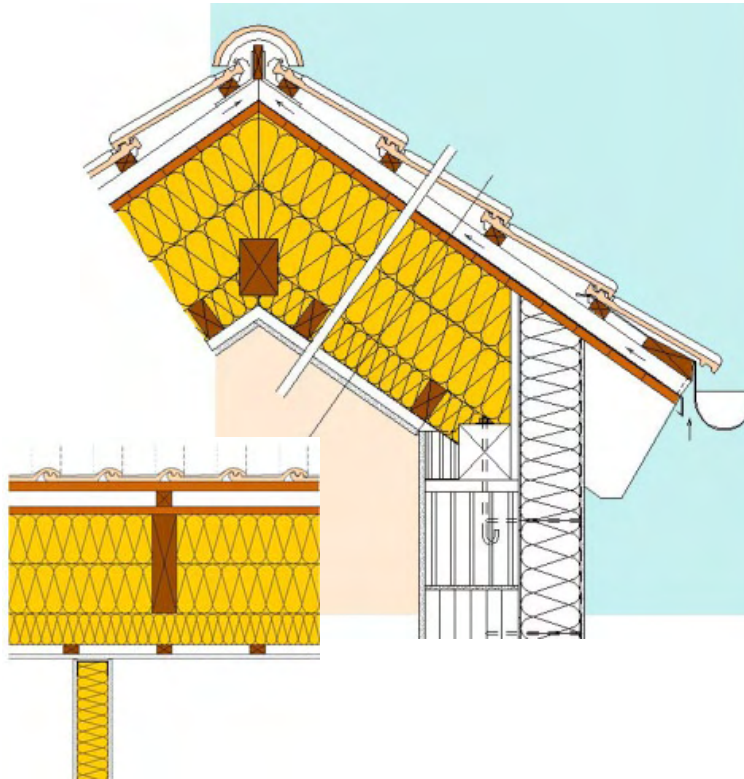
A Exterior wall		Lambda	Rt-value
B Roof			
1	Sheet roofing		
2	Pre-roofing (slotted before sheet roofing)	0,035	6,857
3	2,4 Roof boarding		
4	5,0 Rear ventilation, counter batten		
5	Rain proof, vapour permeable roofing sheet		
6	2,4 Planking		
7	28,0 Rafter system, rafters ca. 28x8 cm, e=80 cm, 10%	0,130	0,215
8	28,0 heat insulation MW-W between rafters, 90%	0,039	6,462
9	Vapour barrier		
10	Aluminium substructure		
11	8,0 heat insulation MW-W, laid across	0,039	2,051
12	1,5 Gypsum plaster board	0,210	0,071
13	1,5 Gypsum plaster board	0,210	0,071
sum thermal resistances			8,870
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,111

Source:

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Full rafter insulation with plaster board fire protection board

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/5 - ventilation area
- Layer of vapour diffusion-permeable spun bonded web
- Under roof - rough formwork
- 2,4 Lightweight glass wool between rafters
- 16,0 Lightweight glass wool between rafters
- 16,0 Lightweight glass wool between counter battens 5/10
- Water vapour barrier (Isover Vario KM Duplex)
- 3,0 Mounting lathing 3/5
- 1,5 Plaster board fire protection board

U = 0,10 W/m²K

R_w ≥ 53 dB

REI 30

Link for different values: Architektenordner online

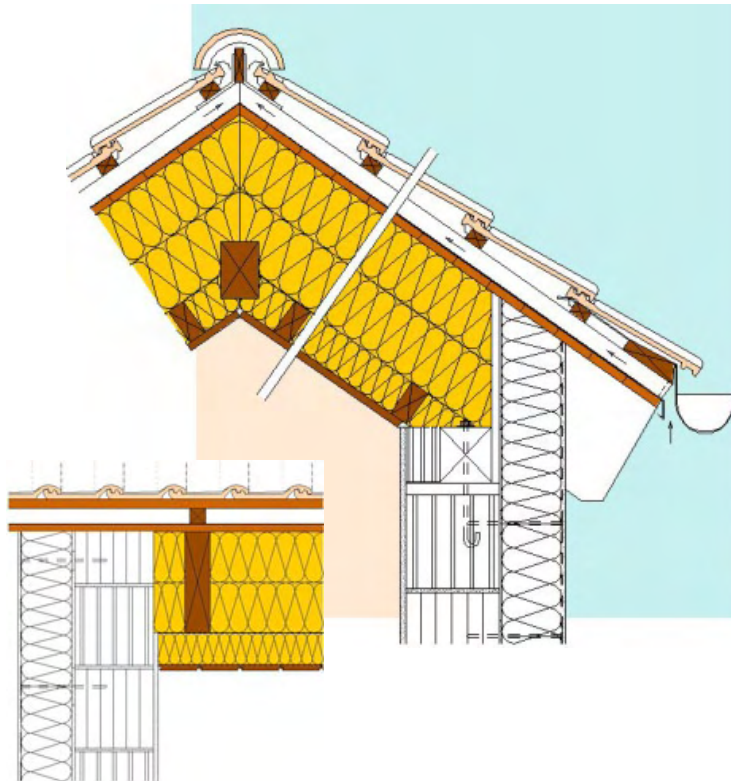
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Full rafter insulation with timber structure and timber cladding

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/5 - ventilation area
- Layer of vapour diffusion-permeable spun bonded web
- 2,4 Under roof - rough formwork
- 16,0 Lightweight glass wool between rafters
- 16,0 Lightweight glass wool between rafters
- 10,0 Lightweight glass wool between counter battens 10/5
- Water vapour barrier (Isover Vario KM Duplex)
- 1,9 Wooden panelling (tongue and groove)

U = 0,10 W/m²K

R_w ≥ 53 dB

REI 30

Link for different values: Architektenordner online

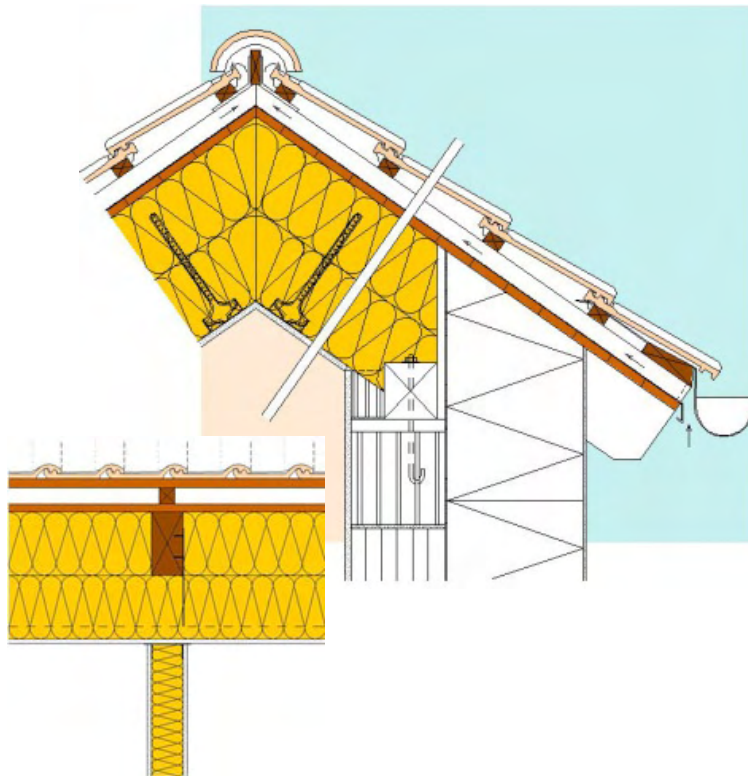
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof with metal tracks



Full rafter insulation with metal track system

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/5 - ventilation area
 - Layer of vapour diffusion-permeable spun bonded web
- 2,4 Under roof - rough formwork
- 20,0 Lightweight glass wool between rafters
- 20,0 Lightweight glass wool between metal track system
 - Water vapour barrier (Isover Vario KM Duplex)
- 1,5 Plaster board fire protection board

$U = 0,10 \text{ W/m}^2\text{K}$

$R_w \geq 53 \text{ dB}$

REI 30

Link for different values: Architektenordner online

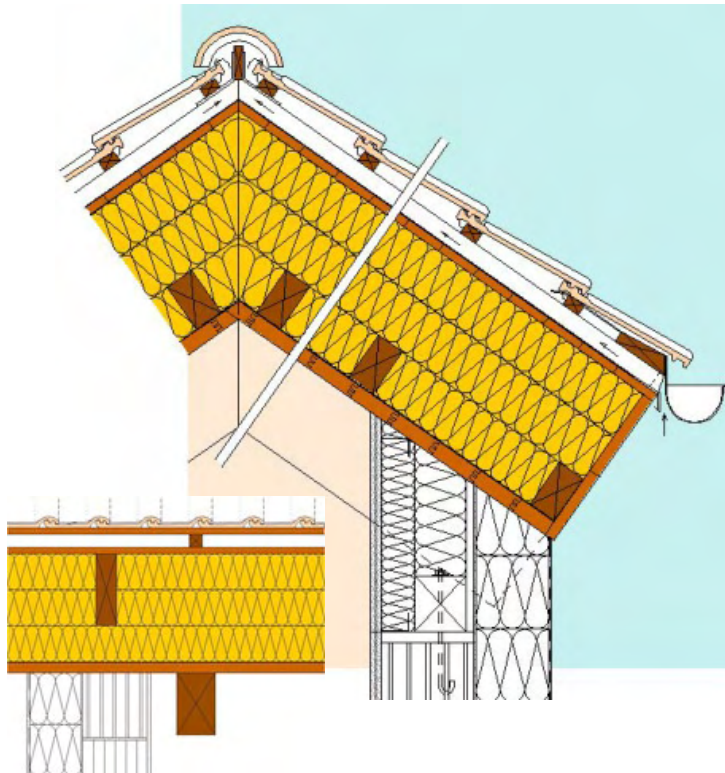
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Full rafter insulation with timber structure and timber cladding

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/5 - ventilation area
 - Layer of vapour diffusion-permeable spun bonded web
- 2,4 Under roof - rough formwork
- 14,0 Lightweight glass wool between wooden battens
- 14,0 Lightweight glass wool between wooden battens
- 14,0 Lightweight glass wool between wooden battens
 - Water vapour barrier (Isover Vario KM Duplex)
- 4,0 Wooden panelling (double tongue and groove)
 - Rafters are visible

U = 0,10 W/m²K

R_w ≥ 51 dB

REI 30

Link for different values: Architektenordner online

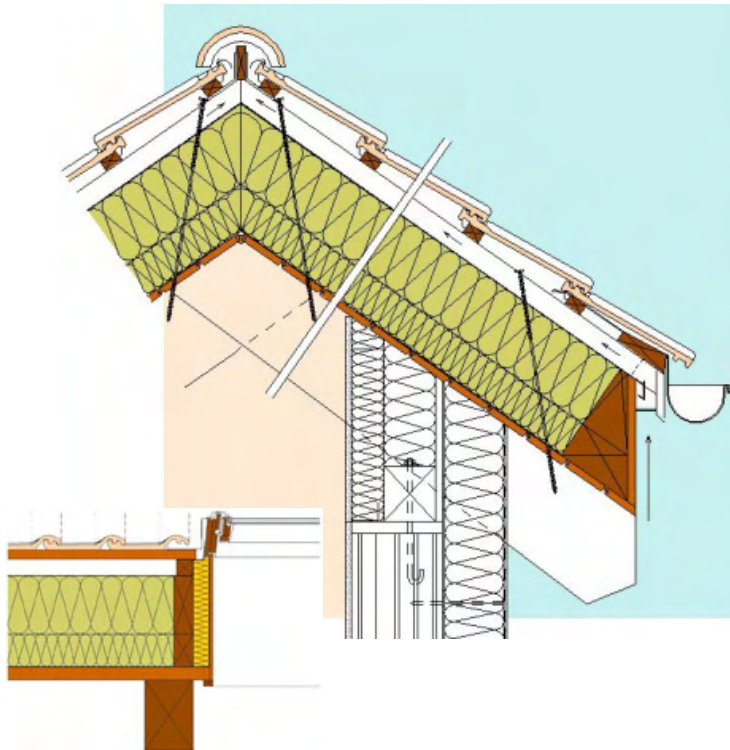
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Rafter insulation

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/8, screwed on rafters
- Layer of vapour diffusion-permeable spun bonded web
- 18,0 Stone wool with mechanical strength
- 10,0 Stone wool with mechanical strength
- Water vapour barrier (Isover Vario KM Duplex)
- 1,9 Wooden panelling (tongue and groove)

U = 0,12 W/m²K

R_w ≥ 51 dB

REI 30

Link for different values: Architektenordner online

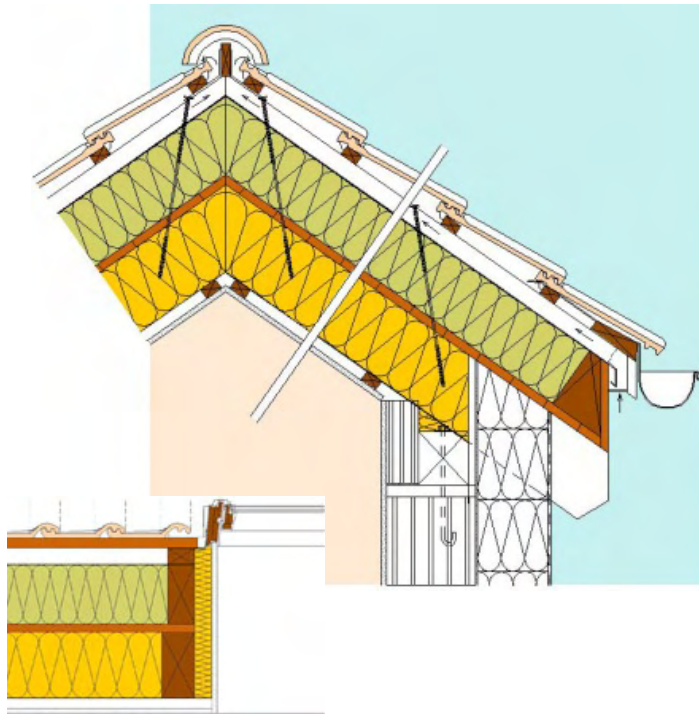
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Rafter insulation and full rafter insulation

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/8, screwed on rafters
- Layer of vapour diffusion-permeable spun-bonded web
- 18,0 Stone wool with mechanical strength on rafters
- 2,4 Rough formwork
- 20,0 Lightweight glass wool between rafters
- Water vapour barrier (Isover Vario KM Duplex)
- 3,0 Mounting lathing 3/5
- 1,5 Plaster board fire-protection board

$U = 0,10 \text{ W/m}^2\text{K}$

$R_w \geq 53 \text{ dB}$

REI 30

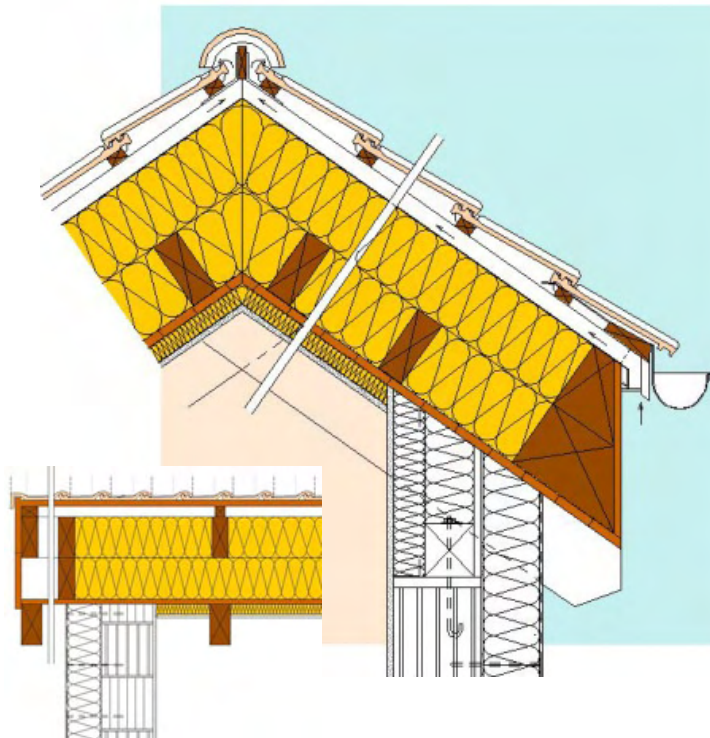
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Brick outside wall with ETICS /
Wood rafter steeply-pitched roof



Rafter insulation - timber structure with insulation between rafters

cm	Composition
	Roof covering
3,0	Roof lathing 3/5
5,0	Counter battens min. 5/5 - ventilation area
	Layer of vapour diffusion-permeable spun-bonded web
20,0	Lightweight glass wool between battens
20,0	Lightweight glass wool between battens
	Water vapour barrier (Isover Vario KM Duplex)
2,4	Rough formwork
5,0	Lightweight glass wool between rafters
1,5	Plaster board fire-protection board

U = 0,09 W/m²K

R_w ≥ 51 dB

REI 30

Link for different values: Architektenordner online

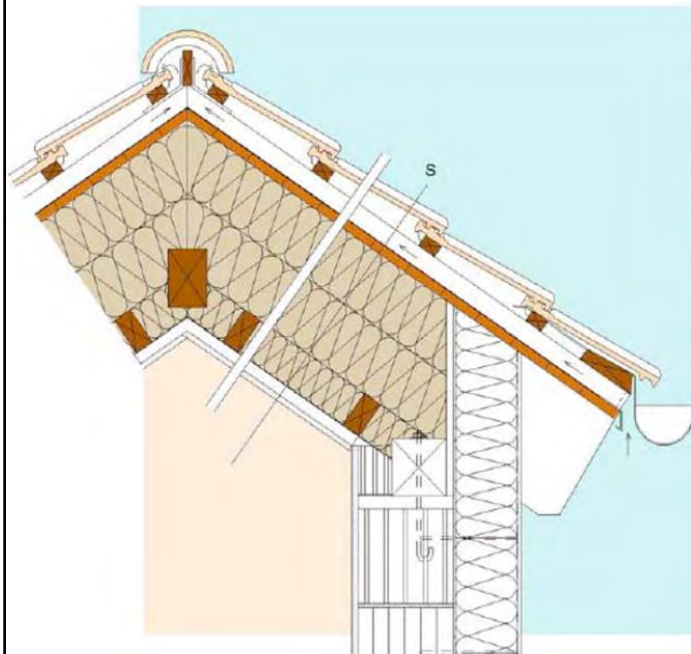
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Full rafter insulation with Isover ULTIMAT with timber structure and plaster board

cm	Composition
	Roof covering
3,0	Roof lathing 3/5
5,0	Counter battens min. 5/5 - ventilation area
	Layer of vapour diffusion-permeable spun-bonded web
2,4	Under roof - rough formwork
16,0	ISOVER ULTIMATE insulation between wooden rafters
16,0	ISOVER ULTIMATE insulation between wooden rafters
10,0	ISOVER ULTIMATE insulation between wooden battens
	Water vapour barrier (Isover Vario KM Duplex)
3,0	Mounting lathing 3/5
1,5	Plaster board fire-protection board

U = 0,10 W/m²K

R_w ≥ 53 dB

REI 30

Link for different values: Architektenordner online

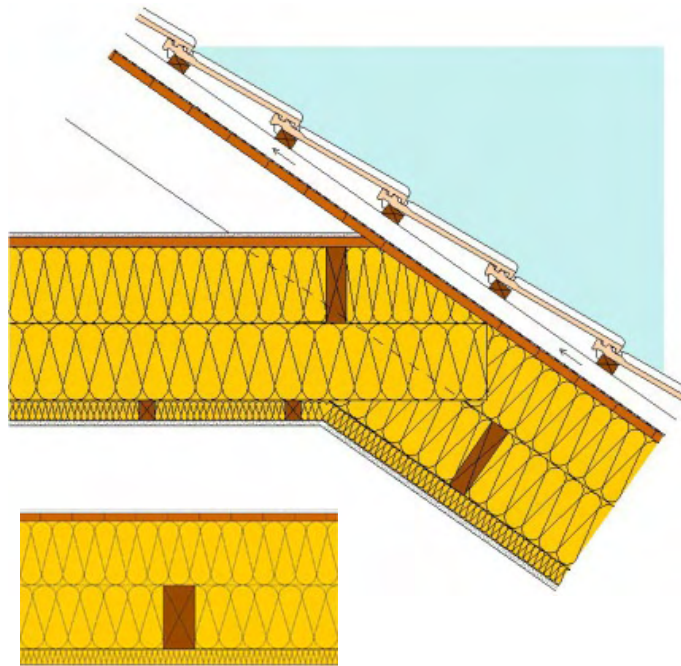
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Wooden rafter steeply-pitched roof with collar beam

Collar beam insulation



cm	Composition
1,0	Plaster board fire protection board
2,4	Rough formwork
20,0	Lightweight glass wool between battens
20,0	Lightweight glass wool between collar beams
	Water vapour barrier (Isover Vario KM Duplex)
5,0	
	Lightweight glass wool between counter battens 4/5
1,5	Plaster board fire protection board

U = 0,10 W/m²K

Rw ≥ 50 dB

REI 30

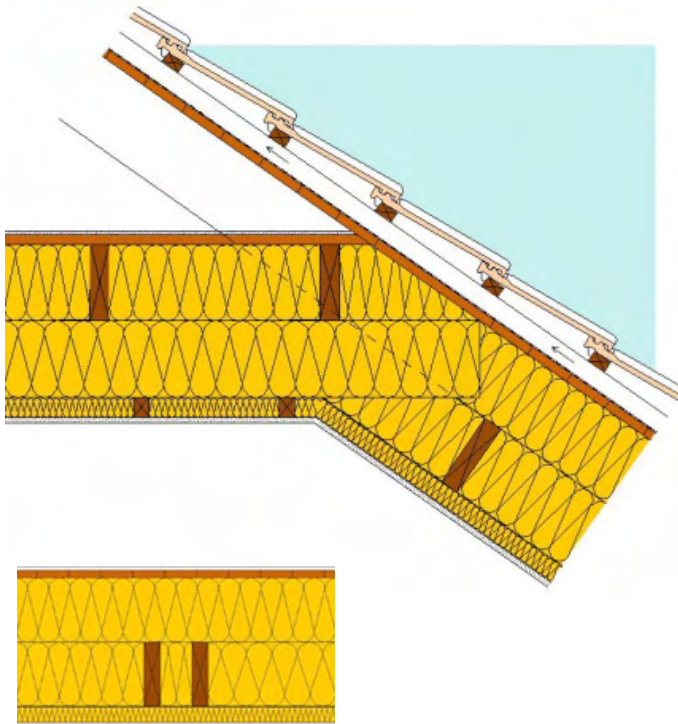
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Wooden rafter steeply-pitched roof with transverse beams



Transverse insulation

cm	Composition
1,0	Plaster board fire protection board
2,4	Rough formwork
20,0	Lightweight glass wool between battens
20,0	Lightweight glass wool between collar beams
	Water vapour barrier (Isover Vario KM Duplex)
5,0	Lightweight glass wool between counter battens 4/5
1,5	Plaster board fire protection board

U = 0,10 W/m²K

R_w ≥ 50 dB

REI 30

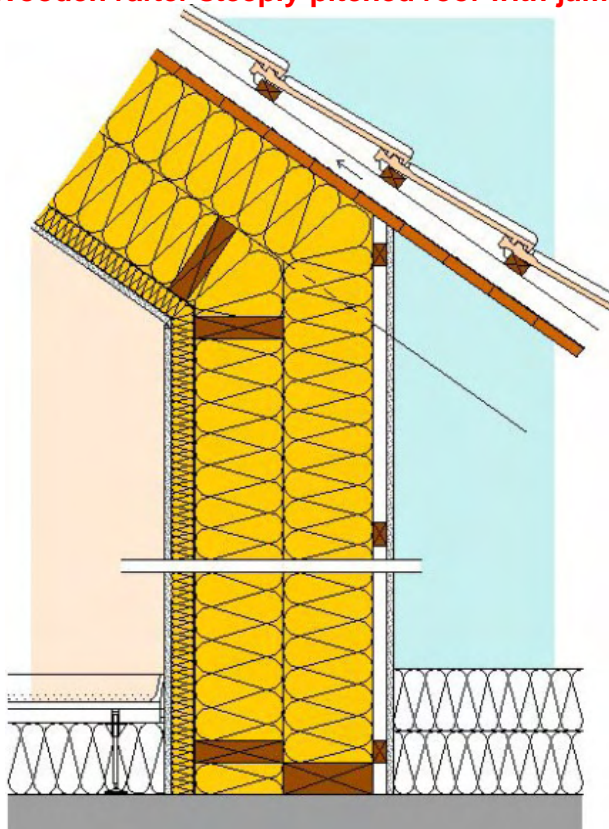
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Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Wooden rafter steeply-pitched roof with jump wall



Jump wall

cm	Composition
1,5	Plaster board fire protection board
3,0	Mounting lathing 3/5
20,0	Lightweight glass wool between wooden beams
20,0	Lightweight glass wool between wooden rafters Water vapour barrier (Isover Vario KM Duplex)
5,0	Lightweight glass wool between counter battens 4/5
1,5	Plaster board fire protection board

U = 0,10 W/m²K

R_w ≥ 47 dB

REI 30

Link for different values: Architektenordner online

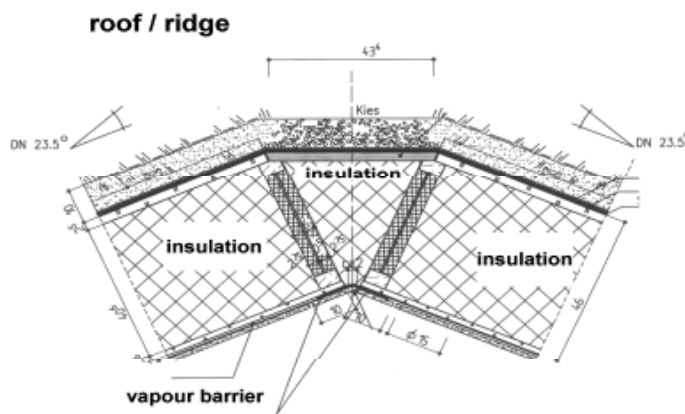
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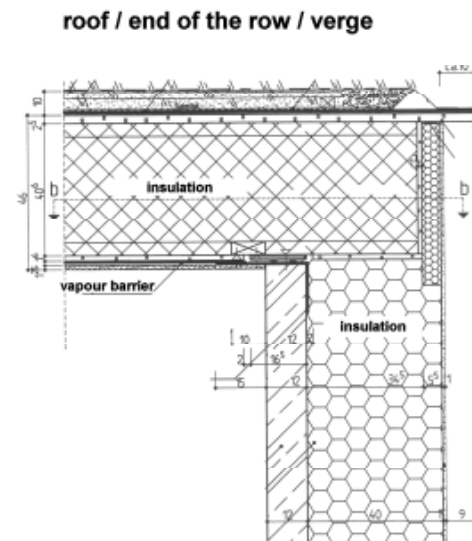
PH-details: Outside wall / Pitched roof

Outside concrete wall with ETICS /

Timber I-section beams, steeply-pitched roof, OSB panel, in-between insulation



Thermal-bridge-free ridge junction

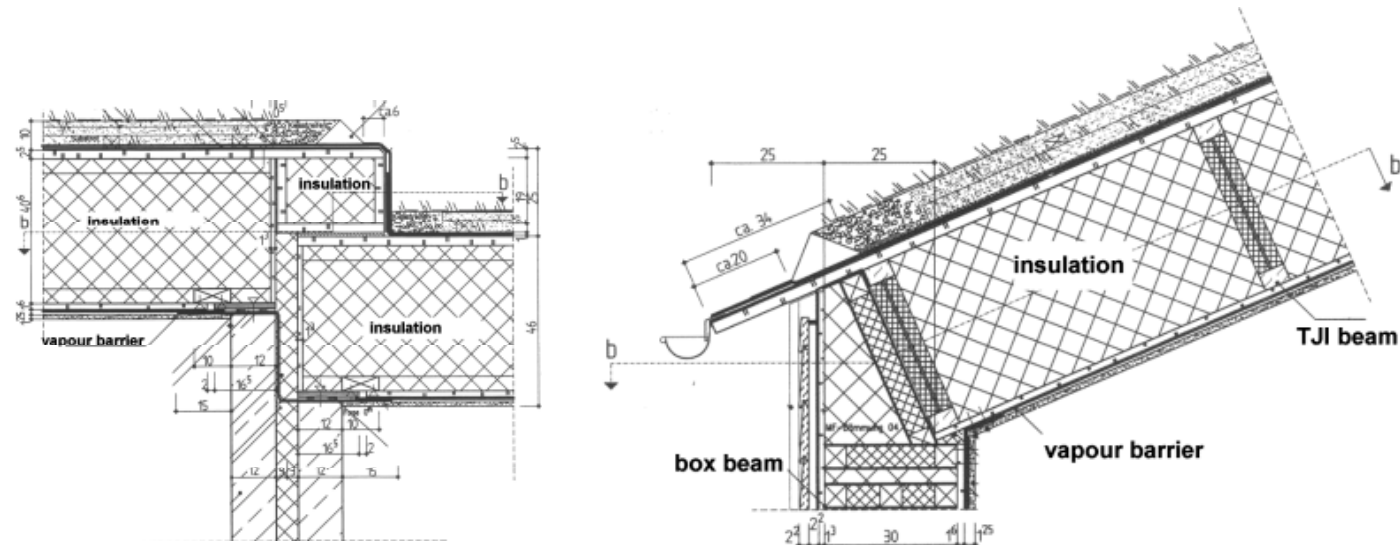


Thermal-bridge-free junction with the gable wall's thermal compound insulation system against the lightweight roof element

PH-details: Outside wall / Pitched roof

Outside concrete wall with ETICS /

Timber I-section beams, steeply-pitched roof, OSB panel, in-between insulation



**Thermal-bridge-free junction
of two offset roof elements**

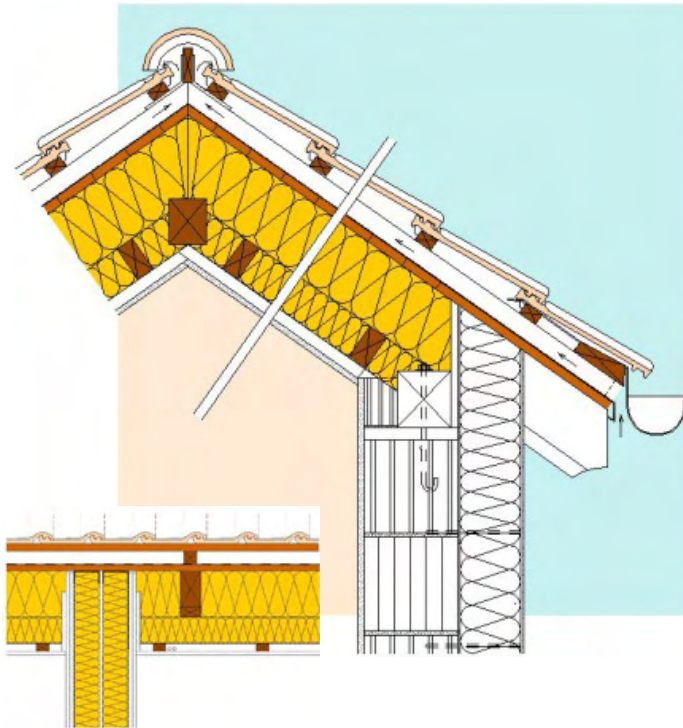
**Thermal-bridge-free eaves junction of
the roof element to the facade element**

Source: http://www.passivhaustagung.de/zehnte/englisch/texte/PEP-Info1_Passive_Houses_Kronsberg.pdf

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Full rafter insulation in renovation

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 5/5 - ventilation area
- Layer roof skin (e.g. polymer bitumen roll roofing)
- Under roof - rough formwork
- 2,4 Lightweight glass wool between rafters
- 18,0 Lightweight glass wool between counter battens 10/5
- 10,0 Water vapour barrier (Isover Vario KM Duplex)
- 3,0 Mounting lathing 3/5
- 1,5 Plaster board fire-protection board

U = 0,15 W/m²K

Rw ≥ 53 dB

REI 30

Link for different values: Architektenordner online

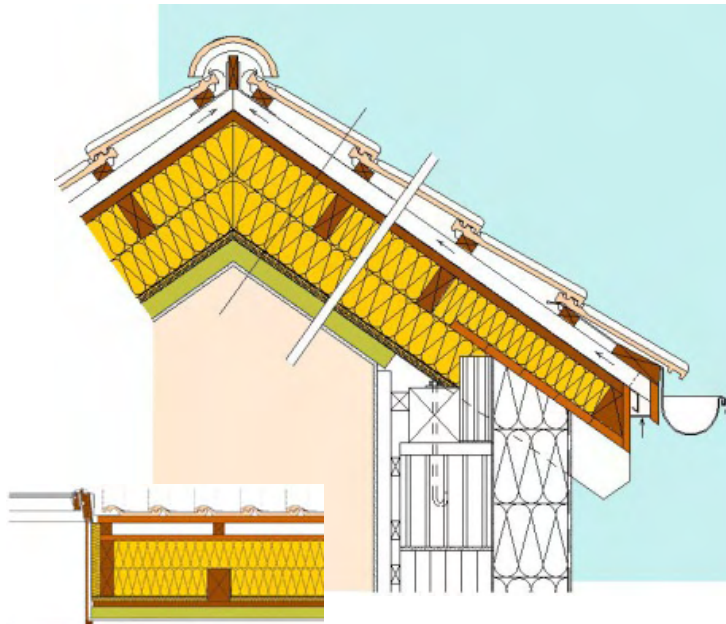
http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)

PH-details: Outside wall / Pitched roof

Outside brick wall with ETICS /

Wooden rafter steeply-pitched roof



Sanidach (renovation)

cm Composition

- Roof covering
- 3,0 Roof lathing 3/5
- 5,0 Counter battens min. 3/5
- Layer of vapour diffusion-permeable spun bonded web
- 2,2 OSB chipboard panel
- 12,0 Lightweight glass wool between wooden battens
- 12,0 Lightweight glass wool between rafters
- Water vapour barrier (Isover Vario KM Duplex)
- 2,0 Glass wool rigid board between rafters to protect the water vapour barrier (Isover Vario KM Duplex)
- 5,0 Existing layer of insulation material
- 1,0 Existing interior plaster

U = 0,15 W/m²K

Rw ≥ 51 dB

REI 30

Link for different values: Architektenordner online

http://www.isover.at/index.php?id=aotech&no_cache=1

Source: www.isover.com/SiteContent/view.do?navId=19 (05.09.2008 15:30)



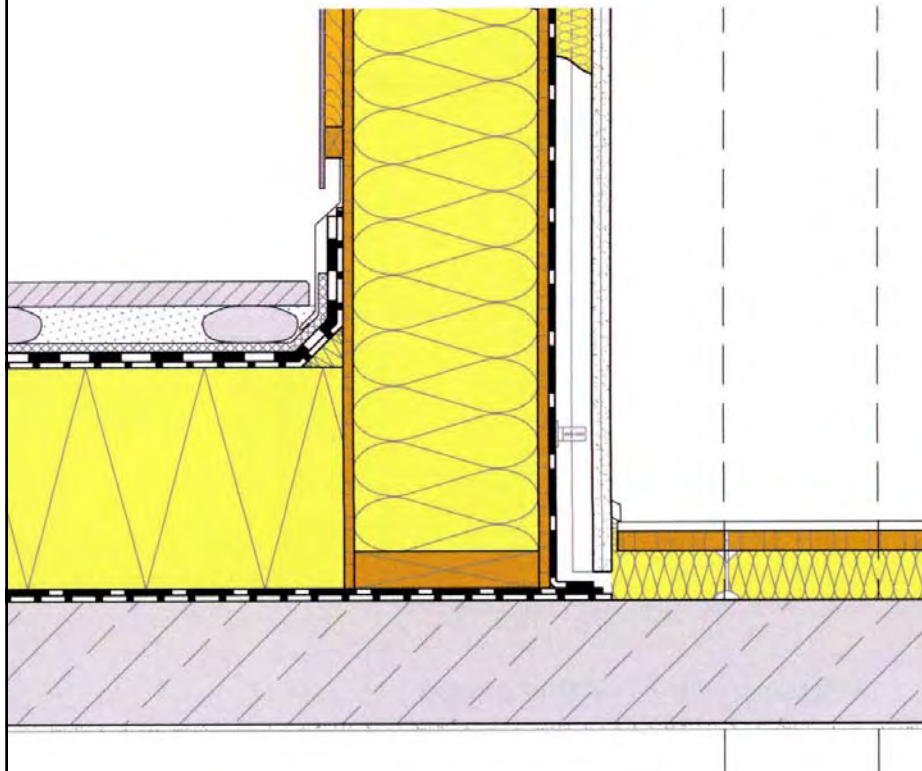
PH-details: Outside wall / Terrace

Outside wall / Terrace

Source:

PH-details: Outside wall / Terrace

Laminated wooden post outside wall /
Reinforced concrete terrace –
Reinforced concrete intermediate floor slab



Technical description

Suitability

- For solid construction method buildings with a lightweight supported upper or uppermost floor

Construction process

- The extended sealing of the outer base area of the wall should be covered with protective metal cladding for protection against UV irradiation and mechanical damage.
- The connection between the wall vapour barrier and the reinforced concrete ceiling vapour barrier should be flow-sealed. The sealing tape should be able to absorb the maximum expected movement between outer wall and ceiling. Perform the blower door test before mounting the facing shell and the floor construction to check for existing leaks and close them.

Maintenance

- Avoid all influences that can cause longer periods of moisture penetration of the wall base (e.g. remove accumulated snow)
- No chemical wood protection is required if the guidelines for structural wood protection are followed.

Structural discussion

- The construction allows for an almost completely thermal bridge-free structure.
- Any preferred insulation thickness is possible.
- Where a thick insulation layer is used for the terrace either steps are required between interior and terrace, or a very high floor construction in the interior.
- A very thick insulation layer offers the possibility of building an effective drainage system in the terrace door area

Building physics

linear thermal bridge coefficient ψ 0,023 W/mK

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007



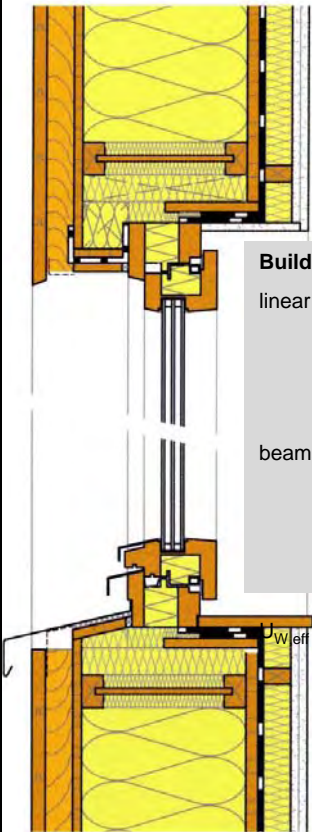
PH-details: Outside wall / Window

Outside wall / Window

Source:

PH-details: Outside wall / Window

Double T-beam outside wall, rear ventilation / Wooden frame window



Building physics

linear thermal bridge coefficient ψ	
- header/reveal	0,007 W/mK
- parapet w/o add insulation	0.021 W/mK
- parapet, 2 cm add. insulation	0.015 W/mK
- parapet, 2 cm add. insulation, double T-	
beams in	
contact with the continuous chipboard	0.019 W/mK
- as above, 7 cm add. insulation	0.012 W/mK
- as above, instead of double T-beam	
6 cm solid construction wood	0.016 W/mK
U_w - value	0.833 W/m ² K

Technical description

Suitability

- Only for limited use for wood-aluminium passive house windows

Construction process

- The construction steps are also valid for window-reveal connections
- Parapet: insert structural mat to drain condensation ("summer condensation")
- Screw window frame onto squared timber elements
- Bond and seal vapour barrier with butyl rubber strip on all sides
- Ensure driving rain sealing and wind tightness with the appropriate completion of the 3-lazer panel (e.g. compression strips with the necessary pre-compression)

Maintenance

- The windows are easy to dismantle and exchange after removing the gypsum fibreboard panel and removing the windowsill
- Observe the maintenance cycles for the finishing coating or the glazings (acrylic finishing lacquers approx. every ten years, coating approx. every four years, longer in protected areas)
- Parapet/wood-aluminium windows: no coating maintenance in necessary due to the aluminium cladding.

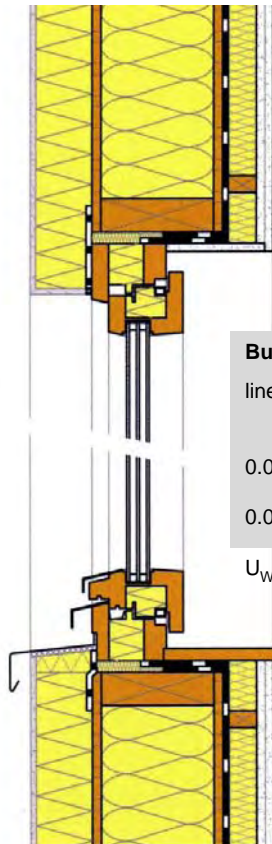
Structural discussion

- Wood-aluminium windows are only suitable if the U_w -value is significantly lower than 0.8 W/m²K due to the high heat conductivity of aluminium and despite the use of an insulation layer on the window frame. Passive house limit value: $U_w = 0.85$ W/m²K.
- Slightly angled reveals to increase solar radiation only lead to a minor increase in the thermal bridge coefficient.
- Where a thick insulation layer is used for the terrace either steps are required between interior and terrace, or a very high floor construction in the interior.
- Also suitable for exterior walls with wood chipboard panels as vapour barriers (bond joints with air-tight seals)

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Window

Wooden post outside wall with ETICS / Wooden frame window



Building physics

linear thermal bridge coefficient ψ	
- header/reveal	0,012 W/mK
- parapet w/o add insulation	0.030 W/mK
- parapet, 2 cm add. insulation	0.025 W/mK
$U_{w,eff}$ – value	0.847 W/m ² K

Technical description

Suitability

- Only of limited use for wood-aluminium passive house windows

Construction process

- The construction steps are also valid for window-reveal connections
- Screw window frame to the uprights
- Bond and seal vapour barrier with butyl rubber strip on all sides
- Ensure driving rain sealing and wind tightness by appropriate completion (e.g. insert compression strips between the insulation material and window frame, connect exterior plaster with plaster bead to the window frame)
- Insert structural mat to drain condensation ("summer condensation").

Maintenance

- The windows are easy to dismantle and exchange after removing the gypsum plasterboard or gypsum fiber board panel.
- Observe the maintenance cycles for the finishing coating or the glazings (acrylic finishing lacquers approx. every ten years, coating approx. every four years, longer in protected areas)

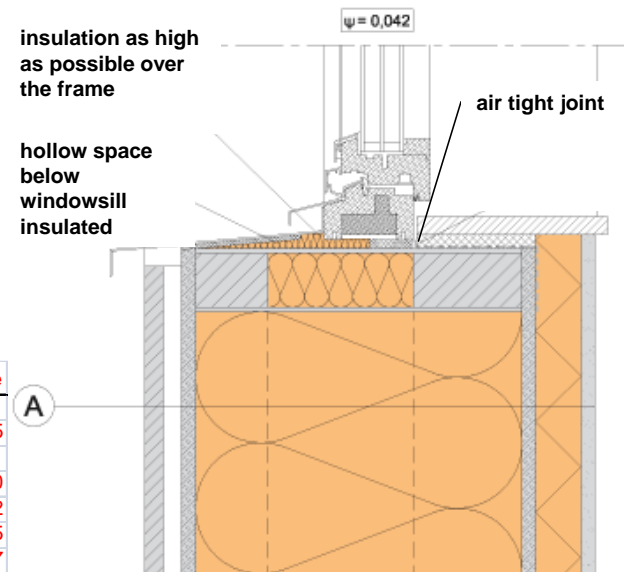
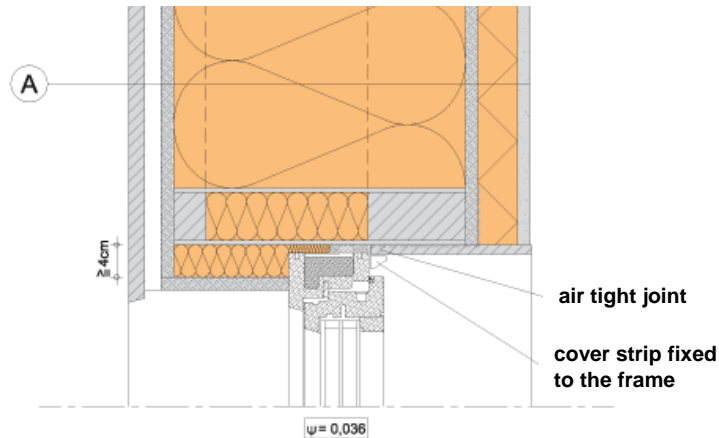
Structural discussion

- Wood-aluminium windows are only suitable if the U_w value is significantly lower than 0.8 W/m²K due to the high heat conductivity of aluminium and despite the use of an insulation layer on the window frame. Passive house limit value: $U_w = 0.85$ W/m²K.
- Slightly angled reveals to increase solar radiation only lead to a minor increase in the thermal bridge coefficient.
- Also suitable for exterior walls with wood-derived panels as vapour barriers (bond joints with air-tight seals).
- Aluminium cladding is definitely advisable along the parapet area due to the high water loads.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Outside wall / Window

Wood post outside wall, heat insulation in-between / Wooden frame window



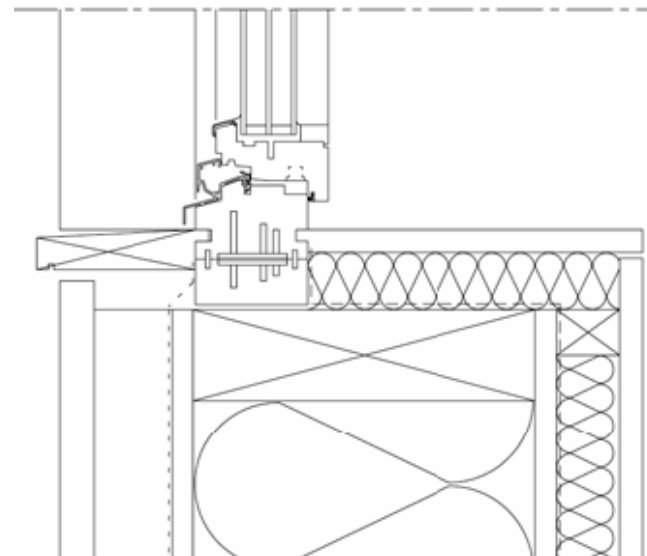
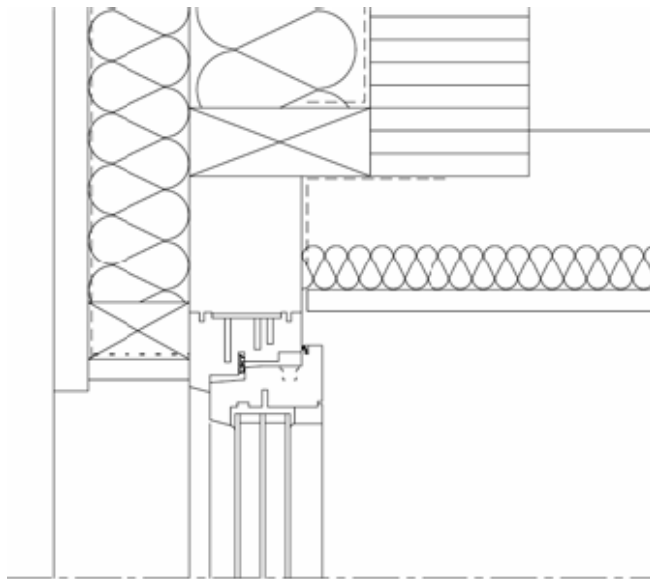
A Exterior wall		Lambda	Rt-value
1	Rear ventilated facade with solid wood profiles		
2	1,6 Composite wood board, vapour permeable	0,290	0,055
3	Box beam: outside 6x4 cm, inside 6x12 cm, e= 62,5cm		
4	36,0 Heat insulation MW-L or MW-W between beams 94%	0,040	8,460
5	1,5 Composite wood board as air tight layer	0,290	0,052
6	5,0 Wood wool slab as insulated installation layer	0,090	0,625
7	1,5 Interior plaster	0,870	0,017
sum thermal resistances			9,140
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,107
sum thermal resistances without installation layer			8,584
heat transmission resistances			0,170
heat transmission coefficient (U-value)			0,114

Source:

PH-details: Outside wall / Window

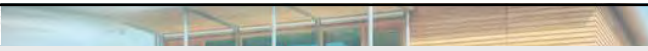
Wooden post outside wall, heat insulation in-between, parapet ventilated /

Wooden frame window



Community centre Ludesch,
Architect Hermann Kaufmann

Source: R. Wehinger, K. Torghele, G. Mötzl, G. Bertsch, B. Weithas, M. Gludovatz, F. Studer, et. al., Neubau ökologisches Gemeindezentrum Ludesch, S 129



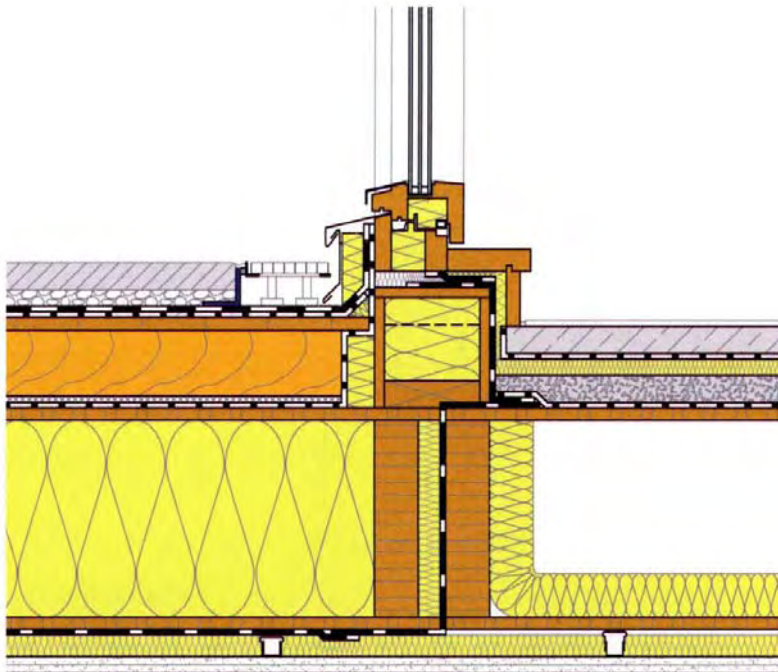
PH-details: Terrace / Terrace door

Terrace / Terrace door

Source:

PH-details: Terrace / Terrace door

Terrace door / terrace



Technical description I

Suitability

- For installation in lightweight construction walls (e.g.B. AWI 04, AWI 05, AWI 03)

Construction process

- Vapour barrier strips should be connected to the roof element and base, or to the exterior wall of the upper level with an air tight seal. Insert this connection before laying the roof or ceiling element.
- Bond insulation wedge in the rear ventilation level to minimise the thermal bridge.
- Mount the window frame in the squared timber or prefabricated base element using screws.
- The butyl rubber strip should be bounded to the vapour barrier with a tight seal along all sides.
- Joints should be filled with fibre insulation material or foamed with sound insulation foam.
- Use weld able, open-diffusion roofing sheet
- Step (prefabricated wood) should feature sound impact insulation strips that separate it from the wall element.
- Ensure protection against driving rain by bonding a sealing layer along the window frame and mount a folded metal sheet using mechanical fastening or clamp joints.

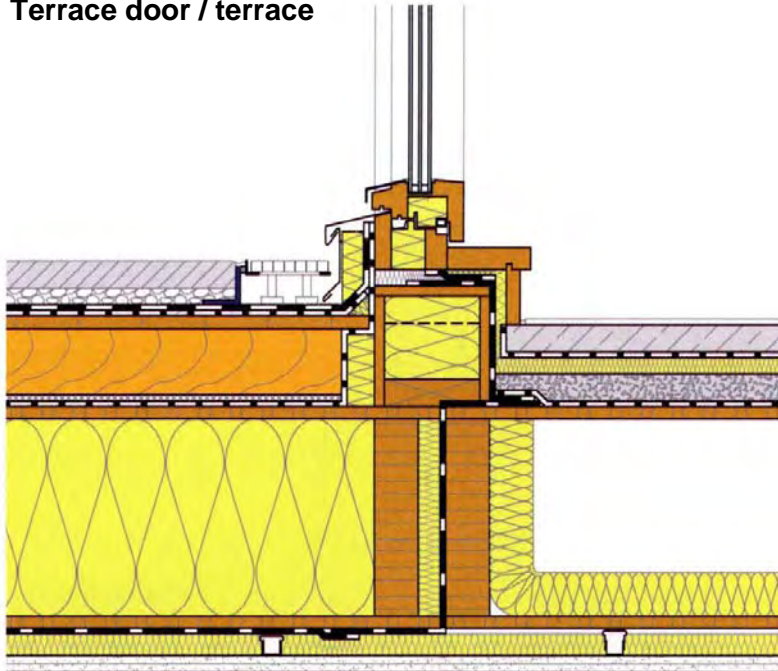
Maintenance

- The windows can be dismantled and exchanged after removing the step.
- The aluminium cladding makes maintenance of the surface unnecessary. The lower horizontal covering rail of the window frame should be removable to check the insulating connection.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007

PH-details: Terrace / Terrace door

Terrace door / terrace



Building physics

linear thermal bridge coefficient ψ	
- base	0,058 W/mK
- header/reveal w. add. insulation	0.008 W/mK
$U_{W,eff}$ – value (1.1-2.2m)	0.847 W/m ² K

Technical description II

Maintenance

- The windows can be dismantled and exchanged after removing the step.
- The aluminium cladding makes maintenance of the surface unnecessary. The lower horizontal covering rail of the window frame should be removable to check the insulating connection.

Structural discussion

- With the corresponding height, parapet supports can be used in the parapet area instead of changing the ceiling supports.
- Rear ventilation openings for the terrace are not possible. Plan the needed vapour pressure compensation solution (e.g. lateral openings).
- Aluminium cladding is definitely advisable along the parapet area due to the high water loads.
- A concrete prefabricated step can be used as an alternative to a prefabricated wood component.
- The connection is also suitable for outside walls with a wood-derivative panel as vapour barrier; joints should be finished with bonded air tight seals.
- Even surface inside and terrace levels can be achieved using bound filler under the screed or a sub-frame.
- The minimum height of the vertical up stand should be determined according to local conditions such as orientation, main wind direction, canopy and national standards.
- When using terrace doors which meet ÖNORM B 7220 standards with reduced vertical up stand of the moisture seal, an additional mechanical fastening to the window frame is required. If, according to the manufacturer, the frame is not suitable, the moisture seal must be fastened to the exterior wall or to a sub-frame.

Source: Details for Passive House, A catalogue of Ecologically Rated Constructions; IBO – Austrian Institute for Healthy and Ecological Building (Ed.); 2007