Passive House Institute
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Certification Report

JUBIZOL PASSIVE

Wall System

Manufacturer:

JUB d.o.o.
Dol pri Ljubljani 28
1262 Dol pri Ljubljani,
SLOVENIA

Date:	23rd of June, 2015
Commissioned by:	**JUB d.o.o**
Processed by:	Dipl.-Ing. Laszlo Lepp, Passive House Institute

1 Basic Information

1.1 General Notes

1.1.1 Object under investigation

The Passive House Institute has defined quality standards for the essential components of a Passive House. In order to provide manufacturers and designers assistance with the project planning of Passive Houses, the Passive House Institute issues certificates for "Certified Passive House Components".

At the time of issuing of the present report, the certification of components for complex solutions for the opaque building envelope may be carried out for the following:

- Building system
  Constructive solutions involving the entire building

- Wall construction system
  Constructive solutions for the entire building, excluding solutions solely for roofs and interior spaces

- EnerPHit thermal insulation systems
  Comprehensive solutions relating to refurbishment of existing buildings

- Floor slab insulation systems
  Limited solutions for floor slabs

There are other certification categories for the opaque building envelope which are not so comprehensive. These and current certification criteria can be found on the website www.passivehouse.com. The criteria which are used and are valid in the context of this investigation are mentioned in this document. The criteria used are based on the fundamental principles for the:

Cool, temperate climate / Germany

The present certification report was prepared for a system which is assigned to the following category:

WALL SYSTEM

The specific designation of the system chosen by the manufacturer is as follows:

JUBIZOL PASSIVE

This report is meant to document the certification criteria on which certification is based, and to publish the submitted documents relating to the system, explain the scope of the investigation and present the results of the examination.

1.1.2 Structure of the certification report

The system components will be considered as certifiable Passive House components only if all major connection details meet the criteria mentioned in Section 1.2.

The concepts of the building system under examination in relation to the type, design and system-specific features are presented in Section 2, while calculation results and boundary conditions specific to the building system are summarised in Section 3. The structure of all examined details and the relevant calculation approaches are described in detail in Sections 4 and 5. Section 6 contains essential information with reference to the chosen airtightness concept of the submitted details. At the end of the report, legal information has been provided in Section 7 and a brief statement and the result of the certification procedure in Section 8.

1.1.3 Using the results in the Passive House Planning Package

For the system being certified here, the thermal bridges in the areal building components resulting from regularly occurring interruptions are determined if these are not negligible. For this, an equivalent thermal conductivity in the interrupted material layer is calculated, this is then used for calculating the U-value and for determining the thermal bridge loss coefficient in place of the material characteristics of the uninterrupted material.

The following points must be kept in mind if the thermal bridge loss coefficients calculated here are used in the energy balance calculations for a building with the Passive House Planning Package (PHPP):

- The thermal bridge effects of the regularly occurring interruptions in the material layers have already been taken into account where necessary, therefore it is neither necessary to calculate the thermal bridge lengths nor do these have to be accounted separately in the calculation procedure.
- All thermal bridge details which meet the criterion for absence of thermal bridges ($_a$ 0.01 W/(mK) are treated as usual in the PHPP; it is not necessary to include these in the balance in the section for assessing thermal bridges (but they may be included if required for a specific project).
- For window connection details, the 3 or 4 different installation situations (top, bottom, left to right) as the case may be, are assessed with the respective thermal bridge loss coefficients. In the case of "combined" connections (e.g. window installation in the exterior wall with integration of the ceiling or plinth formation of a French window on the basement ceiling), the respective thermal bridge loss coefficient for the relevant window installation may only be used in the area of the window opening as a "combined" thermal bridge loss coefficient.
- The results of the calculation of the linear thermal transmittance Ψ_a are always determined based on the external dimensions. This should be taken into account in further calculations.

Note:

Additional point thermal bridges may have to be taken into account in some cases; this is mentioned for the affected connection.

1.1.4 Information provided by the applicant which has been taken into account

The applicant is responsible for detail development and the assigned planning solutions. Successful advanced development of the submitted detail set was carried out with the assistance of the Passive House Institute. Much correspondence took place and agreements were worked out via email. The present certification is based on the following detail set and the key documents provided by the applicant:

Planning documents

Name	Number / Date
Detail documents, system description, airtight layer, etc.	11.08.2014
Reworked details	29.04.2015

1.2 Criteria

1.2.1 Thermal transmittance of the exterior building components

The following limit value for the thermal transmittance of opaque exterior building components resulted in the course of Passive House research, which should be complied with in the context of certification:

$$f * U_{opaq} \leq 0.15\ W/(m^2K)$$

with f: temperature reduction factor

Note: calculation of the thermal transmittance was carried out in accordance with DIN ISO 6946. This is based on the rated lambda values of the thermal conductivities used in German standards. As a rule, a temperature reduction factor of 1.0 is used. Where necessary, the limit value for f = 0.6.

If the system to be certified includes selective penetrations, then a distinction should be made: calculation of dowels or other attachment elements which occur regularly across the area should be converted into the overall U-value of the wall system, which must remain below 0.15 W/(m²K).

1.2.2 Thermal bridge free construction of the Passive House

All essential connection details must be free of thermal bridges. According to the definition, this is the case if the thermal bridge loss coefficient complies with the following limit value:

$$\Psi_a \leq 0.01\ W/(mK)$$

with Ψ_a: thermal bridge loss coefficient based on external dimensions

Note: The calculation algorithm is based on the DIN ISO 10211 standard. The boundary conditions for the calculation are intended for use in the PHPP and for various applications which were studied in the context of Passive House research.

Regularly occurring irregularities (e.g. in the area of the plinth or base of the wall, balcony attachments etc.) should be converted to linear thermal bridges. The Ψ-value thus calculated must remain below 0.01 W/(mK) for the exterior wall and the floor slab. In the case of interior walls and partitions, the Ψ-values may also be above 0.01 W/(mK) in cases checked by the Passive House Institute.

1.2.3 Interior surface temperatures

Due to reasons relating to moisture and thermal comfort, the interior surface temperature of the connection details may not fall below the following limit value at the most unfavourable point:

$\vartheta_{si} \geq$ **17.0 °C** (for opaque connection details)

for an outside temperature of ϑ_e = -10 °C
and an inside temperature of ϑ_i = 20 °C

ϑ_{si} : surface temperature

Notes: Deviating from the boundary conditions given in 4108-2, an outdoor temperature of -10 °C was set for determining the minimum interior surface temperature. The increased heat transfer resistances on the room side (R_{si} = 0.25 m²K/W) were used for calculating the surface temperatures in accordance with DIN ISO 13788.

1.2.4 Window installation situations

Building systems are not limited to any specific window type, therefore a fictional window component, the frame of which was just within the certifiable limit for a Passive House component, was generally used for verifying the window installation situation:

Window used		**Window dimensions :**
U-value of the frame top and sides	$U_{f,o,s}$ <= 0.75 W/(m²K)	Frame width = 120 mm
U-value of the frame bottom	$U_{f,u}$ <= 0.91 W/(m²K)	Frame width = 145 mm
PSI value of the glass edge	Ψ_g = 0.027 W/(mK)	Frame width = 1.23 m
U-value of the glazing	U_g = 0.70 W/(m²K)	Frame width = 1.48 m

With a real or a fictional Passive House window frame which just meets the certification limit, window connection details must comply with the following criterion in the overall balance:

$$\mathbf{U_{w,installed} \leq 0.85\ W/(m^2K)}$$

1.2.5 Airtightness of all standard building components and connection details

In order to ensure that the greater part of the air is supplied by the ventilation system with heat recovery, and in order to prevent structural damage due to moisture transfer, energy-efficient houses also require a high level of airtightness in addition to highly insulated exterior building components.

All connection details must therefore be executed in a permanently airtight manner. The airtight layer must be clearly indicated (e.g. using red ink) in the implementation plan of the certification documents and practical implementation must be clearly explained for general cases as well as for special applications.

2 Description of the wall system

Origins of company JUB date back to the year 1875, when the first mineral paints were produced. Now JUB has more than 45 years of experience also in external thermal insulation composite systems with rendering (ETICS) in big part of Europe and also in some parts of Asia and North Africa. They provide large set of building solutions including interior coatings, coatings for metal and wood, render finishes, façade paints, expanded polystyrene thermal insulation, levelling compounds, renovation mortars, products for waterproofing and ceramic tiles, colorants and tinting system. JUBIZOL, which is company’s brand for external thermal insulation composite systems, is widely used in Residential and Public Buildings, as well as Industry buildings, Shopping Malls, etc.

For more information, please visit the website: www.jub.eu

JUBIZOL PASSIVE is an Exterior Thermal Insulation Compound System (ETICS) that can be used especially in Passive Houses. It is a so called "Thin-film" façade thermal insulating system (thin-film base coat with thickness of a few millimetres) with two ways of fixing thermal insulation slabs on the wall surface. The thermal insulation slabs should be thus secured by gluing with adhesive mortar and by mechanical fixing. Normally, during the installation by mechanical fixing also adhesive mortar is applied to ensure the evenness of the final surface, but the system is dimensioned in that way, that the calculation load is bearing only by fasteners. After installation of thermal insulation slabs on wall, base coat is applied in which reinforcing mesh must be also affixed. Before carrying out the final decorative layer, primer is applied to the base coat.

Components of JUBIZOL PASSIVE system are:

- Adhesive mortar - cement based mortars
- Thermal insulation – expanded polystyrene slabs with the addition of graphite, preferred type
- Base coat – cement or cement free based mortars
- Reinforcement mesh
- Fasteners (anchors)
- Primer
- Finishing coat (Final decorative layer)
- Auxiliary material (corner, base profile, drip ledge, window reveal profile…)

It is necessary to pay special attention also to airtight layer in interior, which can be ensured by means of separate layers of sheeting, plasters and adhesive tape at the transitions.

3 Summary of the results

The results of the certification procedure are given below prior to subsequent documentation.

More detailed information relating to the equivalent thermal conductivity, with the materials and regularly occurring interruptions in the thermal insulation (with centre distances) and calculation of the standard U-values can be found in Section 4 *Calculation of the thermal transmittance*.

Explanation of the information provided by the manufacturer and the calculation approaches used by the Passive House Institute with visualisation of the results with reference to the component connection situations can be found in Section 5 *Thermal bridge loss coefficients of connection details.*

3.1 Summary of the equivalent thermal conductivities

Through equivalent thermal conductivities of the relevant insulation layers, recurrent attachment elements and penetrations have been taken into account in this certification. These were used for calculating the U-values and the two-dimensional heat flow simulations.

The following equivalent thermal conductivities result for the further calculations:

Abbreviation	**equivalent lambda value**	$\lambda_{eq.}$ [W/(mK)]
äq,Pitched roof	in the load-bearing level of the pitched roof insulation layer, above	0,041
äq,Pitched roof	in the load-bearing level of the pitched roof insulation layer, below	0,044

3.2 Summary of the standard U-values

Building element	**Abbreviation**	**U-value** W/(m²K)	**f**	**f * U_{opaque}**	**Criterion: f * U_{opaqe} ≤ 0.15** W/(m²K)
External Wall	EW	0,15	1,0	**0,15**	**met**
Flat Roof	FR	0,14	1,0	**0,14**	**met**
Pitched Roof	PR	0,11	1,0	**0,11**	**met**
Pitched Roof (eq.therm.cond.)	PReq.	0,11	1,0	**0,11**	**met**
Floor Slab	FS	0,10	0,6	**0,06**	**met**
Basement Wall (heated basement)	BWh	0,24	0,6	**0,14**	**met**
Basement Ceiling (unheated basement) 150mm	BCu	0,16	0,6	**0,10**	**met**

3.3 Summary of the tested building component connection situations

Abbreviation	Connection details	Ψ_a-Value [W/mK)]	Min. Surface-temp. [°C]	Thermal bridge free?	
Building element connection details					
Thermal bridge loss coefficient	**Criterion**	**≤ 0.01 [W/(mK)]**	**ϑ_{si} ≥ 17 °C**		
A3-02	external wall to flat roof	-0,052	17,8	**yes**	**roof**
A3-03	external wall to pitched roof - eaves	-0,037	18,6	**yes**	**roof**
A3-04	external wall to pitched roof - verge	-0,029	17,7	**yes**	**roof**
A3-05	external edge of external wall	-0,061	18,1	**yes**	**wall**
A3-06	internal edge of external wall	0,023	19,0	**no**	**wall**
A3-07	internal wall meets external wall	0,000	18,9	**yes**	**wall**
A3-08	ceiling supported by external wall	0,000	18,9	**yes**	**wall**
A3-09	external wall on floor slab	-0,030	17,0	**yes**	**base**
A3-10	internal wall on floor slab	0,007	19,5	**yes**	**base**
A3-11	external wall on basement ceiling - heated basement	-0,011	17,1	**yes**	**base**
A3-12	external wall on basement ceiling - unheated basement	0,155	14,6	**no**	**base**
A3-12a	external wall on basement ceiling - unheated basement	-0,008	17,1	**yes**	**base**
A3-13	internal wall on basement ceiling - unheated basement	0,367	18,6	**no**	**base**
A3-13a	internal wall on basement ceiling - unheated basement	0,101	19,4	**no**	**base**
Window connections		Ψ_a-Value [W/mK)]			
A3-14	window installation in external wall - top	0,007	**further results, see overall evaluation of installed window**		**window-connection**
A3-15	window installation in external wall - side	0,007			**window-connection**
A3-16	window installation in external wall - bottom	0,018			**window-connection**
A3-17	window inst. in ext. wall - roller shutter box - top	0,038			**window-connection**
A3-18	window inst. in ext. wall - roller shutter box - side	0,007			**window-connection**
A3-19	window inst. in ext. wall - roller shutter box - bottom	0,018			**window-connection**
A3-20	window inst. in ext. wall - venetian blind - top	0,027			**window-connection**
A3-21	window inst. in ext. wall - venetian blind - side	0,023			**window-connection**
A3-22	window inst. in ext. wall - venetian blind - bottom	0,059			**window-connection**
A3-23	inst. of French window in ext. wall, exit - bottom	0,015			**window-connection**
Overall U-value of installed window	**Criterion**	**≤ 0.85 [W/(m²K)]**			
		U-Value [W/(m²K)]	Thermal bridge free?		
A3-14, A3-15, A3-16	window installation in external wall	0,83	**yes**		
A3-17, A3-18, A3-19	window installation in external wall - roller shutter box	0,85	**yes**		
A3-20, A3-21, A3-22	window installation in external wall - venetian blind	0,84	**yes**		
A3-14, A3-15, A3-23	installation of French window in external wall	0,83	**yes**		

The above summary reflects the entirety of the examined detail solutions with their main results and includes the details which are not thermal bridge free. These uncertified details may not carry the "Certified Passive House Component" Seal and may not be mentioned in connection with the certification in the public relations context. An exemption is made in the case of Detail A3-06. This is a geometric thermal bridge which does not meet the "thermal bridge free" criterion in accordance with the certification criteria. However, this detail is still suitable for Passive Houses, but since an inner edge always also has an additional outer edge which compensates these losses, this does not cause any problems.

For these details, thermal bridge losses should be explicitly included in the PHPP calculation.

4 Calculation of the thermal transmittance

4.1 Calculating the equivalent thermal conductivities of quasihomogeneous layers

For the construction system certified here, the non-negligible regularly occurring interruptions in the areal building components were taken into account with equivalent thermal conductivities. These are used for calculating the standard U-values and for determining the thermal bridge loss coefficient. The calculations forming the basis for determining the equivalent thermal conductivities are based on the Finite Element Method.

4.2 Calculating the U-values

All major interruptions in the form of point and linear thermal bridges are accounted using the following basic formula. An uninterrupted building component means the building component without considera-tion of the material that causes the thermal bridge:

$$U_{reg.} = U_{ung} + \frac{l_{WB:}}{A} \cdot \Psi_{WB} + \frac{\mathbf{n}}{A} \cdot X_{WB}$$

with:

$U_{reg.}$ U-value of the standard building component in [W/(m²K)]

$U_{unin.}$ U-value of the uninterrupted building component in [W/(m²K)]

$L_{TB:}$ Length of the thermal bridge through the interrupted layer in [m]

A Area of the building component in [m²]

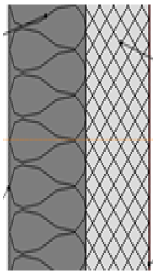
Ψ_{TB} Thermal bridge loss coefficient through the interrupted layer in [W/(mK)]

X_{TB} Thermal bridge loss coefficient through point of interruption in [W/K]

$\mathbf{n}$ Number of points of interruption

If the standard U-values calculated in this certification procedure are used for calculating the energy balance with the PHPP, then the thermal bridge effects of the regularly occurring interruptions have already been taken into account.

Construction drawing	Results $U_{standard}$

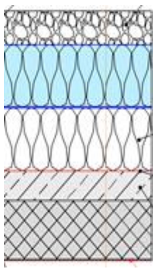


Assembly no.	Building assembly description	Interior insulation?
1	External Wall	

Heat transfer resistance [m²K/W] interior R_{si}: 0,13 exterior R_{se}: 0,04

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Exterior plaster JUBIZ	0,910					3
2.	JUBIZOL EPS F-G	0,039					250
3.	JUBIZOL Adhesive morta	0,910					5
4.	Reinforced concrete wa	2,300					200
5.	Interior plaster JUBOI	0,910					5
6.							
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 46,3 cm

U-value supplement: W/(m²K) **U-Value:** 0,150 W/(m²K)

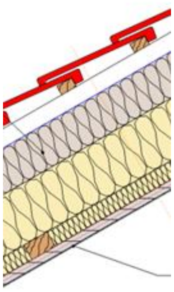


Assembly no.	Building assembly description	Interior insulation?
2	Flat Roof	

Heat transfer resistance [m²K/W] interior R_{si}: 0,10 exterior R_{se}: 0,04

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Gravel	2,000					80
2.	JUBIZOL EPS Strong Pre	0,045					150
3.	Eurotherm EPS 100	0,044					150
4.	Concrete	1,600					70
5.	Reinforced concrete	2,300					140
6.	Interior plaster JUBOI	0,910					3
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 59,3 cm

U-value supplement: W/(m²K) **U-Value:** 0,142 W/(m²K)

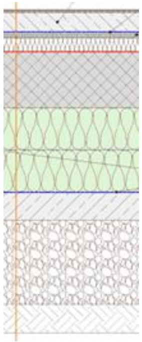


Assembly no.	Building assembly description	Interior insulation?
4	Pitched Roof (eq.therm.cond.)	

Heat transfer resistance [m²K/W] interior R_{si}: 0,10 exterior R_{se}: 0,10

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Mineral wool-Rockwool	0,035					120
2.	Mineral wool-Glasswool	0,04124	(eq.thermal conductivity)				160
3.	Mineral wool-Glasswool	0,04421	(eq.thermal conductivity)				50
4.	Gypsum board 2x12mm	0,250					24
5.	Interior plaster JUBOI	0,910					3
6.							
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 35,7 cm

U-value supplement: W/(m²K) **U-Value:** 0,114 W/(m²K)

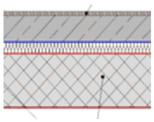


Assembly no.	Building assembly description	Interior insulation?
5	Floor Slab	

Heat transfer resistance [m²K/W] interior R_{si}: 0,17 exterior R_{se}: 0,00

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Wood flooring-hardwooc	0,180					10
2.	Screed	1,400					70
3.	Eurotherm EPS-T	0,051					20
4.	Eurotherm EPS 100	0,044					50
5.	Reinforced concrete	2,300					200
6.	EPS 300	0,038					300
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 65,0 cm

U-value supplement W/(m²K) **U-Value: 0,102** W/(m²K)

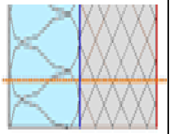


Assembly no.	Building assembly description	Interior insulation?
6	Basement Ceiling (heated basement)	

Heat transfer resistance [m²K/W] interior R_{si}: 0,17 exterior R_{se}: 0,17

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Wood flooring-hardwooc	0,180					10
2.	Screed	1,400					70
3.	Eurotherm EPS-T	0,051					30
4.	Eurotherm EPS 100	0,044					50
5.	Reinforced concrete	2,300					140
6.	Interior plaster JUBOI	0,910					3
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 30,3 cm

U-value supplement W/(m²K) **U-Value: 0,448** W/(m²K)

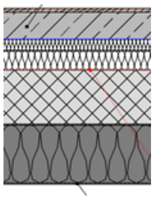


Assembly no.	Building assembly description	Interior insulation?
7	Basement Wall (heated basement)	

Heat transfer resistance [m²K/W] interior R_{si}: 0,13 exterior R_{se}: 0,00

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	JUBIZOL EPS Strong Pre	0,045					180
2.	JUBIZOL Adhesive morta	0,910					3
3.	Reinforced Concrete	2,300					200
4.	Interior plaster JUBOI	0,910					3
5.							
6.							
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 38,6 cm

U-value supplement W/(m²K) **U-Value: 0,237** W/(m²K)

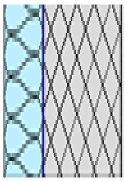


Assembly no.	Building assembly description	Interior insulation?
8	Basement Ceiling (unheated basement) 150mm	

Heat transfer resistance [m²K/W] interior R_{si}: 0,17 exterior R_{se}: 0,17

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Wood flooring-hardwooc	0,180					10
2.	Screed	1,400					70
3.	Eurotherm EPS-T	0,051					30
4.	Eurotherm EPS 100	0,044					50
5.	Reinforced concrete	2,300					140
6.	JUBIZOL EPS F-G	0,039					150
7.	Interior plaster JUBOI	0,910					3
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 45,3 cm

U-value supplement W/(m²K) **U-Value: 0,164** W/(m²K)



Assembly no.	Building assembly description					Interior insulation?
9	Basement Wall (unheated basement)					

Heat transfer resistance [m²K/W] interior R_{si}: 0,13; exterior R_{se}: 0,00

	Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
1.	Reinforced Concrete	2,300					200
2.	JUBIZOL EPS Strong Pre	0,045					100
3.	Interior plaster JUBOI	0,910					3
4.							
5.							
6.							
7.							
8.							
	Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 30,3 cm

U-value supplement ___ W/(m²K) **U-Value:** 0,409 W/(m²K)

Important note:

The above calculations of the U-value, calculated lambda values have been used similarly to the rated lambda values used as standard in Germany. The U-value calculation commonly used in other countries may differ noticeably from this.

The U-values calculated above are used for the standardised certification procedure for opaque building systems as used by the Passive House Institute and may not necessarily be used in international projects and country-specific calculation approaches for proof of thermal protection under public law.

5 Thermal bridge loss coefficient of the connection details

The basic principles and results of the heat flow calculations have been documented on the following pages. The details and the respective results are shown in the same recurring structure.

The applicant's information regarding the materials and lambda values of the examined building components is provided on the first sheet of the detail report. The type of airtight layer of the respective detail and its execution may also be mentioned in a highlighted text box.

The calculation basis used by the Passive House Institute and the illustrations showing the modelling approach with visualisation of the results can be seen on the second page.

Basic numerical parameters and the results are listed on the third page; any explanations and interpretations of the results are also given here.

For window connections, certification takes place based on the criterion that takes account of an entire standard window, therefore the result is found in the respective overall evaluation with consideration of different window installation situations.

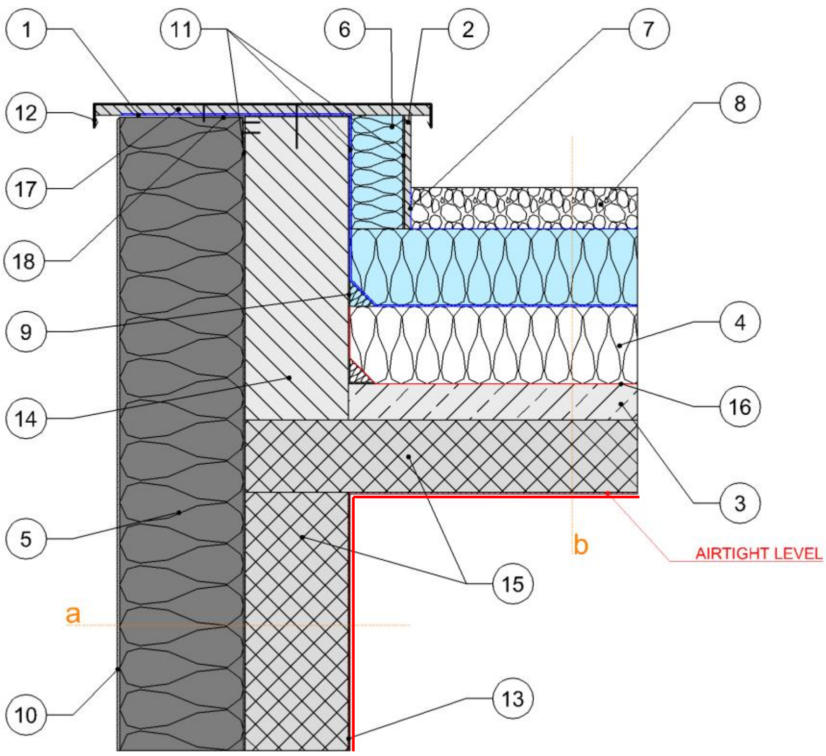
The illustrations in this documentation are not to scale.

5.1 Group A (roof connections)

5.1.1 Roof connection detail – attic

Massive Construction **Roof connection detail - attic**	Abbreviation Detail A3-02	JUB

Construction drawing - vertical section



Airtight level:

Self-leveling compound on the inner surfaces of roof slab and external wall must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint.

Before concreting the roof slab head-space surface of the wall is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

The contacts between the thermal insulation slabs should not be in the plane of headspace surface of the wall.

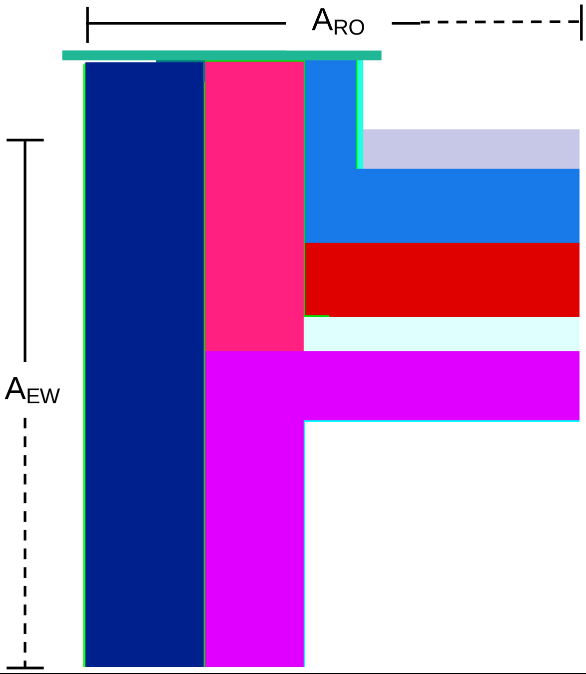
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : General component : Outer wall (a)				General component : Flat roof (b)		
13	Plaster (Jubolin + Jupol)	0,91	0,3	13	Plaster (Jubolin + Jupol)	0,91	0,3
15	Reinforced concrete	2,30	20,0	15	Reinforced concrete	2,30	14,0
11	Jubizol Adhesive mortar	0,91	0,5	3	Concrete	1,60	7,0
5	Jubizol EPS F-G	0,039	25,0	16	Vapour barrier	generic	0,05
10	Jubizol (base coat + finishing coat)	0,91	0,5	4	Eurotherm EPS 100	0,044	15,0
				1	Waterproofing – 2x bitumen membrane	0,17	1,25
				6	Jubizol EPS Strong Premium	0,045	15,0
				7	Fleece	generic	0,1
				8	Gravel	2,00	8,0
	General component :				Other materials (materials not included in general component)		
				12	Metal sheeting (steel)	50,00	0,1
				17	Wood-cement panel	0,28	2,0
				14	Porous concrete	0,118	20,0
				9	Hidrozol	0,91	0,3
				2	Cement panel	0,67	1,2
				7	Fleece	generic	0,1
				18	Metal profile (steel) HOP 100x40x4	50,00	0,4

Graphical presentation of the results (A3-02):

Materials

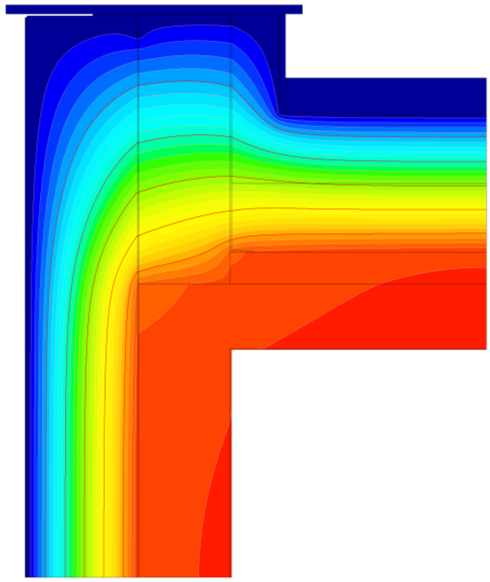
Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
Innenputz (Jubolin+Jupol)	0.910			
Stahl	50.000			
Beton unbewehrt	1.600			
Eurotherm EPS 100	0.044			
Stahlbeton	2.300			
Jubizol adhesive mortar	0.910			
Jubizol EPS F-G	0.039			
Jubizol EPS Strong Premium	0.045			
Gasbeton	0.118			
innen Wärmestrom aufwärts			20.0	10.00
Kies	2.000			
Aussenputz (Jubizol)	0.910			
Zement-Platte	0.670			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70
Zementfaserplatte	0.280			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-02):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-02**		
connection detail:	**external wall to flat roof**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Flat Roof	U_2	0,14	W/(m²K)

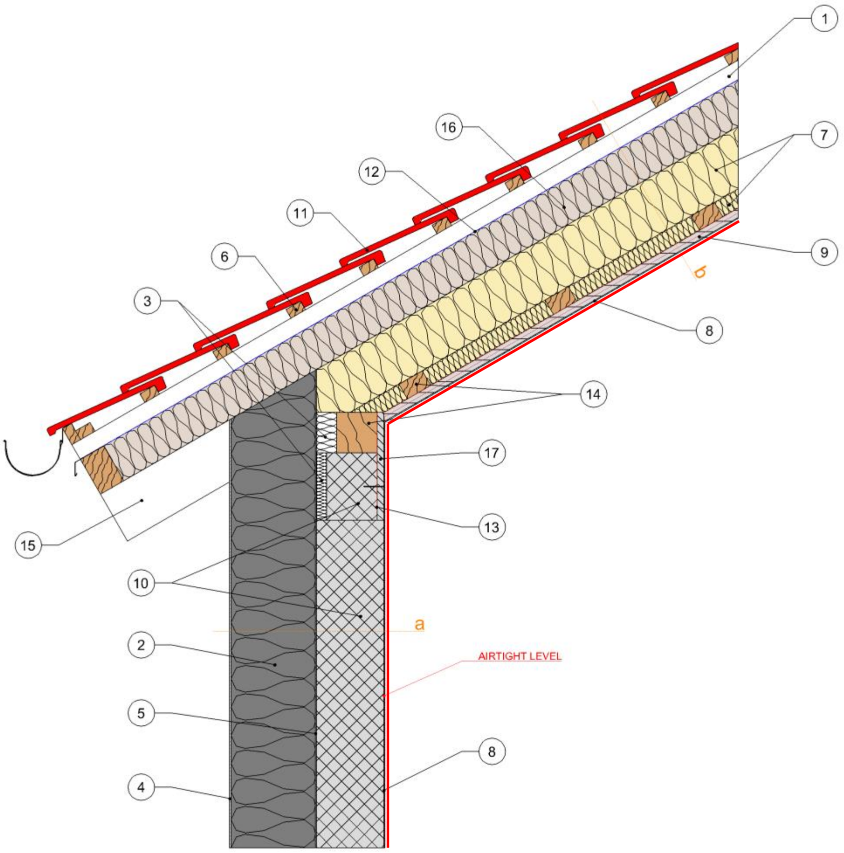
results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,052	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,8	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,93	-

The connection is thermal bridge free. The depicted seal may be used:

5.1.2 Roof connection detail external wall – pitched roof

Massive Construction **Roof connection detail external wall – pitched roof**	Abbreviation Detail A3-03

Construction drawing - vertical section



Airtight level:

In order to achieve airtightness of the contact between pitched roof and external wall, it is necessary to keep vapor barrier over the corner with ending on a concrete mount, overlap must be greater than 100 mm and fixed with suitable adhesive tape.

To avoid uncontrolled crack formation at joint of linings in the corner, joint is carried out by sliding connection between the linings.

Before concreting the concrete mount headspace surface of the wall is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

The contacts between the thermal insulation slabs should not be in the plane of headspace surface of the wall.

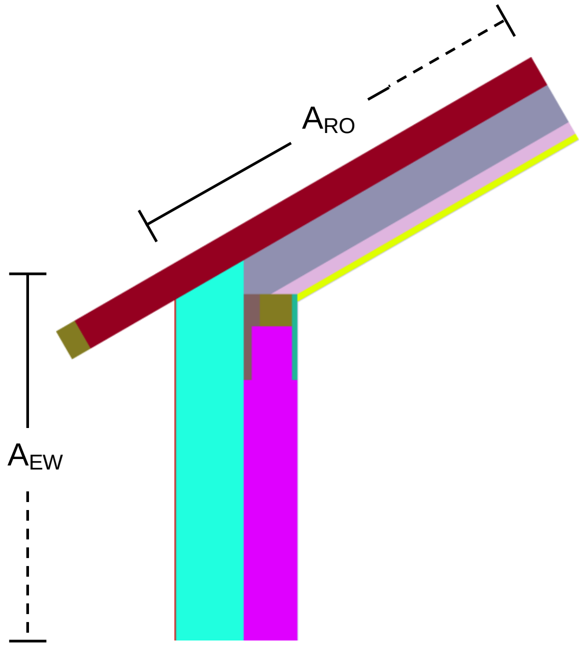
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : General component : Outer wall (a)				General component : Pitched roof (b)		
8	Plaster (Jubolin + Jupol)	0,91	0,3	8	Plaster (Jubolin + Jupol)	0,91	0,3
10	Reinforced concrete	2,30	20,0	9	Plaster board 2x12,5 mm	0,25	2,5
5	Jubizol Adhesive mortar	0,91	0,5	13	Vapour barrier	generic	0,05
2	Jubizol EPS F-G	0,039	25,0	7	Mineral wool - glasswool	0,035	5
4	Jubizol (base coat + finishing coat)	0,91	0,5	(14)	(softwood 50 x 80 mm, e = 0,6 m)	0,13	5
				7	Mineral wool - glasswool	0,035	16
				(15)	(softwood 60 x 160 mm, e = 0,6 m)	0,13	16
				16	Mineral wool - rockwool	0,035	12
				12	Roof underlayment	generic	0,05
	General component :				Other materials (materials not included in general component)		
				3	Eurotherm EPS 100	0,044	6 and 3
				1	Counter lathe - softwood	0,13	5
				6	Lathe - softwood	0,13	3
				11	Roof tile	N/A	N/A
				17	Wood-cement panel	0,28	2

Graphical presentation of the results (A3-03):

Materials

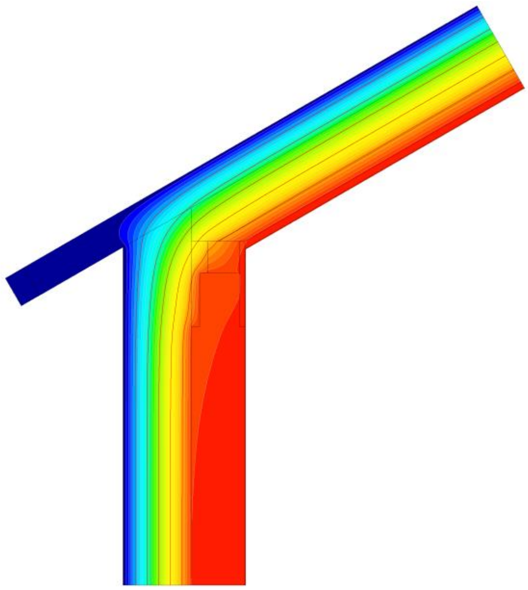
Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
Aussenputz (Jubizol)	0.910			
Stahlbeton	2.300			
Gipskartonplatte	0.250			
adiabat 0° 0W/m²K			0.0	0.00
Eurotherm EPS 100	0.044			
innen Wärmestrom aufwärts			20.0	10.00
Mineralwolle, eq.therm.cond.	0.041			
Innenputz (Jubolin+Jupol)	0.910			
Weichholz ca.500kg/m³	0.130			
Jubizol EPS F-G	0.039			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70
Mineralwolle	0.035			
Faserzementplatte	0.280			
Mineralwolle, eq.therm.cond.	0.044			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-03):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-03**		
connection detail:	**external wall to pitched roof - eaves**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Pitched Roof	U_2	0,11	W/(m²K)

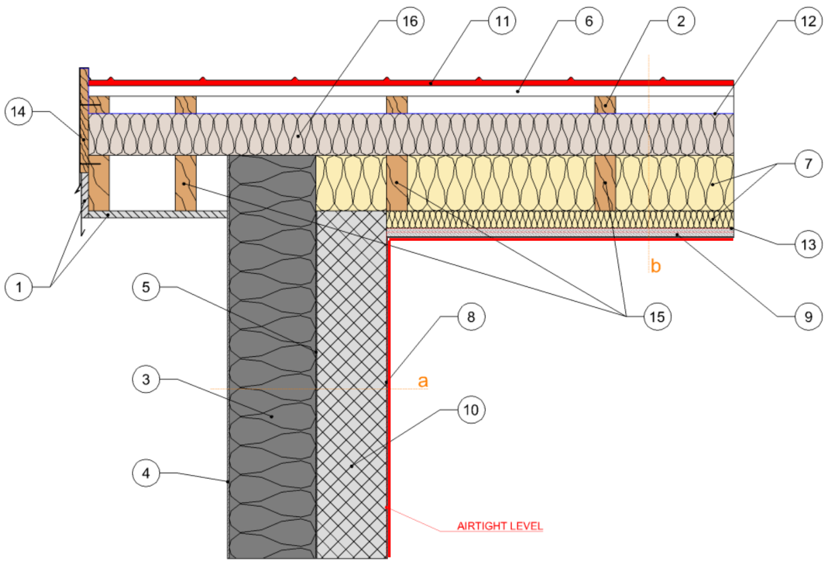
results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,037	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	18,6	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,95	-

The connection is thermal bridge free. The depicted seal may be used:

5.1.3 Roof connection detail external wall – pitched roof (verge)

Massive Construction **Roof connection detail external wall – pitched roof (verge)**	Abbreviation Detail A3-04

Construction drawing - vertical section



Airtight level:

To achieve airtightness the vapor barrier is fixed on the wall with suitable and durable adhesive tape.

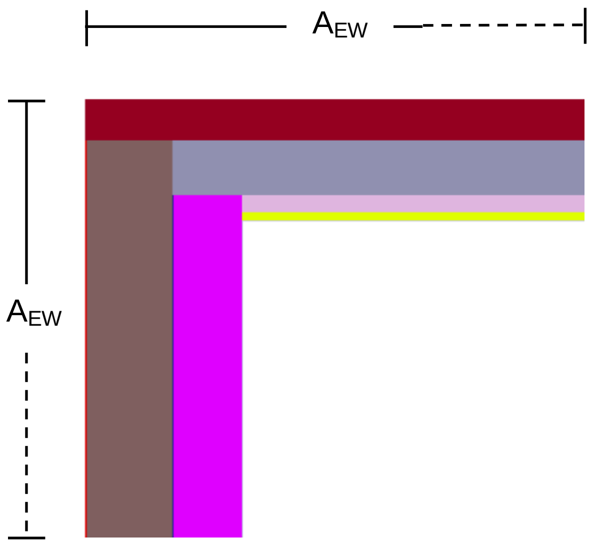
From indoor to outdoor		λ [W/(mK)]	Thick. [cm]	From indoor to outdoor		λ [W/(mK)]	Thick. [cm]
General component : General component : Outer wall (a)				General component : Pitched roof (b)			
8	Plaster (Jubolin + Jupol)	0,91	0,3	8	Plaster (Jubolin + Jupol)	0,91	0,3
10	Reinforced concrete	2,30	20	9	Plaster board 2x12,5 mm	0,25	2,5
5	Jubizol Adhesive mortar	0,91	0,5	13	Vapour barrier	generic	0,05
3	Jubizol EPS F-G	0,039	25	7	Mineral wool - glasswool	0,035	5
4	Jubizol (base coat + finishing coat)	0,91	0,5		(softwood 50 x 80 mm, e = 0,6 m)	0,13	5
				7	Mineral wool - glasswool	0,035	16
				(15)	(softwood 60 x 160 mm, e = 0,6 m)	0,13	16
				16	Mineral wool - rockwool	0,035	12
				12	Roof underlayment	generic	0,05
General component :				Other materials (materials not included in general component)			
				1	Gypsum fiber board	0,46	18
				2	Counter lathe - softwood	0,13	5
				6	Lathe - softwood	0,13	3
				11	Roof tile	N/A	N/A
				14	Wood-softwood	0,13	2,4
				17	Metal sheeting	generic	0,1

Graphical presentation of the results (A3-04):

Materials

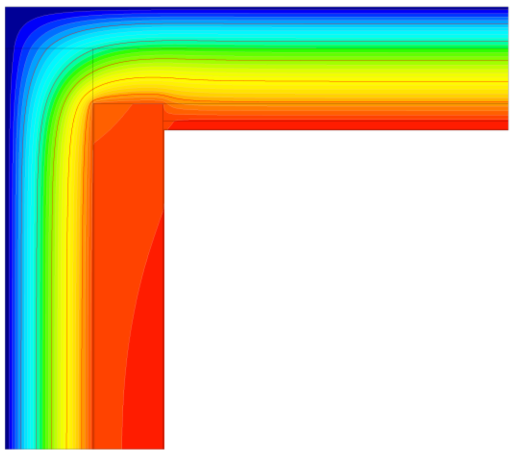
Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
Aussenputz (Jubizol)	0.910			
Stahlbeton	2.300			
Gipskartonplatte	0.250			
Jubizol EPS F-G	0.044			
Kleber (Jubizol)	0.910			
innen Wärmestrom aufwärts			20.0	10.00
Mineralwolle, eq.therm.cond.	0.041			
Innenputz (Jubolin+Jupol)	0.910			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70
Mineralwolle	0.035			
Mineralwolle, eq.therm.cond.	0.044			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-04):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-04**		
connection detail:	**external wall to pitched roof - verge**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Pitched Roof	U_2	0,11	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,029	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,7	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,92	-

The connection is thermal bridge free. The depicted seal may be used:

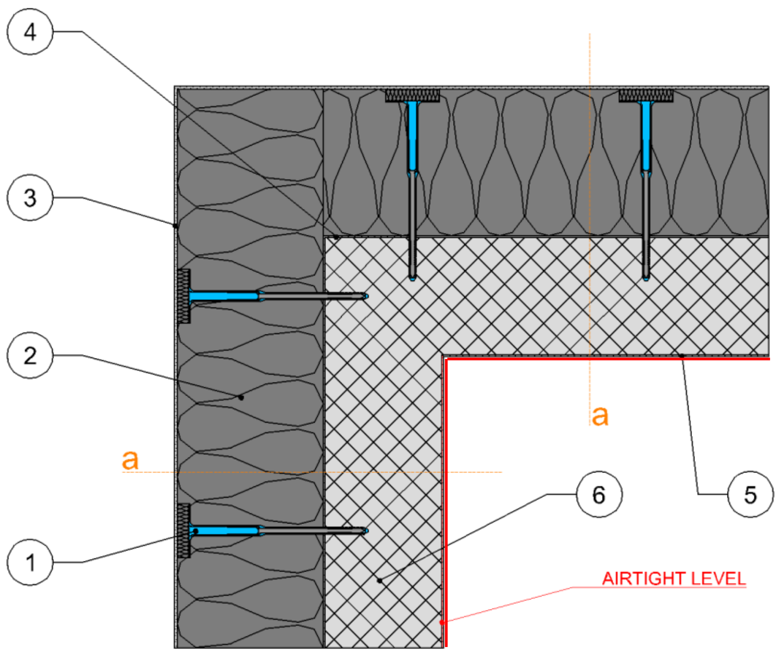
CERTIFIED COMPONENT
Passive House Institute

5.2 Group B (exterior wall connections)

5.2.1 External edge of external wall

Massive Construction **External edge of external wall**	Abbreviation Detail A3-05	JUB

Construction drawing - vertical section



Airtight level:

Self-leveling compound on the inner surfaces of external walls must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint.

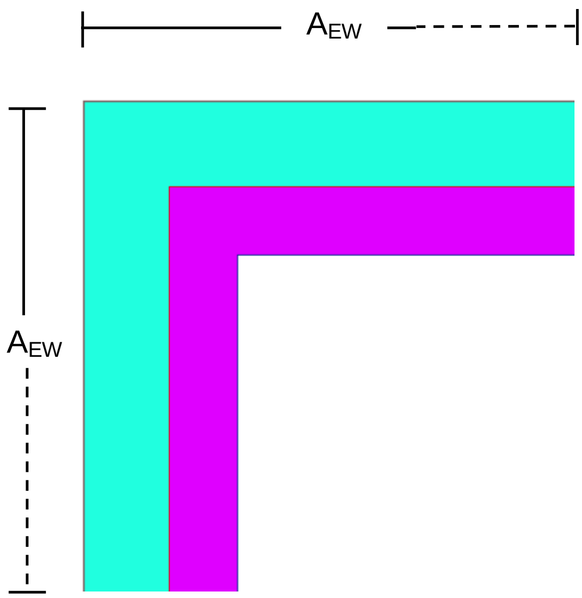
From indoor to outdoor		λ [W/(mK)]	Thick. [cm]	From indoor to outdoor		λ [W/(mK)]	Thick. [cm]
General component : Outer wall (a)				General component :			
5	Plaster (Jubolin + Jupol)	0,91	0,3				
6	Reinforced concrete	2,30	20				
4	Jubizol Adhesive mortar	0,91	0,5				
2	Jubizol EPS F-G	0,039	25				
3	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component)			
				1	Anchor	N/A	N/A

Graphical presentation of the results (A3-05):

Materials

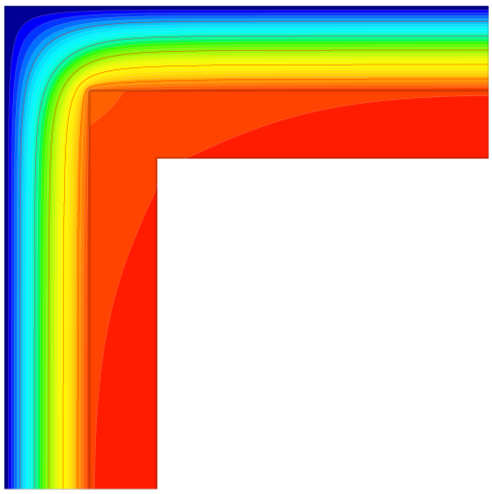
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Kleber (Jubizol)	0.910			
	Stahlbeton	2.300			
	Aussenputz (Jubizol)	0.910			
	Innenputz (Jubolin+Jupol)	0.910			
	Jubizol EPS F-G	0.039			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-05):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-05**		
connection detail:	**external edge of external wall**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
External Wall	U_2	0,15	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,061	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	18,1	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,94	-

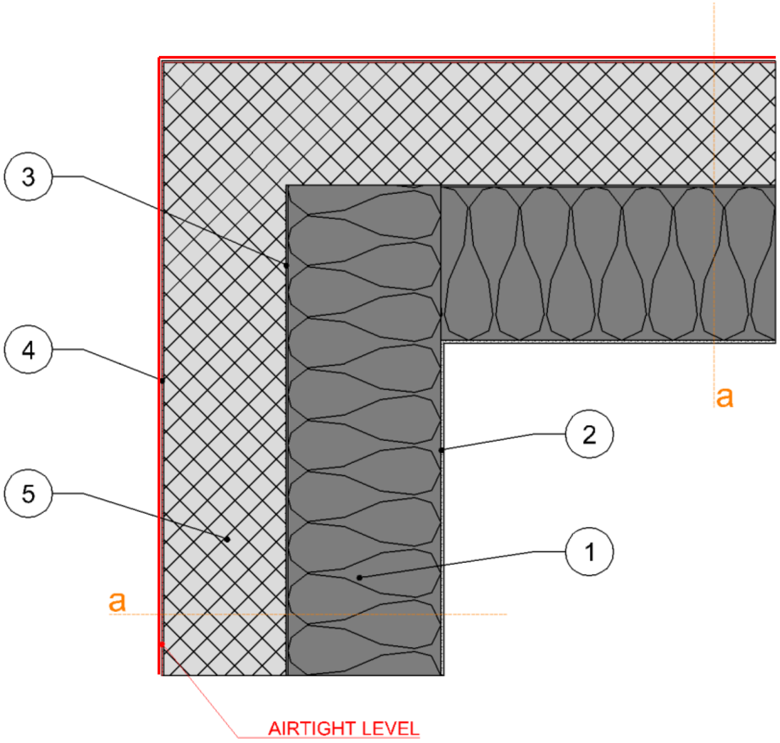
The connection is thermal bridge free. The depicted seal may be used:

CERTIFIED COMPONENT
Passive House Institute

5.2.2 Internal edge of external wall

Massive Construction **Internal edge of external wall**	Abbreviation Detail A3-06	JUB

Construction drawing - vertical section



Airtight level:

Self-leveling compound on the inner surfaces of external walls must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint. Plastic or aluminium corner can be used.

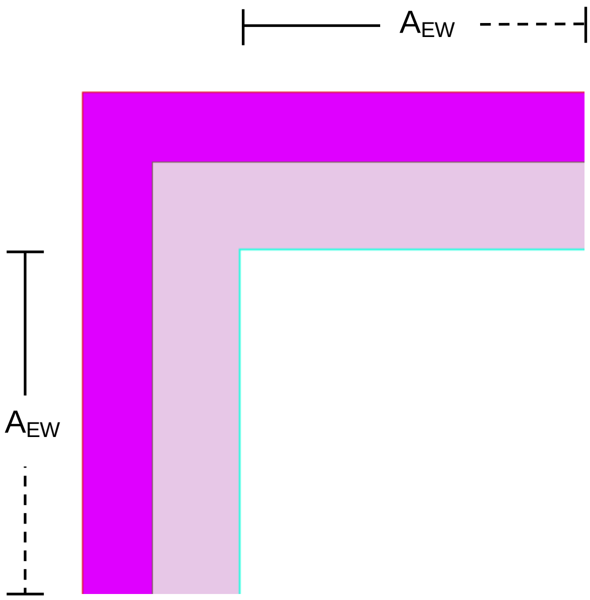
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : Outer wall (a)				General component :			
4	Plaster (Jubolin + Jupol)	0,91	0,3				
5	Reinforced concrete	2,30	20				
3	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			

Graphical presentation of the results (A3-06):

Materials

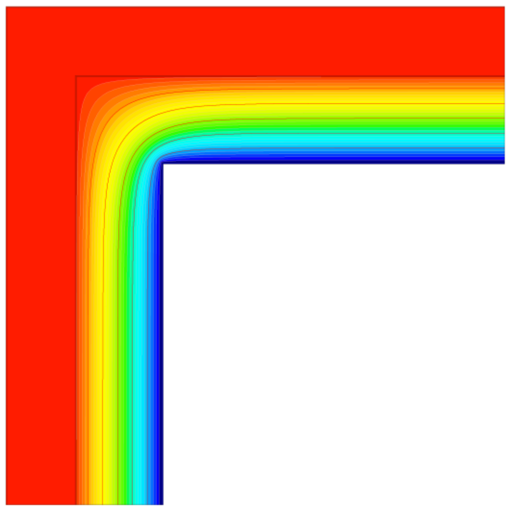
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Innenputz (Jubolin+Jupol)	0.910			
	Stahlbeton	2.300			
	Kleber (Jubizol)	0.910			
	Jubizol EPS F-G	0.039			
	Aussenputz (Jubizol)	0.910			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-06):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-06**		
connection detail:	**internal edge of external wall**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
External Wall	U_2	0,15	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,023	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	19,0	°C
without thermal bridges?	The connection is not thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,97	-

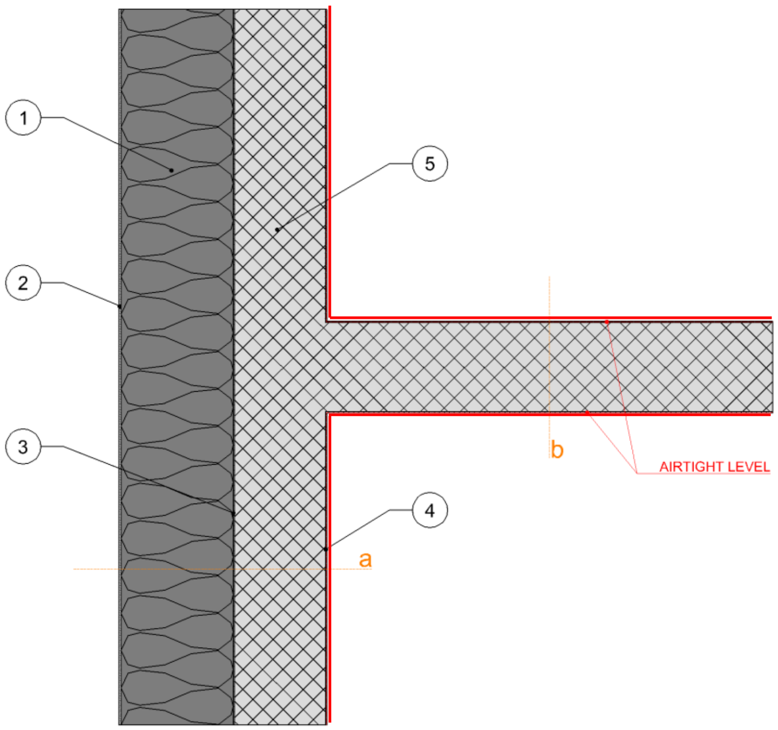
The connection is not thermal bridge free (geometric thermal bridge), but Passive House suitable.

The linear thermal bridge loss coefficient Ψ_a has to be considered in the PHPP calculation.

5.2.3 Internal wall meets external wall

Massive Construction **Internal wall meets external wall**	Abbreviation Detail A3-07	JUB

Construction drawing - vertical section



Airtight level:

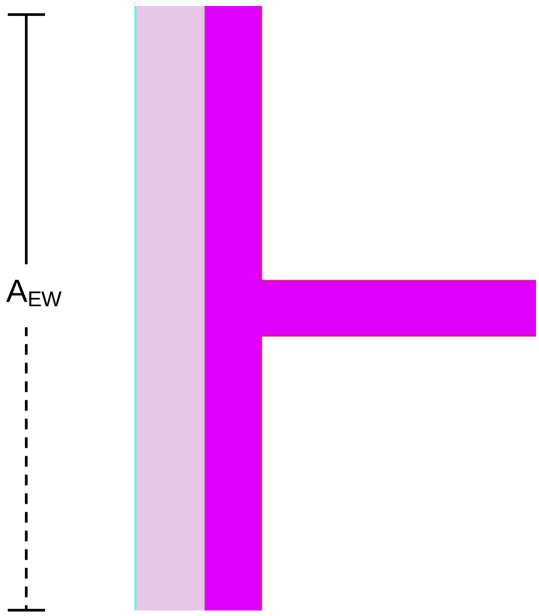
Self-leveling compound on the inner surfaces of external walls must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint.

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : Outer wall (a)				General component : Internal wall (b)			
4	Plaster (Jubolin + Jupol)	0,91	0,3	4	Plaster (Jubolin + Jupol)	0,91	0,3
5	Reinforced concrete	2,30	20	5	Reinforced concrete	2,30	20
3	Jubizol Adhesive mortar	0,91	0,5	4	Plaster (Jubolin + Jupol)	0,91	0,3
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			

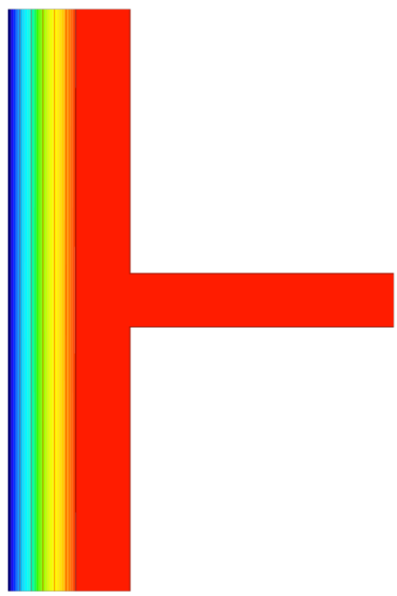
Graphical presentation of the results (A3-07):

Materials	Model

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Innenputz (Jubolin+Jupol)	0.910			
	Stahlbeton	2.300			
	Kleber (Jubizol)	0.910			
	Jubizol EPS F-G	0.039			
	Aussenputz (Jubizol)	0.910			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70



Temperature [°C]	Isotherms



Calculation results according to DIN EN ISO 10211 (A3-07):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-07**		
connection detail:	**internal wall meets external wall**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	$(m^2K)/W$
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	$(m^2K)/W$
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	$(m^2K)/W$
interior heat transfer resistance, upwards	R_{si}	0,10	$(m^2K)/W$
interior heat transfer resistance, horizontal	R_{si}	0,13	$(m^2K)/W$
interior heat transfer resistance, downwards	R_{si}	0,17	$(m^2K)/W$
heat transfer resistance to the ground	R_{sg}	0,00	$(m^2K)/W$
heat transfer coefficients			
External Wall	U_1	0,15	$W/(m^2K)$
0	U_2	0,00	$W/(m^2K)$

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,000	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	18,9	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 $(m^2K)/W$	$f_{Rsi=0.25}$	0,96	-

The connection is thermal bridge free. The depicted seal may be used:

CERTIFIED COMPONENT
Passive House Institute

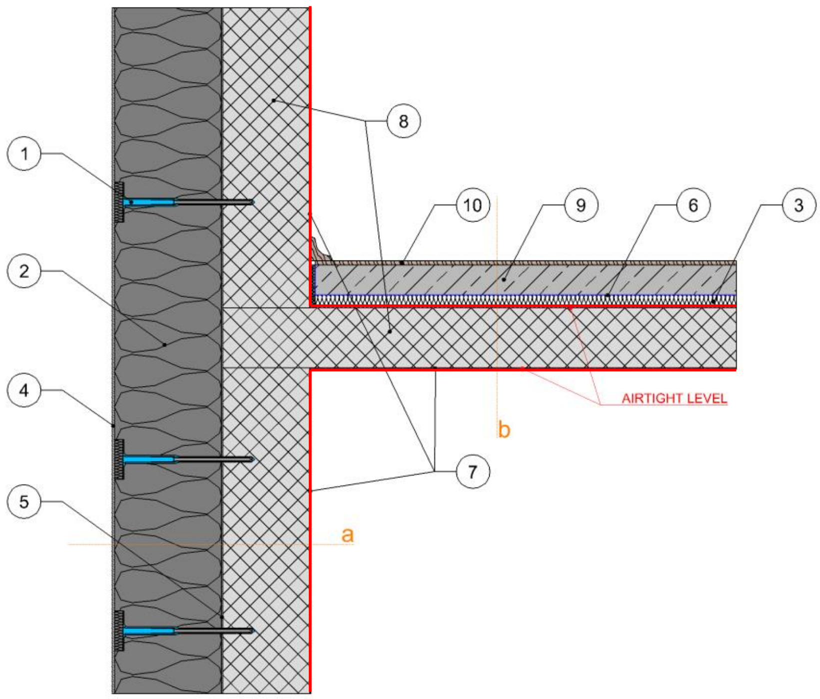
5.2.4 Ceiling supported by external wall

Massive Construction Ceiling supported by external wall	Abbreviation Detail A3-08	JUB

Massive Construction

Ceiling supported by external wall

Construction drawing - vertical section



Airtight level:

Self-leveling compound on the inner surfaces of ceiling and external wall must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint.

Prior to installation of EPS-T for sound insulation, self-leveling compound of wall must be applicated to the base of the wall.

Before concreting the ceiling, head-space surface of the wall is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint. The same goes prior concreting walls on next floor (at the base of the wall).

The contacts between the thermal insulation slabs should not be in the plane of upper or lower edge of the ceiling.

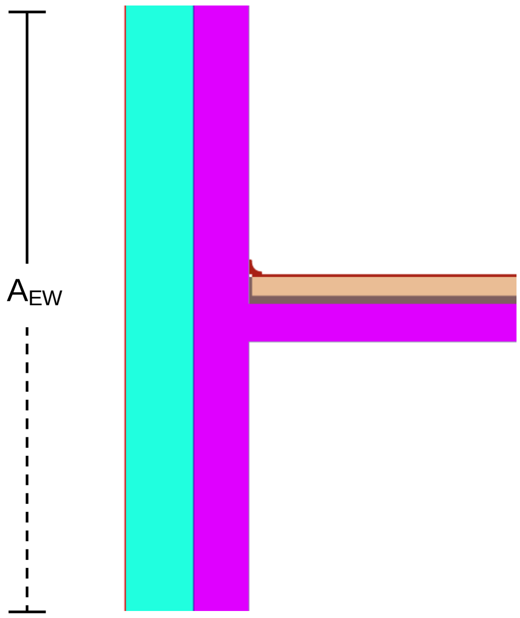
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From below	λ [W/(mK)]	Thick. [cm]
General component : Outer wall (a)				General component : ceiling (b)			
7	Plaster (Jubolin + Jupol)	0,91	0,3	7	Plaster (Jubolin + Jupol)	0,91	0,3
8	Reinforced concrete	2,30	20	8	Reinforced concrete	2,30	14
5	Jubizol Adhesive mortar	0,91	0,5	3	Eurotherm EPS-T	0,051	3
2	Jubizol EPS F-G	0,039	25	6	PE foil	generic	0,05
4	Jubizol (base coat + finishing coat)	0,91	0,5	9	Screed	1,40	7
				10	Wood floring - hardwood	0,18	1
General component :				Other materials (materials not included in general component) :			
				1	Anchor	N/A	N/A

Graphical presentation of the results (A3-08):

Materials

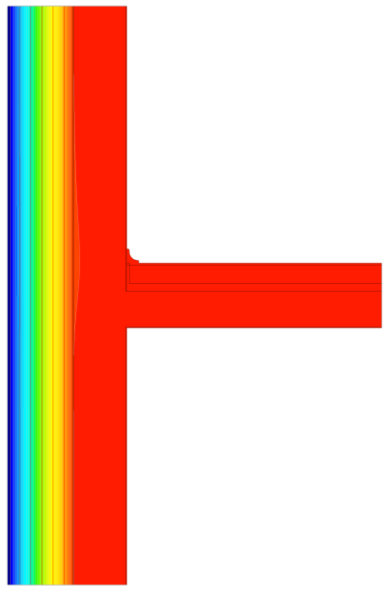
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
		0.058			
	Hartholz ca. 700kg/m³	0.180			
	Aussenputz (Jubizol)	0.910			
	Stahlbeton	2.300			
	Eurotherm EPS-T	0.051			
	Estrich	1.400			
	Kleber (Jubizol)	0.910			
	Innenputz (Jubolin+Jupol)	0.910			
	Jubizol EPS F-G	0.039			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-08):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-08**		
connection detail:	**ceiling supported by external wall**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
0	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,000	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	18,9	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,96	-

The connection is thermal bridge free. The depicted seal may be used:

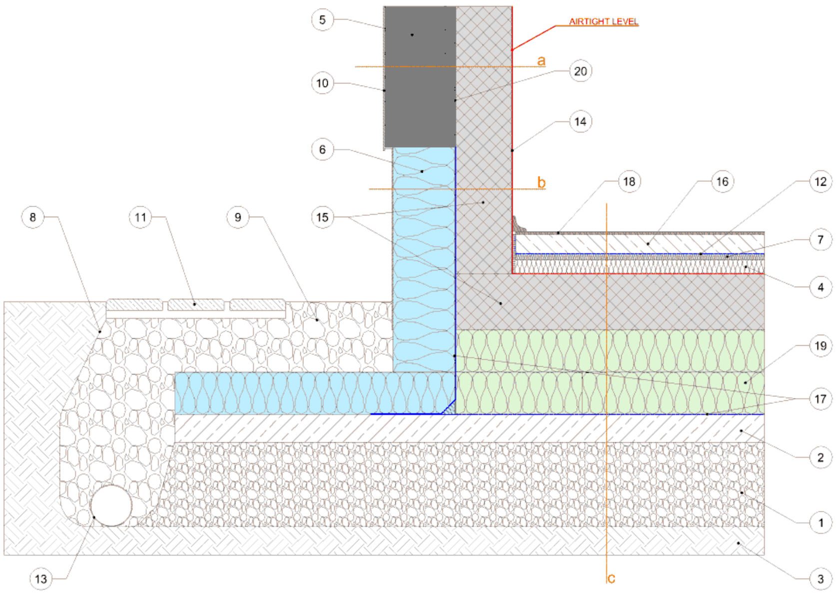
CERTIFIED COMPONENT
Passive House Institute

5.3 Group C (basement and plinth connections)

5.3.1 Base detail external wall on floor slab

Massive Construction **Base detail external wall on floor slab**	Abbreviation Detail A3-09	JUB

Construction drawing - vertical section



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the foot of the wall.

Before concreting the wall, at the base of the wall floor slab is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

The contacts between the thermal insulation slabs should not be in the plane of upper edge of the concrete floor slab.

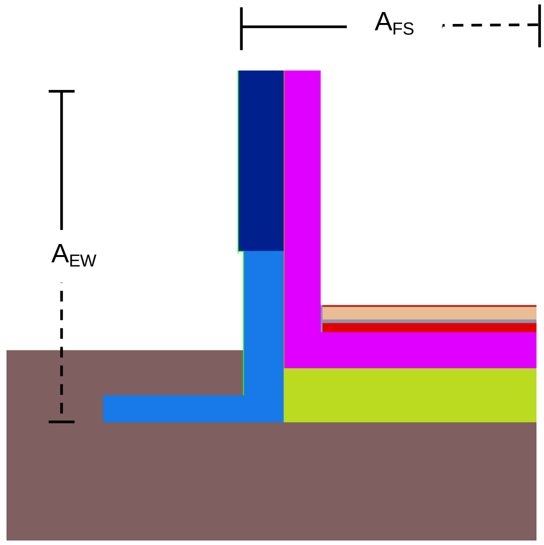
From indoor to outdoor		λ [W/(mK)]	Thick. [cm]	From below		λ [W/(mK)]	Thick. [cm]
General component : Outer wall (a)				General component : Outer wall (b)			
14	Plaster (Jubolin + Jupol)	0,91	0,3	14	Plaster (Jubolin + Jupol)	0,91	0,3
15	Reinforced concrete	2,30	20	15	Reinforced concrete	2,30	20
20	Jubizol Adhesive mortar	0,91	0,5	17	Waterproofing – bitumen membrane	0,17	0,3
5	Jubizol EPS F-G	0,039	25	20	Jubizol Adhesive mortar	0,91	0,3
10	Jubizol (base coat + finishing coat)	0,91	0,5	6	Jubizol EPS Strong Premium	0,045	22
				10	Jubizol (base coat + finishing coat)	0,91	0,3
General component : Floor slab (c)				Other materials (materials not included in general component) :			
18	Wood floring - hardwood	0,18	1	9	Gravel	1,00	25
16	Screed	1,40	7	11	Paving	generic	N/A
12	PE foil	generic	0,05	8	Fleece membrane	generic	0,1
7	Eurotherm EPS-T	0,051	3	13	Perforated drainage pipe	N/A	N/A
4	Eurotherm EPS 100	0,044	5				
15	Reinforced concrete	2,30	20				
19	EPS 300	0,038	30				
17	Waterproofing – bitumen membrane	0,17	0,3				
2	Concrete	1,60	10				
1	Compacted gravel	1,00	30				
3	Soil	2,00	N/A				

Graphical presentation of the results (A3-09):

Materials

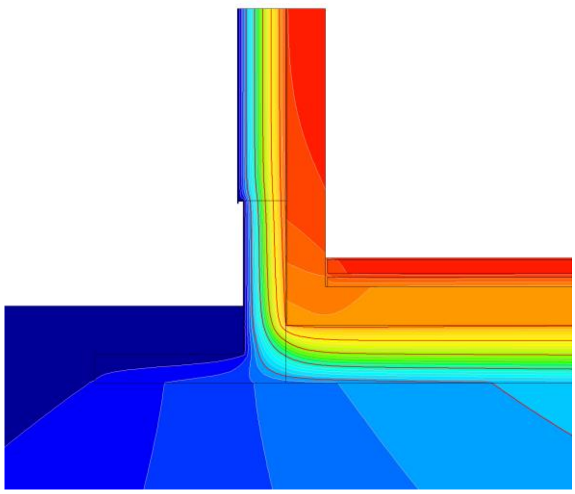
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Hartholz ca. 700kg/m³	0.180			
	Eurotherm EPS 100	0.044			
	Stahlbeton	2.300			
	Erdreich	2.000			
	Estrich	1.400			
	Jubizol EPS F-G	0.039			
	Jubizol EPS Strong Premium	0.044			
	Eurotherm EPS-T	0.051			
	Aussenputz (Jubizol)	0.910			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70
	innen Wärmestrom abwärts 20°C			20.0	6.00
	EPS 300	0.038			
	Kleber (Jubizol)	0.910			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-09):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-09**		
connection detail:	**external wall on floor slab**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Floor Slab	U_2	0,00	W/(m²K)

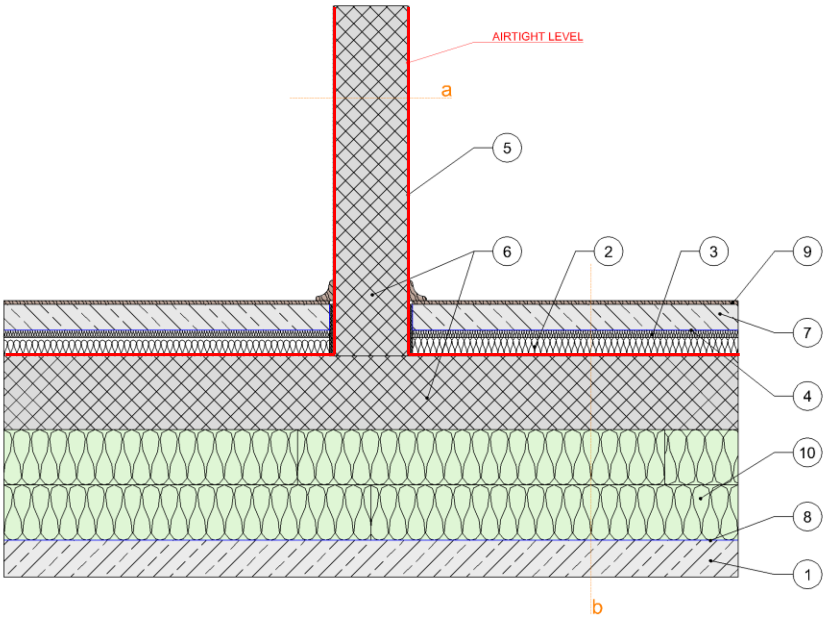
results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,030	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,0	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-

The connection is thermal bridge free. The depicted seal may be used:

5.3.2 Base detail internal wall on floor slab

Massive Construction **Base detail internal wall on floor slab**	Abbreviation Detail A3-10	JUB

Construction drawing - vertical section



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the foot of the wall.

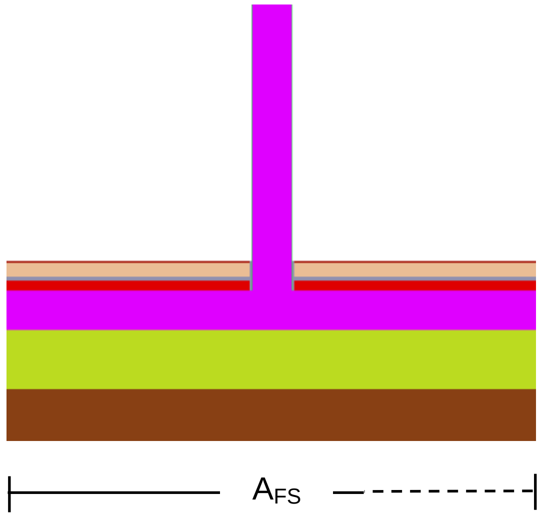
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : Internal wall (a)				General component : Floor slab (b)			
5	Plaster (Jubolin + Jupol)	0,91	0,3	9	Wood floring - hardwood	0,18	1
6	Reinforced concrete	2,30	20	7	Screed	1,40	7
5	Plaster (Jubolin + Jupol)	0,91	0,3	4	PE foil	generic	0,05
				3	Eurotherm EPS-T	0,051	3
				2	Eurotherm EPS 100	0,044	5
				6	Reinforced concrete	2,30	20
				10	EPS 300	0,038	30
				8	Waterproofing – bitumen membrane	0,17	0,3
				1	Concrete	1,60	10
General component :				Other materials (materials not included in general component) :			

Graphical presentation of the results (A3-10):

Materials

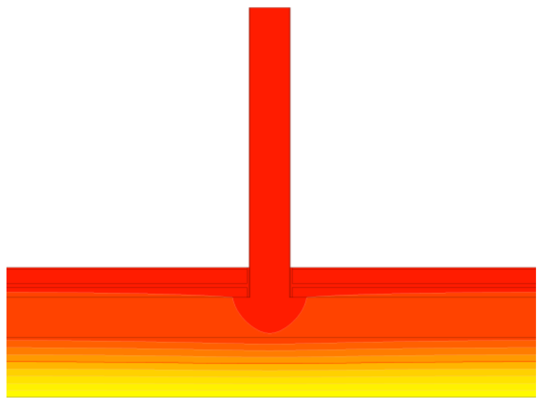
Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
Hartholz ca. 700kg/m³	0.180			
Eurotherm EPS 100	0.044			
Stahlbeton	2.300			
Estrich	1.400			
Innenputz (Jubolin+Jupol)	0.910			
Eurotherm EPS-T	0.051			
Ground, 10°C			10.0	10000.00
innen Wand 20°C 7.69W/m²K			20.0	7.70
innen Wärmestrom abwärts 20°C			20.0	6.00
EPS 300	0.038			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-10):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-10**		
connection detail:	**internal wall on floor slab**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
Floor Slab	U_1	0,10	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,007	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	19,5	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,98	-

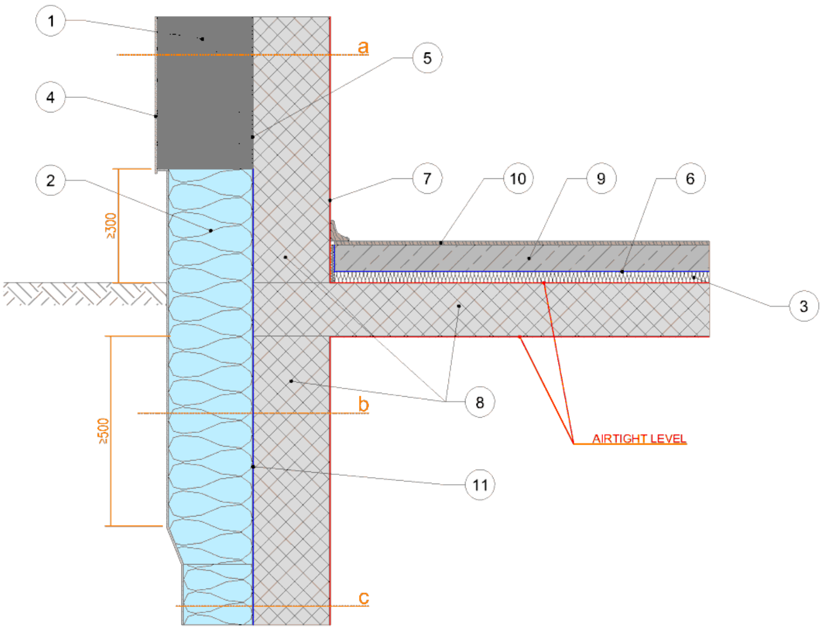
The connection is thermal bridge free. The depicted seal may be used:

CERTIFIED COMPONENT
Passive House Institute

5.3.3 External wall on basement ceiling, heated basement

Massive Construction **External wall on basement ceiling, heated basement**	Abbreviation Detail A3-11	JUB

Construction drawing - vertical section



Airtight level:

Self-leveling compound on the inner surfaces of ceiling and external wall must be made in this manner that is continuous, e.g. there shouldn't be any break - gap in the joint.

Prior to installation of EPS-T for sound insulation, self-leveling compound of wall must be made to the base of the wall.

Before concreting the ceiling, head-space surface of the wall is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint. The same goes prior concreting walls on next floor (at the base of the wall).

The contacts between the thermal insulation slabs should not be in the plane of upper or lower edge of the ceiling.

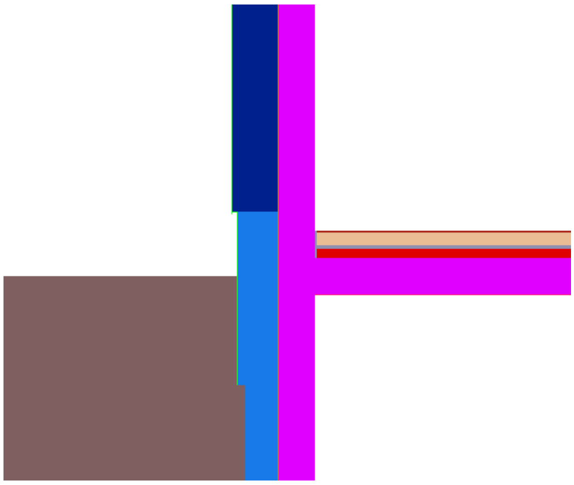
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : external wall (a)				General component : external wall (b)		
7	Plaster (Jubolin + Jupol)	0,91	0,3	7	Plaster (Jubolin + Jupol)	0,91	0,3
8	Reinforced concrete	2,30	20	8	Reinforced concrete	2,30	20
5	Jubizol Adhesive mortar	0,91	0,3	11	Waterproofing – bitumen membrane	0,17	0,3
1	Jubizol EPS F-G	0,039	25	5	Jubizol Adhesive mortar	0,91	0,3
4	JUBIZOL (base coat + finishing coat)	0,91	0,5	2	Jubizol EPS Strong premium	0,045	22
	General component : external wall (c)				Other materials (materials not included in general component) :		
7	Plaster (Jubolin + Jupol)	0,91	0,3	3	Eurotherm EPS T	0,051	3
8	Reinforced concrete	2,30	20	6	PE foil	generic	0,05
11	Waterproofing – bitumen membrane	0,17	0,3	9	Screed	1,40	7
5	Jubizol Adhesive mortar	0,91	0,3	10	Wood floring - hardwood	0,18	1
2	Jubizol EPS Strong premium	0,045	18				

Graphical presentation of the results (A3-11):

Materials

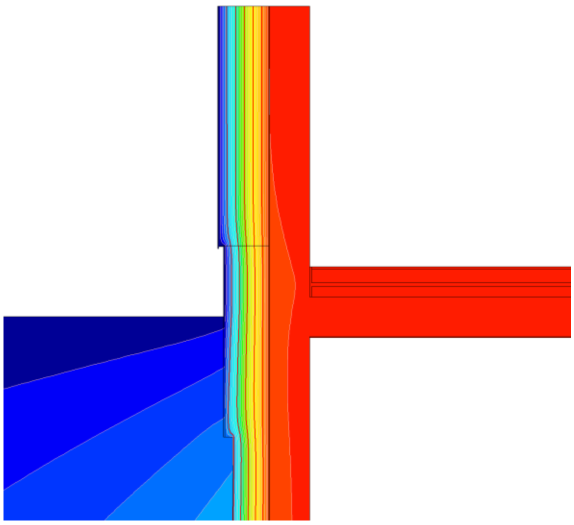
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Hartholz ca. 700kg/m^3	0.180			
	Eurotherm EPS 100	0.044			
	Stahlbeton	2.300			
	Erdreich	2.000			
	Estrich	1.400			
	Jubizol EPS F-G	0.039			
	Jubizol EPS Strong Premium	0.044			
	Innenputz (Jubolin+Jupol)	0.910			
	Eurotherm EPS-T	0.051			
	Aussenputz (Jubizol)	0.910			
	außen -10°C 25W/m^2K			-10.0	25.00
	innen Wand 20°C 7.69W/m^2K			20.0	7.70
	innen Wärmestrom abwärts 20°C			20.0	6.00
	EPS 300	0.038			
	Kleber (Jubizol)	0.910			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-11):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-11**		
connection detail:	**external wall on basement ceiling - heated basement**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m^{2}K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m^{2}K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m^{2}K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m^{2}K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m^{2}K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m^{2}K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m^{2}K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m^{2}K)
Heat flow basement wall and basement floor slab	U_2	0,00	W/(m^{2}K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,011	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m^{2}K)/W	$f_{Rsi=0.25}$	0,90	-

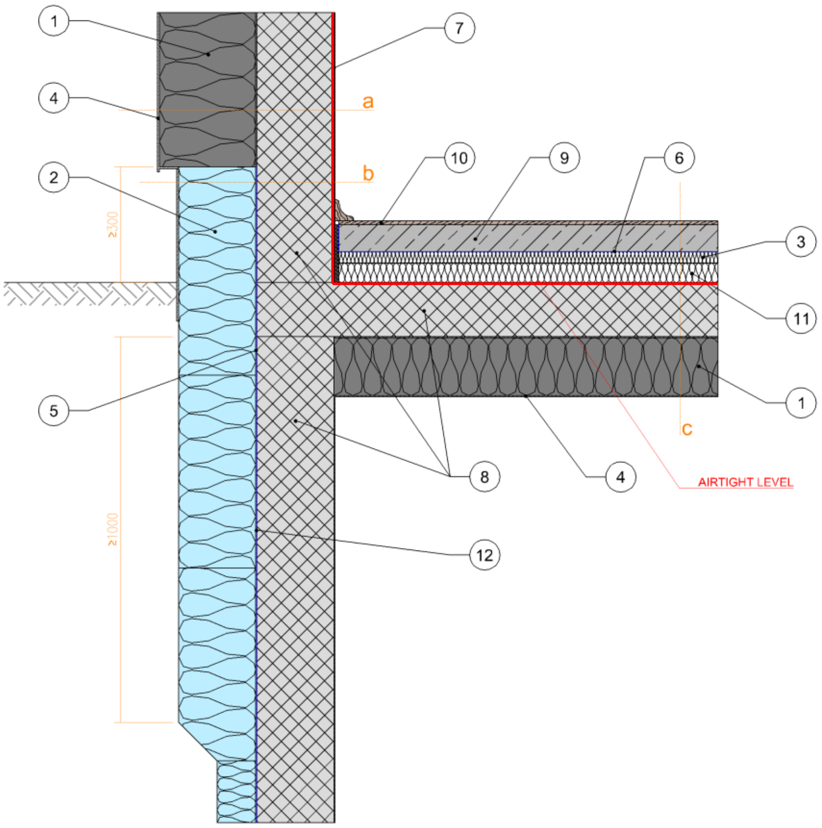
The connection is thermal bridge free. The depicted seal may be used:

CERTIFIED COMPONENT
Passive House Institute

5.3.4 External wall on basement ceiling, unheated basement, without thermal break

Massive Construction **External wall on basement ceiling, unheated basement**	Abbreviation Detail A3-12	JUB

Construction drawing - vertical section



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the foot of the wall.

Before concreting the wall, at the base of the wall ceiling is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

The contacts between the thermal insulation slabs should not be in the plane of upper edge of the concrete floor slab.

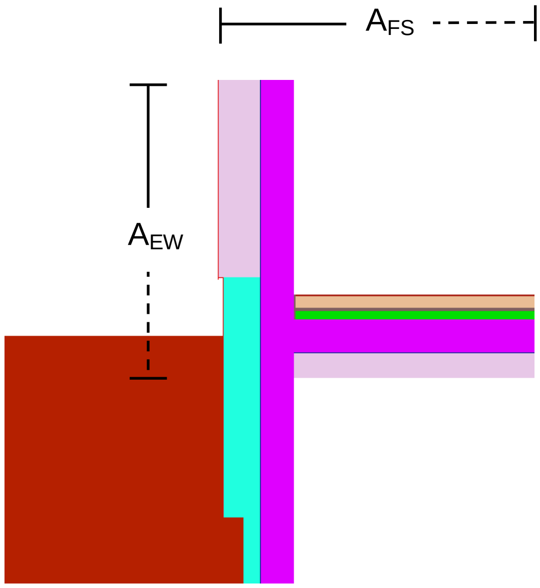
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : external wall (a)				General component : external wall (b)		
7	Plaster (Jubolin + Jupol)	0,91	0,3	7	Plaster (Jubolin + Jupol)	0,91	0,3
8	Reinforced concrete	2,30	20	8	Reinforced concrete	2,30	20
5	Jubizol Adhesive mortar	0,91	0,3	12	Waterproofing – bitumen membrane	0,17	0,3
1	Jubizol EPS F-G	0,039	25	5	Jubizol Adhesive mortar	0,91	0,3
4	JUBIZOL (base coat + finishing coat)	0,91	0,3	2	Jubizol EPS Strong premium	0,045	22
				4	JUBIZOL (base coat + finishing coat)	0,91	0,3
	General component : basement ceiling (c)				Other materials (materials not included in general component) :		
10	Wood floring - hardwood	0,18	1				
9	Screed	1,40	7				
6	PE foil	generic	0,05				
3	Eurotherm EPS T	0,051	3				
11	Eurotherm EPS 100	0,044	5				
8	Reinforced concrete	2,30	14				
1	Jubizol EPS F-G	0,039	15				
4	JUBIZOL (base coat + finishing coat)	0,91	0,3				

Graphical presentation of the results (A3-12):

Materials

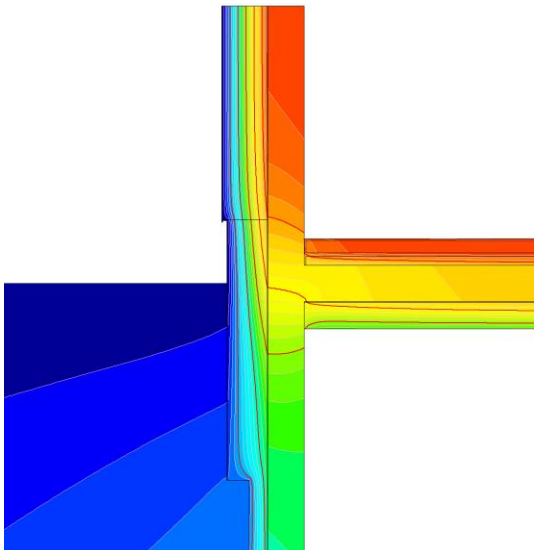
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	Hartholz ca. 700kg/m³	0.180			
	Aussenputz (JUBIZOL)	0.910			
	Stahlbeton	2.300			
	Eurotherm EPS-T	0.051			
	Eurotherm EPS 100	0.044			
	Estrich	1.400			
	Erdreich	2.000			
	JUBIZOL EPS F-G	0.039			
	JUBIZOL Adhesive mortar	0.910			
	JUBIZOL EPS Strong Premium	0.045			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-12):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-12**		
connection detail:	**external wall on basement ceiling - unheated basement**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Basement Ceiling (unheated basement) 150mm	U_2	0,16	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,155	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	14,6	°C
without thermal bridges?	The connection is not thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,82	-

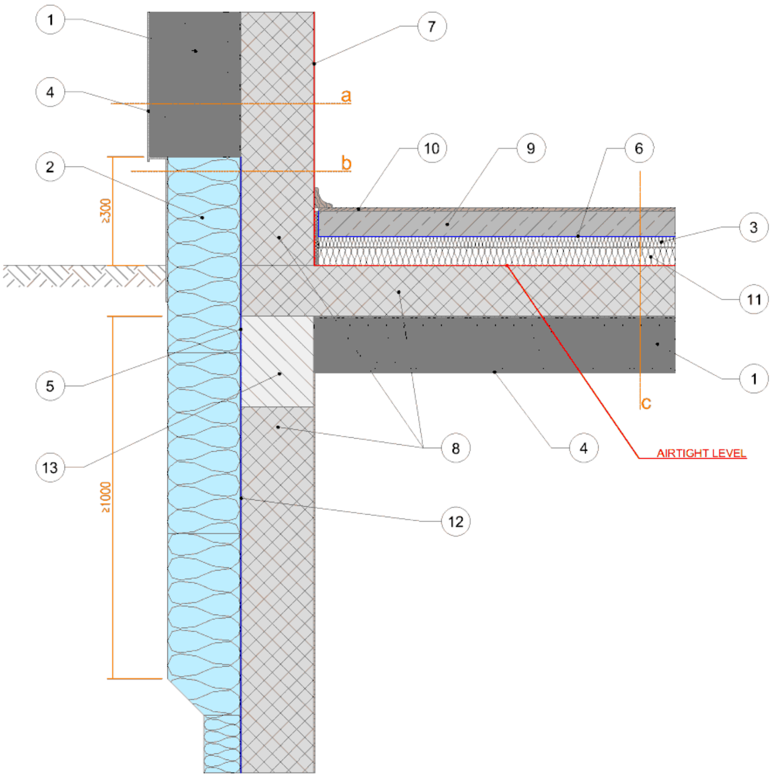
The connection is not thermal bridge free.

Upon request of the manufactorer this detail has been considered, for areas with earthquakes.

The minimal interior surface temperature is too low, the detail is not suitable for Passive Houses.

5.3.5 External wall on basement ceiling, unheated basement, with thermal break

Massive Construction **External wall on basement ceiling, unheated basement**	Abbreviation Detail A3-12a	JUB
Construction drawing - vertical section		



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the foot of the wall.

Before concreting the wall, at the base of the wall ceiling is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

The contacts between the thermal insulation slabs should not be in the plane of upper edge of the concrete floor slab.

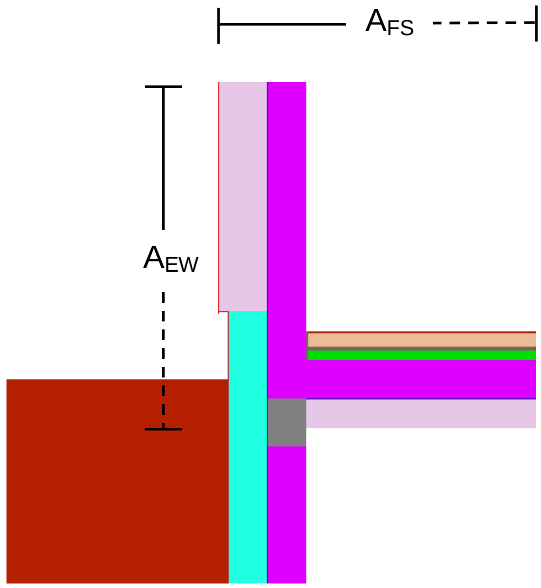
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : external wall (a)				General component : external wall (b)		
7	Plaster (Jubolin + Jupol)	0,91	0,3	7	Plaster (Jubolin + Jupol)	0,91	0,3
8	Reinforced concrete	2,30	20	8	Reinforced concrete	2,30	20
5	Jubizol Adhesive mortar	0,91	0,3	12	Waterproofing – bitumen membrane	0,17	0,3
1	Jubizol EPS F-G	0,039	25	5	Jubizol Adhesive mortar	0,91	0,3
4	JUBIZOL (base coat + finishing coat)	0,91	0,3	2	Jubizol EPS Strong premium	0,045	20
				4	JUBIZOL (base coat + finishing coat)	0,91	0,3
	General component : basement ceiling (c)				Other materials (materials not included in general component) :		
10	Wood floring - hardwood	0,18	1	13	Porous concrete (height 25 cm)	0,156	20
9	Screed	1,40	7				
6	PE foil	generic	0,05				
3	Eurotherm EPS T	0,051	3				
11	Eurotherm EPS 100	0,044	5				
8	Reinforced concrete	2,30	14				
1	Jubizol EPS F-G	0,039	15				
4	JUBIZOL (base coat + finishing coat)	0,91	0,3				

Graphical presentation of the results (A3-12a):

Materials

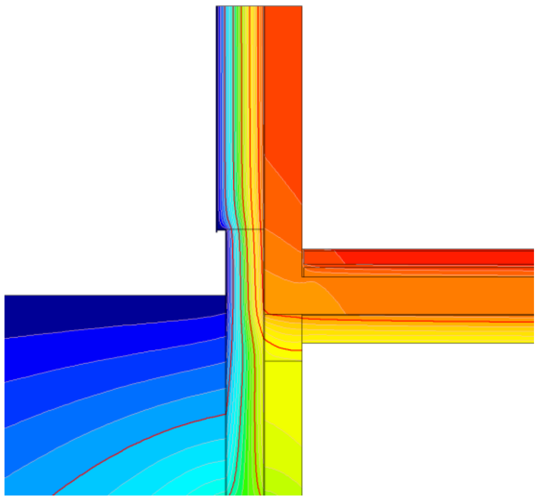
Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
Porous concrete (YTONG)	0.156			
Hartholz ca. 700kg/m³	0.180			
Aussenputz (JUBIZOL)	0.910			
Stahlbeton	2.300			
Eurotherm EPS-T	0.051			
Eurotherm EPS 100	0.044			
Estrich	1.400			
Erdreich	2.000			
JUBIZOL EPS F-G	0.039			
JUBIZOL Adhesive mortar	0.910			
JUBIZOL EPS Strong Premium	0.045			

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-12a):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-12a**		
connection detail:	**external wall on basement ceiling - unheated basement**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Basement Ceiling (unheated basement) 150mm	U_2	0,16	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	-0,008	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
without thermal bridges?	The connection is thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-

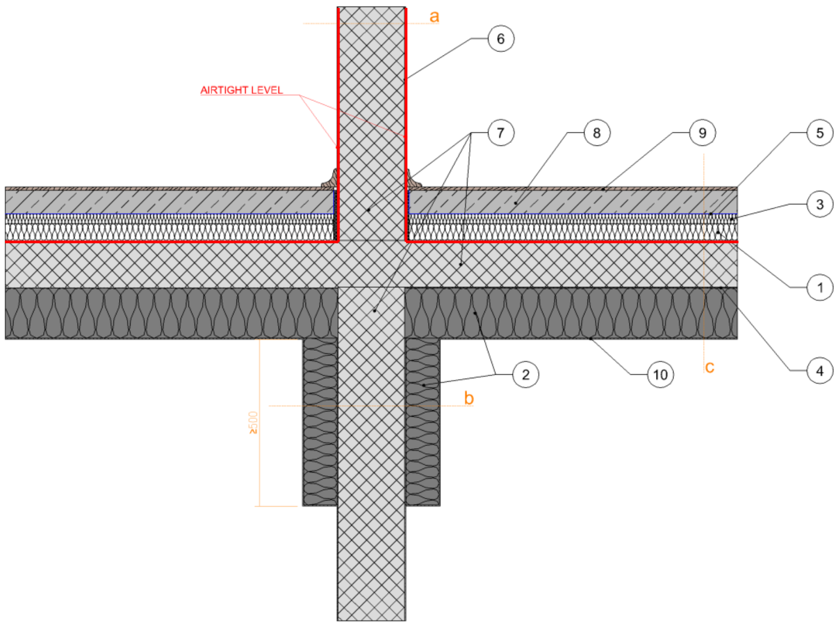
The connection is thermal bridge free. The depicted seal may be used:

CERTIFIED COMPONENT
Passive House Institute

5.3.6 Internal wall on basement ceiling, unheated basement, without thermal break

Massive Construction **Internal wall on basement ceiling, unheated basement**	Abbreviation Detail A3-13	JUB

Construction drawing - vertical section



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the foot of the wall.

Before concreting the wall, at the base of the wall ceiling is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

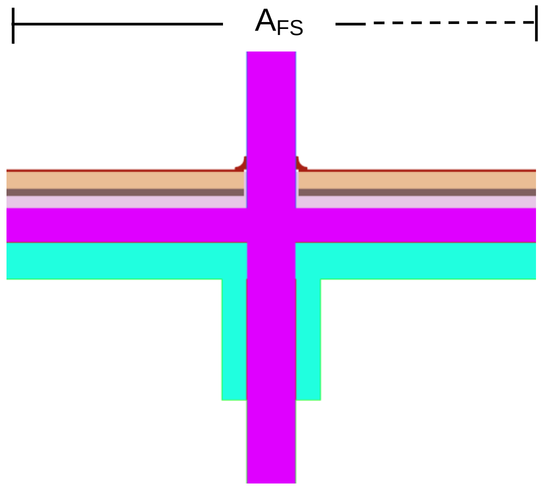
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : internal wall (a)				General component : internal wall (b)		
6	Plaster (Jubolin + Jupol)	0,91	0,3	10	JUBIZOL (base coat + finishing coat)	0,91	0,3
7	Reinforced concrete	2,30	20	2	Jubizol EPS F-G	0,039	10
6	Plaster (Jubolin + Jupol)	0,91	0,3	4	Jubizol Adhesive mortar	0,91	0,3
				7	Reinforced concrete	2,30	20
				4	Jubizol Adhesive mortar	0,91	0,3
				2	Jubizol EPS F-G	0,039	10
				10	JUBIZOL (base coat + finishing coat)	0,91	0,3
	General component : basement ceiling (c)				Other materials (materials not included in general component) :		
9	Wood floring - hardwood	0,18	1				
8	Screed	1,40	7				
5	PE foil	generic	0,05				
3	Eurotherm EPS T	0,051	3				
1	Eurotherm EPS 100	0,044	5				
7	Reinforced concrete	2,30	14				
2	Jubizol EPS F-G	0,039	15				
10	JUBIZOL (base coat + finishing coat)	0,91	0,3				

Graphical presentation of the results (A3-13):

Materials

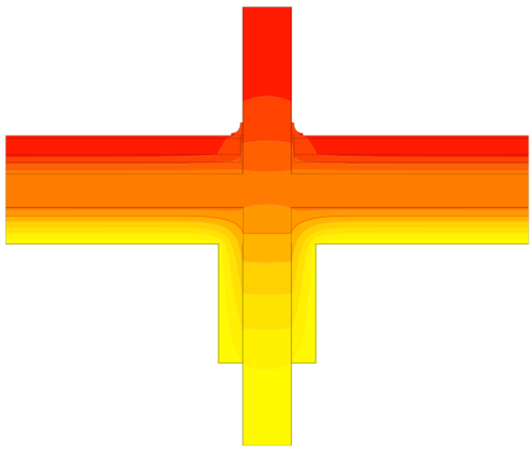
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
		0.038			
	Hartholz ca. 700kg/m³	0.180			
	Kleber (Jubizol)	0.910			
	Stahlbeton	2.300			
	Eurotherm EPS-T	0.051			
	Estrich	1.400			
	Eurotherm EPS 100	0.044			
	Innenputz (Jubolin+Jupol)	0.910			
	innen, Wärmestrom aufwärts			10.0	10.00
	Innenputz (Jubizol)	0.910			
	Jubizol EPS F-G	0.039			
	innen Wand 20°C			20.0	7.70
	innen Wärmestrom abwärts			20.0	6.00
	innen Wand 10°C			10.0	7.70

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-13):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-13**		
connection detail:	**internal wall on basement ceiling - unheated basement**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
Basement Ceiling (unheated basement) 150mm	U_1	0,16	W/(m²K)
0	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,367	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	18,6	°C
without thermal bridges?	The connection is not thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,95	-

The connection is not thermal bridge free, because of the load bearing wall in the basement.

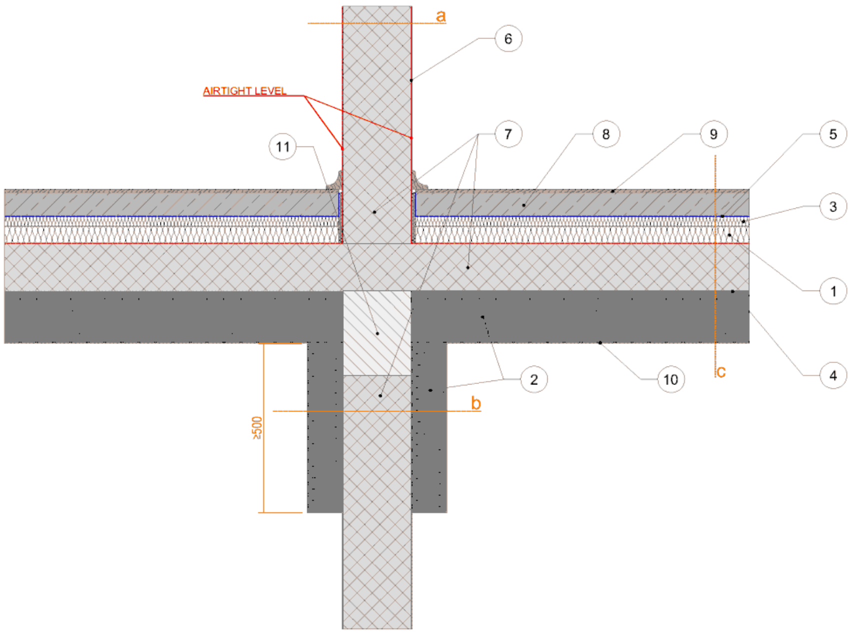
Upon request of the manufactorer this detail (without thermal break) has been considered, for areas with earthquakes.

The linear thermal bridge loss coefficient Ψ_a has to be considered in the PHPP calculation.

5.3.7 Internal wall on basement ceiling, unheated basement, with thermal break

Massive Construction **Internal wall on basement ceiling, unheated basement**	Abbreviation Detail A3-13a	JUB

Construction drawing - vertical section



Airtight level:

Prior to installation of thermal insulation on inner side (before screed), self-leveling compound of wall must be applicated to the base of the wall.

Before concreting the wall, at the base of the wall ceiling is coated with bonding mortar like JUBOSAN C110 to prevent eventual air gaps in joint.

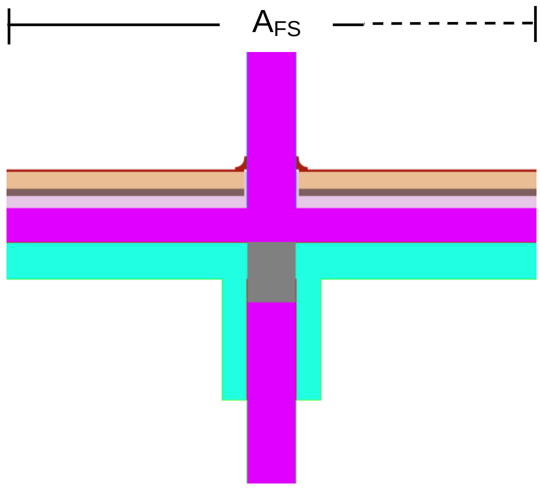
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : internal wall (a)				General component : internal wall (b)		
6	Plaster (Jubolin + Jupol)	0,91	0,3	10	JUBIZOL (base coat + finishing coat)	0,91	0,3
7	Reinforced concrete	2,30	20	2	Jubizol EPS F-G	0,039	10
6	Plaster (Jubolin + Jupol)	0,91	0,3	4	Jubizol Adhesive mortar	0,91	0,3
				7	Reinforced concrete	2,30	20
				4	Jubizol Adhesive mortar	0,91	0,3
				2	Jubizol EPS F-G	0,039	10
				10	JUBIZOL (base coat + finishing coat)	0,91	0,3
	General component : basement ceiling (c)				Other materials (materials not included in general component) :		
9	Wood floring - hardwood	0,18	1	11	Porous concrete (height 25 cm)	0,156	20
8	Screed	1,40	7				
5	PE foil	generic	0,05				
3	Eurotherm EPS T	0,051	3				
1	Eurotherm EPS 100	0,044	5				
7	Reinforced concrete	2,30	14				
2	Jubizol EPS F-G	0,039	15				
10	JUBIZOL (base coat + finishing coat)	0,91	0,3				

Graphical presentation of the results (A3-13a):

Materials

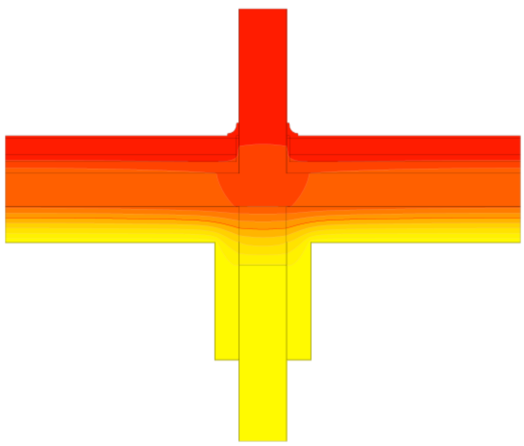
	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
		1.000			
		0.038			
	Hartholz ca. 700kg/m³	0.180			
	Kleber (Jubizol)	0.910			
	Stahlbeton	2.300			
	Eurotherm EPS-T	0.051			
	Porous concrete (YTONG)	0.156			
	Estrich	1.400			
	Eurotherm EPS 100	0.044			
	Innenputz (Jubolin+Jupol)	0.910			
	innen, Wärmestrom aufwärts			10.0	10.00
	Innenputz (Jubizol)	0.910			
	Jubizol EPS F-G	0.039			
	innen Wand 20°C			20.0	7.70
	innen Wärmestrom abwärts			20.0	6.00
	innen Wand 10°C			10.0	7.70

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-13a):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-13a**		
connection detail:	**internal wall on basement ceiling - unheated basement**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
Basement Ceiling (unheated basement) 150mm	U_1	0,16	W/(m²K)
0	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,101	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	19,4	°C
without thermal bridges?	The connection is not thermal bridge free.		
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,98	-

The connection is not thermal bridge free, because of the load bearing wall in the basement.

The linear thermal bridge loss coefficient Ψ_a has to be considered in the PHPP calculation.

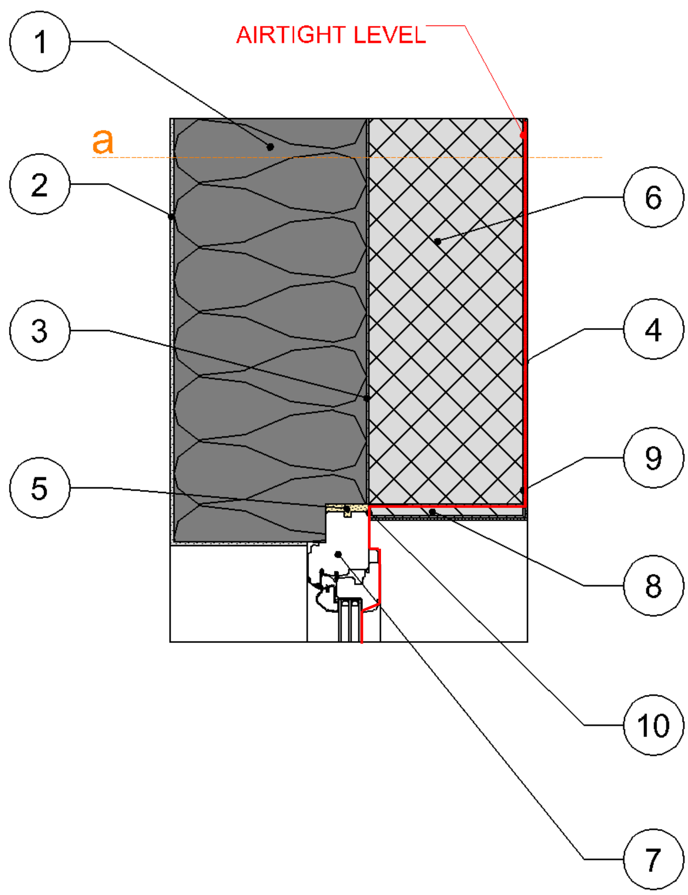
5.4 Group D (window installations)

5.4.1 Window installation in external wall

5.4.1.1 Window connection top

Massive Construction **Window installation in external wall - top**	Abbreviation Detail A3-14	JUB

Construction drawing - vertical section



Airtight level:

In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

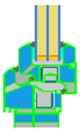
Joint between lining and window frame is in the end made with Acrylic sealant.

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From below	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
4	Plaster (Jubolin + Jupol)	0,91	0,3				
9	Jubizol Adhesive mortar	0,91	0,2				
6	Reinforced concrete	2,30	20				
3	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				5	PU foam	0,029	1
				8	Plaster board	0,25	1,2
				10	Sealing tape	generic	0,05
				7	Window frame	generic	N/A
					Metal profile (steel supports of window)	50,00	0,4

Graphical presentation of the results (A3-14):

Materials

Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
PVC, hart	0.170			
Stahl	50.000			
Thermix Ersatz	0.440			
PU-Schaum 40kg/m³	0.029			
Stahlbeton	2.300			
Gipskartonplatte	0.250			
JUBIZOL Adhesive mortar	0.910			
EPDM	0.250			
JUBIZOL Adhesive mortar	0.910			
Polysulfid	0.400			
JUBIZOL EPS F-G	0.039			
Innenputz (JUBOLIN+Jupol)	0.910			
Molekularsieb	0.100			
GFK	0.190			
Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
innen (reduziert) 20°C 5W/m²K			20.0	5.00
SZR 16 mm 0.7	0.026			
Glas	1.000			
Aussenputz JUBIZOL	0.910			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70



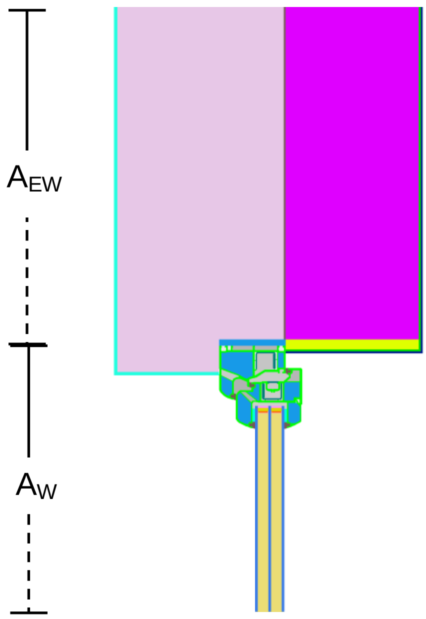
Passive house suitable window, standard size

$U_f \leq 0{,}75$ W/(m²K)

$U_g = 0{,}70$ W/(m²K)

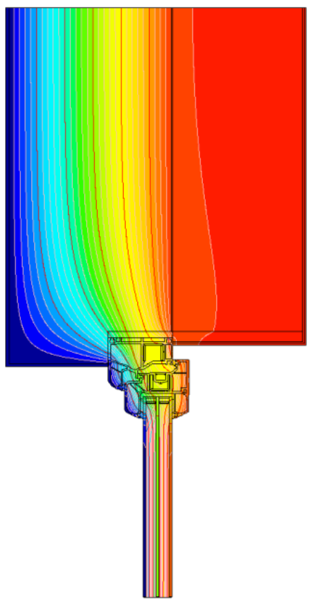
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-14):

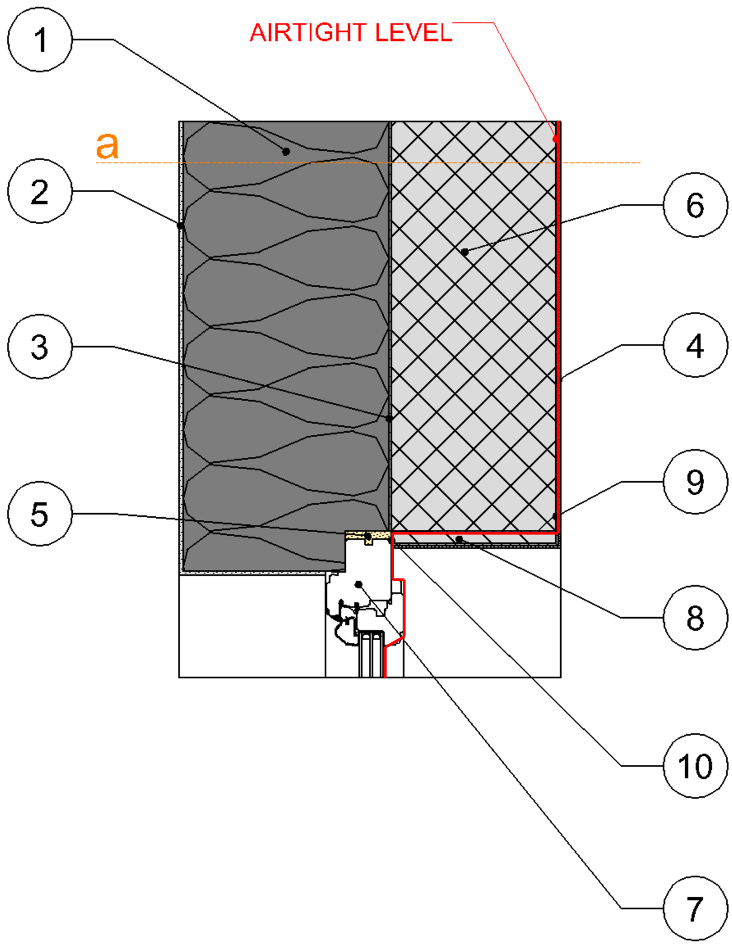
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-14**		
connection detail:	**window installation in external wall - top**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,007	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.1.2 Window connection side

Massive Construction **Window installation in external wall - side**	Abbreviation Detail A3-15	JUB

Construction drawing - vertical section



Airtight level:

In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

Joint between lining and window frame is in the end made with Acrylic sealant.

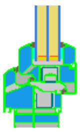
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
	General component : External wall (a)		
4	Plaster (Jubolin + Jupol)	0,91	0,3
9	Jubizol Adhesive mortar	0,91	0,2
6	Reinforced concrete	2,30	20
3	Jubizol Adhesive mortar	0,91	0,5
1	Jubizol EPS F-G	0,039	25
2	Jubizol (base coat + finishing coat)	0,91	0,5
	General component :		

	From below	λ [W/(mK)]	Thick. [cm]
	General component : External wall (b)		
	Other materials (materials not included in general component) :		
5	PU foam	0,029	1
8	Plaster board	0,25	1,2
10	Sealing tape	generic	0,05
7	Window frame	generic	N/A
	Metal profile (steel supports of window)	50,00	0,4

Graphical presentation of the results (A3-15):

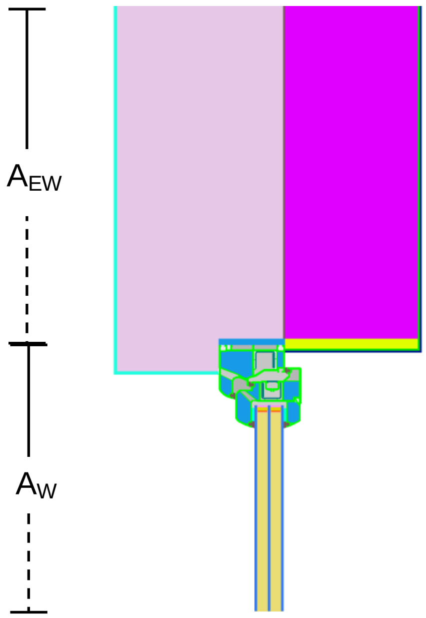
Materials

Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
PVC, hart	0.170			
Stahl	50.000			
Thermix Ersatz	0.440			
PU-Schaum 40kg/m³	0.029			
Stahlbeton	2.300			
Gipskartonplatte	0.250			
JUBIZOL Adhesive mortar	0.910			
EPDM	0.250			
JUBIZOL Adhesive mortar	0.910			
Polysulfid	0.400			
JUBIZOL EPS F-G	0.039			
Innenputz (JUBOLIN+Jupol)	0.910			
Molekularsieb	0.100			
GFK	0.190			
Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
innen (reduziert) 20°C 5W/m²K			20.0	5.00
SZR 16 mm 0.7	0.026			
Glas	1.000			
Aussenputz JUBIZOL	0.910			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70



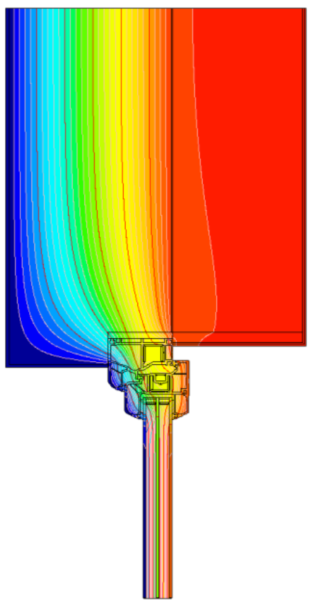
Passive house suitable window, standard size
$U_f \leq 0{,}75$ W/(m²K)
$U_g = 0{,}70$ W/(m²K)
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-15):

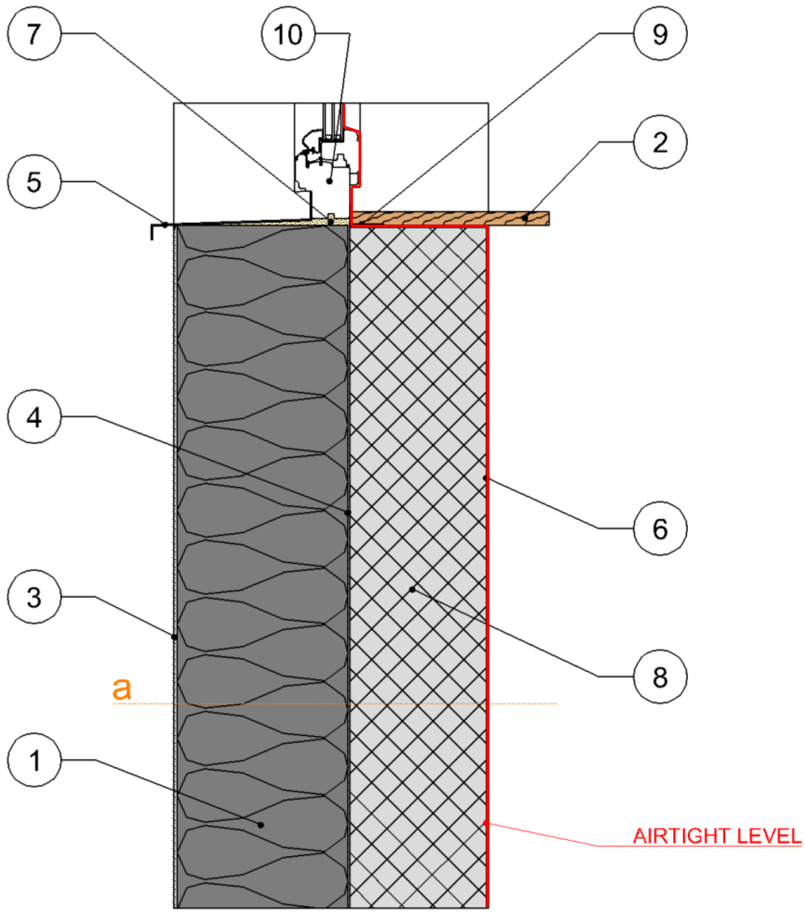
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-15**		
connection detail:	**window installation in external wall - side**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,007	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.1.3 Window connection bottom

Massive Construction **Window installation in external wall - bottom**	Abbreviation Detail A3-16	JUB

Construction drawing - vertical section



Airtight level:

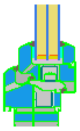
In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From below	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component : External wall (b)			
6	Plaster (Jubolin + Jupol)	0,91	0,3				
8	Reinforced concrete	2,30	20				
4	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
3	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				7	PU foam	0,029	1
				2	Internal wooden window sill	0,13	1,8
				9	Sealing tape	generic	0,05
				5	Metal window sill (aluminium)	generic	0,1
				10	Window frame	generic	N/A
					Metal profile (steel supports of window)	50,00	0,4

Graphical presentation of the results (A3-16):

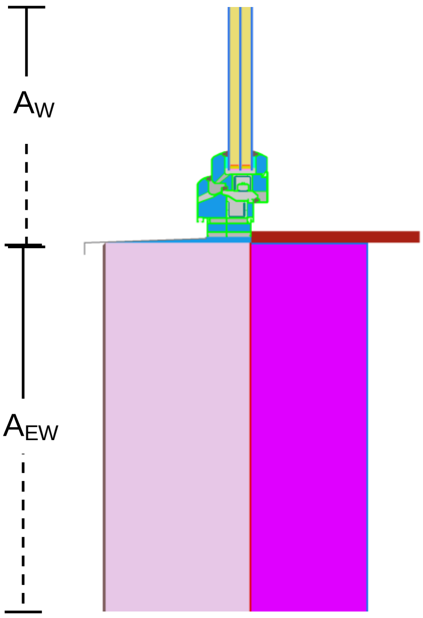
Materials

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	PVC, hart	0.170			
	Aluminium	160.000			
	Hartholz ca. 700kg/m³	0.180			
	Stahl	50.000			
	Thermix Ersatz	0.440			
	PU-Schaum 40kg/m³	0.029			
	JUBIZOL Adhesive mortar	0.910			
	Stahlbeton	2.300			
	Aussenputz JUBIZOL	0.910			
	EPDM	0.250			
	Polysulfid	0.400			
	JUBIZOL EPS F-G	0.039			
	Molekularsieb	0.100			
	Innenputz JUBOLIN+Jupol)	0.910			
	GFK	0.190			
	Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
	innen (reduziert) 20°C 5W/m²K			20.0	5.00
	SZR 16 mm 0.7	0.026			
	Glas	1.000			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70



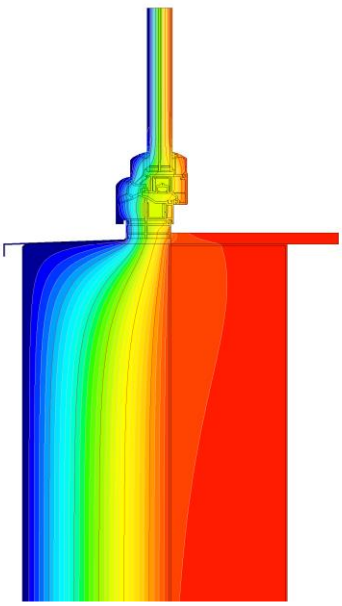
Passive house suitable window, standard size
$U_f \leq 0,75$ W/(m²K)
$U_g = 0,70$ W/(m²K)
$\Psi_g \leq 0,035$ W/(mK)

Model



Temperature [°C]

Isotherms

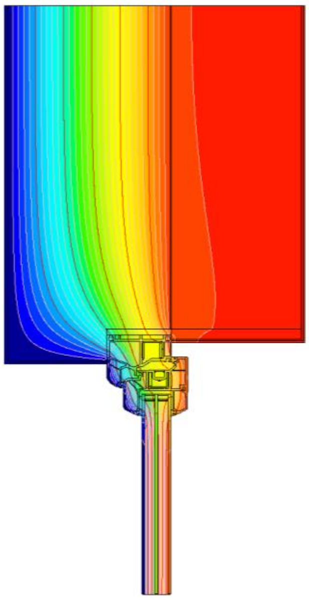
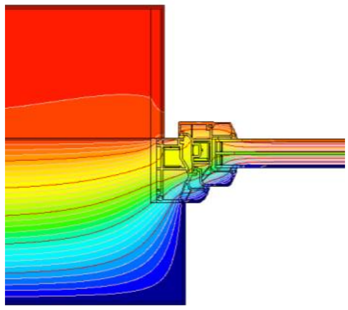
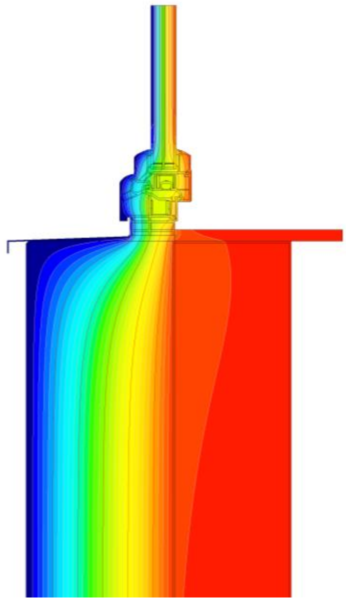


Calculation results according to DIN EN ISO 10211 (A3-16):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-16**		
connection detail:	**window installation in external wall - bottom**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,018	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	15,9	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,86	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.1.4 Window installation in external wall – overview of results

Window installation situation	h = 1.48 m / b = 1.23 m	
Window lintel	Window reveal	Window sill
		
Ψ_a = 0,007 W/(mK)	Ψ_a = 0,007 W/(mK)	Ψ_a = 0,018 W/(mK)
A3-14	**A3-15**	**A3-16**
Resulting installation situation		$U_{w,installed}$ [W/(m²K)]
Installed window frame – exterior wall		**0,83**

With the use of the Passive House suitable window with the standard dimensions, the window installation situation meets the described criteria. The following Seal (illustration) is to be used when required:

5.4.2 Window installation in external wall – roller shutter box

5.4.2.1 Window connection top

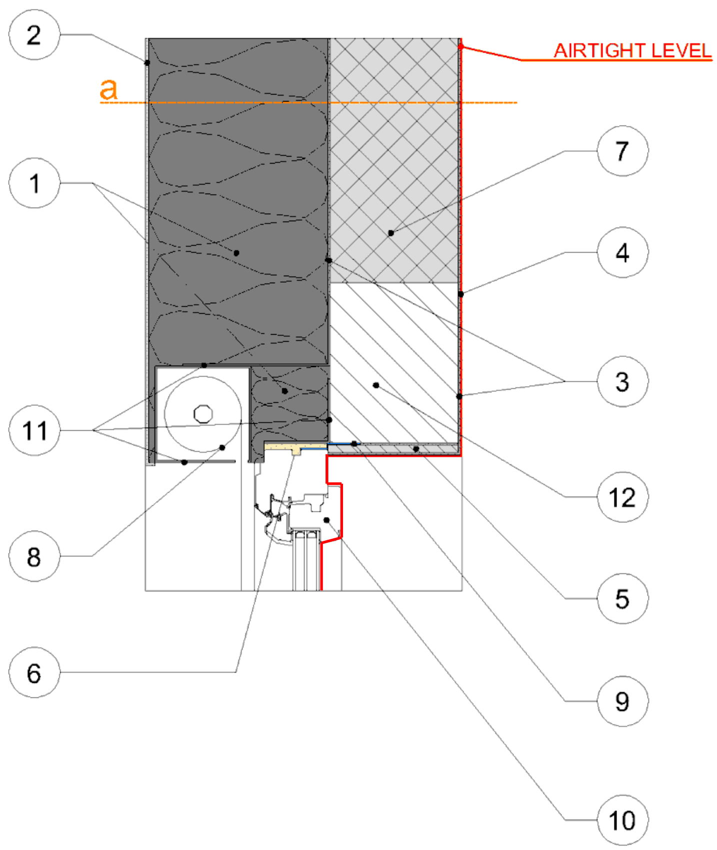
Massive Construction

Window installation in external wall – roller shutter box - top

Abbreviation

Detail A3-17

Construction drawing - vertical section



Airtight level:

In order to achieve airtightness of the contact between window frame wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

Gap between window frame and external wall must be foamed with PU foam, and on the inner side reinforcing mesh is placed in adhesive mortar layer to prevent cracks at the joint of different material.

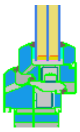
	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)			
4	Plaster (Jubolin + Jupol)	0,91	0,3
3	Jubizol Adhesive mortar	0,91	0,2
7	Reinforced concrete	2,30	20
3	Jubizol Adhesive mortar	0,91	0,5
1	Jubizol EPS F-G	0,039	25
2	Jubizol (base coat + finishing coat)	0,91	0,5
General component :			

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component :			
Other materials (materials not included in general component) :			
5	Lime cement plaster	1,40	1,5
6	PU foam	0,029	1
8	Roller shutters	N/A	N/A
9	Sealing tape	generic	0,05
10	Window frame	generic	N/A
11	Steel casing	N/A	N/A
12	Porous concrete lintel	0,20	20

Graphical presentation of the results (A3-17):

Materials

Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
PVC, hart	0.170			
Stahl	50.000			
Thermix Ersatz	0.440			
PU-Schaum 40kg/m³	0.029			
Porous concrete lintel	0.200			
Innenputz (JUBOLIN+Jupol)	0.910			
Stahlbeton	2.300			
JUBIZOL Adhesive mortar	0.910			
EPDM	0.250			
Polysulfid	0.400			
JUBIZOL EPS F-G	0.039			
Lime cement plaster	1.400			
Molekularsieb	0.100			
GFK	0.190			
Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
innen (reduziert) 20°C 5W/m²K			20.0	5.00
SZR 16 mm 0.7	0.026			
Glas	1.000			
Aussenputz (JUBIZOL)	0.910			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70



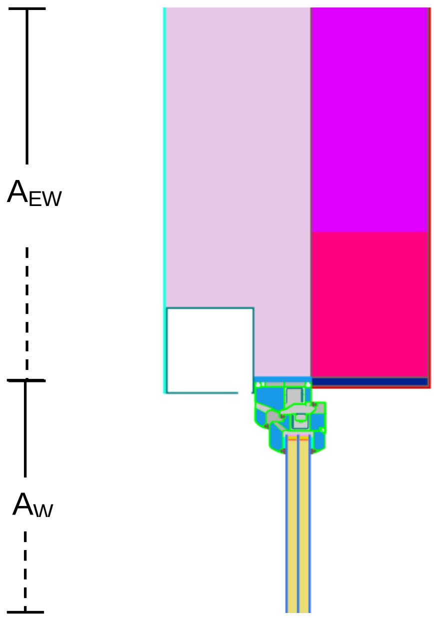
Passive house suitable window, standard size

$U_f \leq 0{,}75$ W/(m²K)

$U_g = 0{,}70$ W/(m²K)

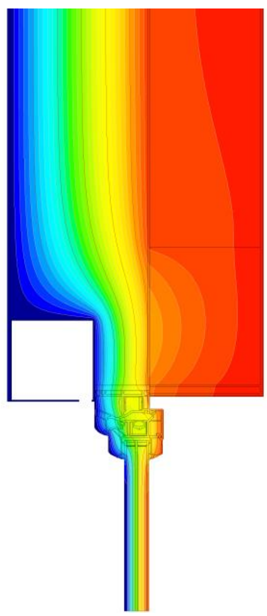
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-17):

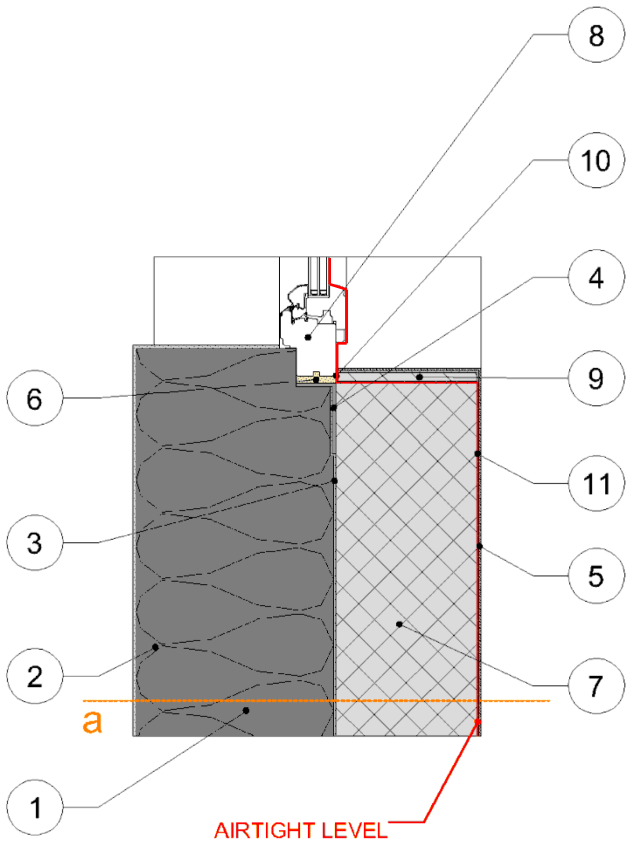
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-17**		
connection detail:	**window inst. in ext. wall - roller shutter box - top**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,038	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	13,3	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,78	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.2.2 Window connection side

Massive Construction **Window installation in external wall – roller shutter box - side**	Abbreviation Detail A3-18	JUB

Construction drawing - vertical section



Airtight level:

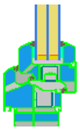
In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

From indoor to outdoor		λ [W/(mK)]	Thick. [cm]	From indoor to outdoor		λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
5	Plaster (Jubolin + Jupol)	0,91	0,3				
11	Plaster	0,91	0,2				
7	Reinforced concrete	2,30	20				
3	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				4	Metal profile (steel supports of window)	50,00	0,4
				6	PU foam	0,029	1
				8	Window frame	generic	N/A
				9	Lime cement plaster	1,40	1,5
				10	Sealing tape	generic	0,05

Graphical presentation of the results (A3-18):

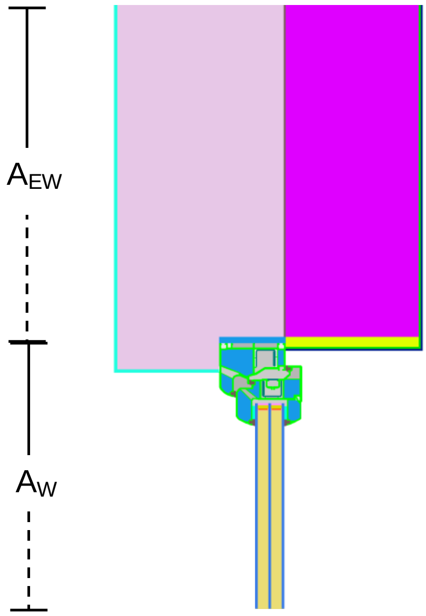
Materials

Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
PVC, hart	0.170			
Stahl	50.000			
Thermix Ersatz	0.440			
PU-Schaum 40kg/m³	0.029			
Stahlbeton	2.300			
Gipskartonplatte	0.250			
JUBIZOL Adhesive mortar	0.910			
EPDM	0.250			
JUBIZOL Adhesive mortar	0.910			
Polysulfid	0.400			
JUBIZOL EPS F-G	0.039			
Innenputz (JUBOLIN+Jupol)	0.910			
Molekularsieb	0.100			
GFK	0.190			
Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
innen (reduziert) 20°C 5W/m²K			20.0	5.00
SZR 16 mm 0.7	0.026			
Glas	1.000			
Aussenputz JUBIZOL	0.910			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70



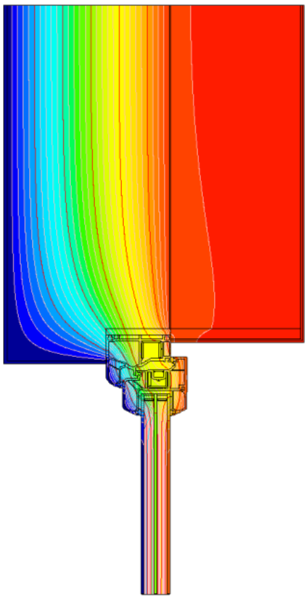
Passive house suitable window, standard size
$U_f \leq 0{,}75$ W/(m²K)
$U_g = 0{,}70$ W/(m²K)
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-18):

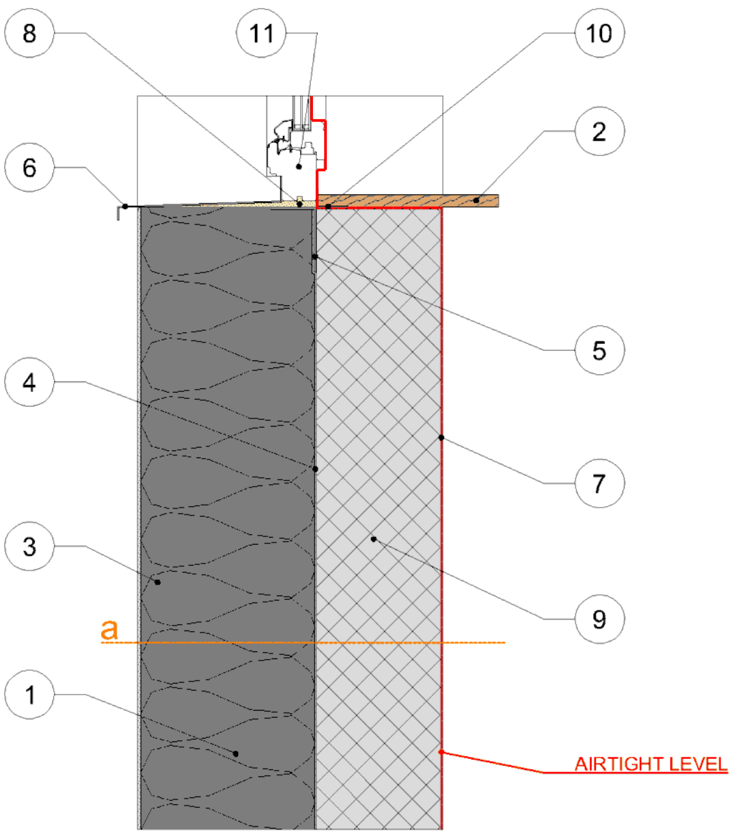
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-18**		
connection detail:	**window inst. in ext. wall - roller shutter box - side**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,007	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.2.3 Window connection bottom

Massive Construction **Window installation in external wall – roller shutter box - bottom**	Abbreviation Detail A3-19	JUB

Construction drawing - vertical section



Airtight level:

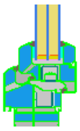
In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

From indoor to outdoor		λ [W/(mK)]	Thick. [cm]	From indoor to outdoor		λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
7	Plaster (Jubolin + Jupol)	0,91	0,3				
9	Reinforced concrete	2,30	20				
4	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	28				
3	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				2	Internal wooden window sill	0,13	1,8
				5	Metal profile (steel suports of window)	50,00	0,4
				6	Metal window sill (aluminium)	generic	0,1
				8	PU foam	0,029	1
				10	Sealing tape	generic	0,05
				11	Window frame	generic	N/A

Graphical presentation of the results (A3-19):

Materials

Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
PVC, hart	0.170			
Aluminium	160.000			
Hartholz ca. 700kg/m³	0.180			
Stahl	50.000			
Thermix Ersatz	0.440			
PU-Schaum 40kg/m³	0.029			
JUBIZOL Adhesive mortar	0.910			
Stahlbeton	2.300			
Aussenputz JUBIZOL	0.910			
EPDM	0.250			
Polysulfid	0.400			
JUBIZOL EPS F-G	0.039			
Molekularsieb	0.100			
Innenputz JUBOLIN+Jupol)	0.910			
GFK	0.190			
Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
innen (reduziert) 20°C 5W/m²K			20.0	5.00
SZR 16 mm 0.7	0.026			
Glas	1.000			
außen -10°C 25W/m²K			-10.0	25.00
innen Wand 20°C 7.69W/m²K			20.0	7.70



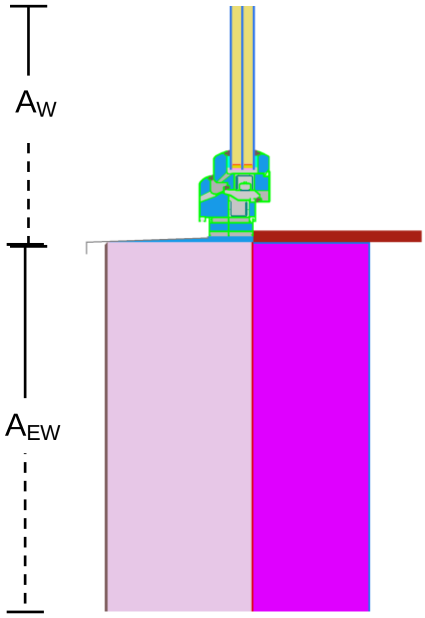
Passive house suitable window, standard size

$U_f \leq 0{,}75$ W/(m²K)

$U_g = 0{,}70$ W/(m²K)

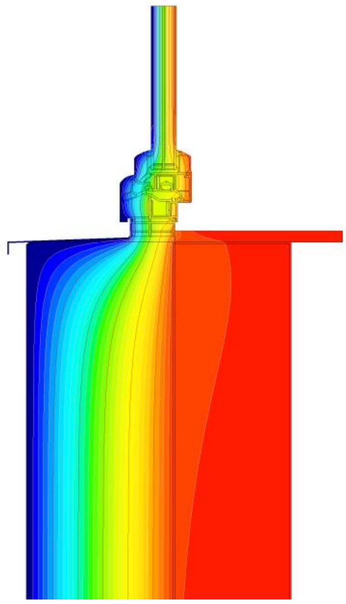
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms

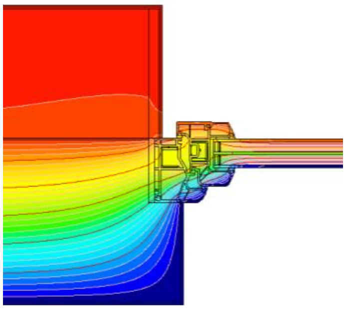
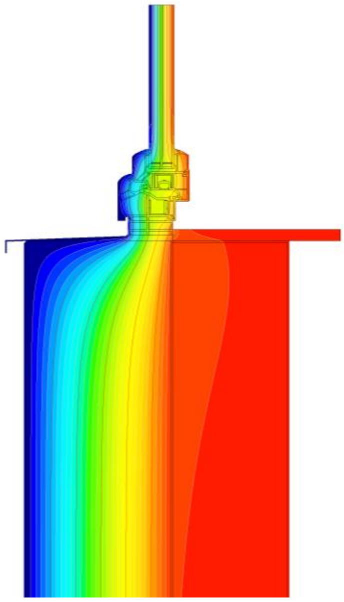


Calculation results according to DIN EN ISO 10211 (A3-19):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-19**		
connection detail:	**window inst. in ext. wall - roller shutter box - bottom**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,018	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	15,9	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,86	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.2.4 Window installation in external wall, roller shutter box – overview of results

Window installation situation h = 1.48 m / b = 1.23 m		
Window lintel	Window reveal	Window sill
		
Ψ_a = 0,038 W/(mK)	Ψ_a = 0,007 W/(mK)	Ψ_a = 0,018 W/(mK)
A3-17	**A3-18**	**A3-19**
Resulting installation situation		$U_{w,installed}$ [W/(m²K)]
Installed window frame – exterior wall		**0,85**

With the use of the Passive House suitable window with the standard dimensions, the window installation situation meets the described criteria. The following Seal (illustration) is to be used when required:

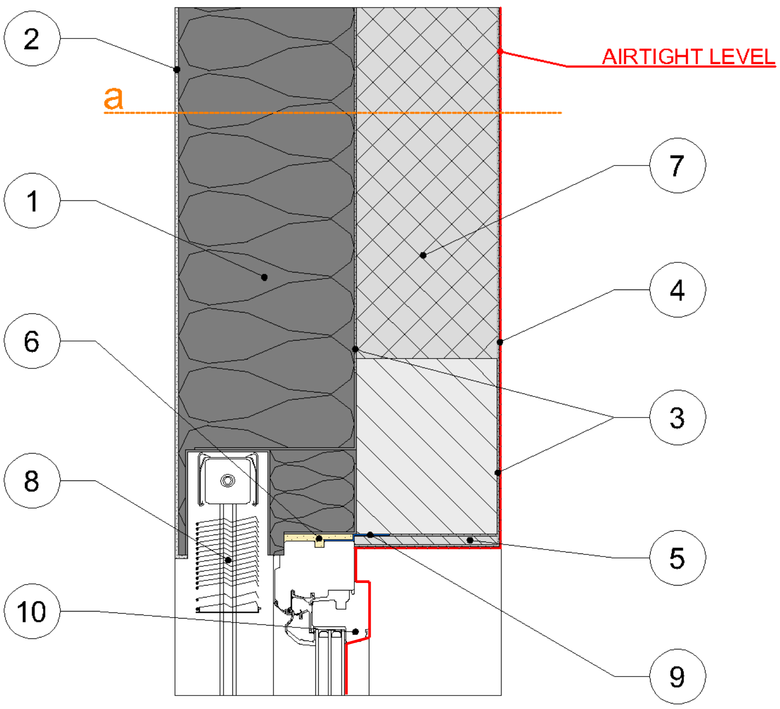
CERTIFIED COMPONENT
Passive House Institute

5.4.3 Window installation in external wall – venetian blind

5.4.3.1 Window connection top

Massive Construction **Window installation in external wall – venetian blind - top**	Abbreviation Detail A3-20	JUB

Construction drawing - vertical section



Airtight level:

In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

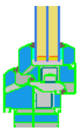
Gap between TI frame and external wall must be also foamed with PU foam, and on the inner side reinforcing mesh is placed in adhesive mortar layer to prevent cracks at the joint of different material.

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
4	Plaster (Jubolin + Jupol)	0,91	0,3				
3	Jubizol adhesive mortar	0,91	0,2				
7	Reinforced concrete	2,30	20				
3	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				5	Lime cement plaster	1,4	1,5
				6	PU foam	0,029	1
				8	Venetian blinds	N/A	N/A
				9	Sealing tape	generic	0,05
				10	Window frame	generic	N/A

Graphical presentation of the results (A3-20):

Materials

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	PVC, hart	0.170			
	Stahl	50.000			
	Thermix Ersatz	0.440			
	PU-Schaum 40kg/m³	0.029			
	Porous concrete lintel	0.200			
	Innenputz (JUBOLIN+Jupol)	0.910			
	Stahlbeton	2.300			
	JUBIZOL Adhesive mortar	0.910			
	EPDM	0.250			
	Polysulfid	0.400			
	JUBIZOL EPS F-G	0.039			
	Lime cement plaster	1.400			
	Molekularsieb	0.100			
	GFK	0.190			
	Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
	innen (reduziert) 20°C 5W/m²K			20.0	5.00
	SZR 16 mm 0.7	0.026			
	Glas	1.000			
	Aussenputz (JUBIZOL)	0.910			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70



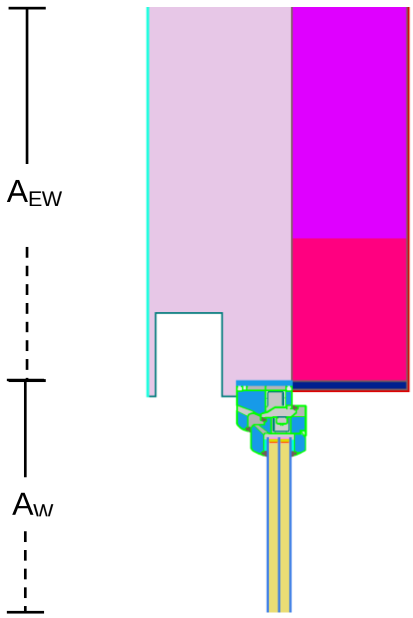
Passive house suitable window, standard size

$U_f \leq 0,75$ W/(m²K)

$U_g = 0,70$ W/(m²K)

$\Psi_g \leq 0,035$ W/(mK)

Model



Temperature [°C]

Isotherms

Calculation results according to DIN EN ISO 10211 (A3-20):

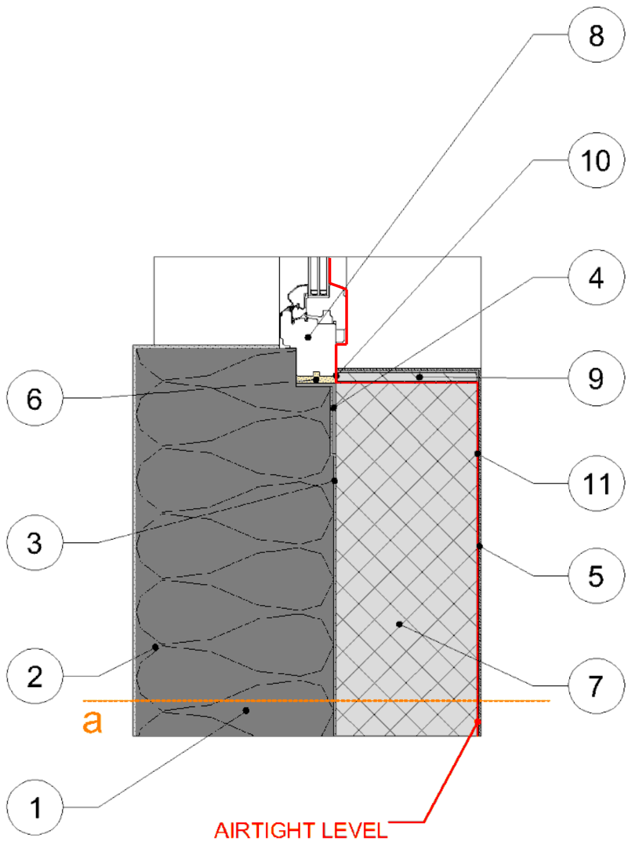
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-20**		
connection detail:	**window inst. in ext. wall - venetian blind - top**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,026	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	13,5	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,78	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.3.2 Window connection side

Massive Construction **Window installation in external wall – venetian blind - side**	Abbreviation Detail A3-21	JUB

Construction drawing - vertical section



Airtight level:

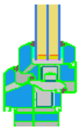
In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
5	Plaster (Jubolin + Jupol)	0,91	0,3				
11	Plaster	0,91	0,2				
7	Reinforced concrete	2,30	20				
3	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	25				
2	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				4	Metal profile (steel supports of window)	50,00	0,4
				6	PU foam	0,029	1
				8	Window frame	generic	N/A
				9	Lime cement plaster	1,40	1,5
				10	Sealing tape	generic	0,05

Graphical presentation of the results (A3-21):

Materials

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	PVC, hart	0.170			
	Stahl	50.000			
	Thermix Ersatz	0.440			
	PU-Schaum $40kg/m^3$	0.029			
	Stahlbeton	2.300			
	Gipskartonplatte	0.250			
	JUBIZOL Adhesive mortar	0.910			
	EPDM	0.250			
	JUBIZOL Adhesive mortar	0.910			
	Polysulfid	0.400			
	JUBIZOL EPS F-G	0.039			
	Innenputz (JUBOLIN+Jupol)	0.910			
	Molekularsieb	0.100			
	GFK	0.190			
	Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
	innen (reduziert) 20°C $5W/m^2K$			20.0	5.00
	SZR 16 mm 0.7	0.026			
	Glas	1.000			
	Aussenputz JUBIZOL	0.910			
	außen -10°C $25W/m^2K$			-10.0	25.00
	innen Wand 20°C $7.69W/m^2K$			20.0	7.70



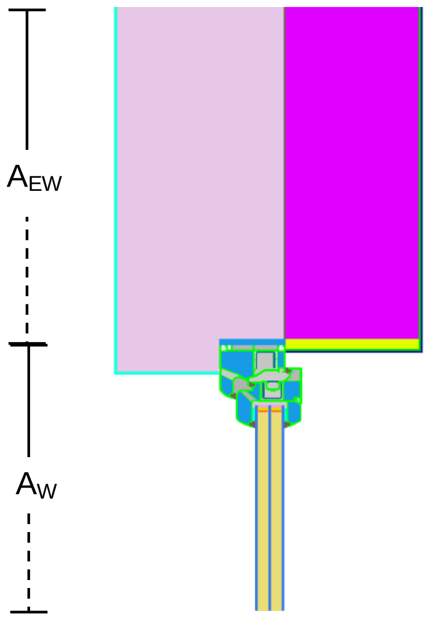
Passive house suitable window, standard size

$U_f \leq 0{,}75$ W/(m²K)

$U_g = 0{,}70$ W/(m²K)

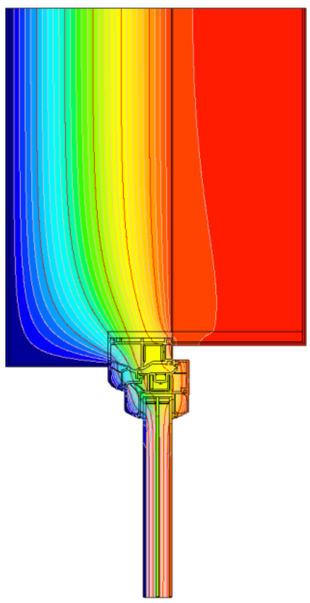
$\Psi_g \leq 0{,}035$ W/(mK)

Model



Temperature [°C]

Isotherms



Calculation results according to DIN EN ISO 10211 (A3-21):

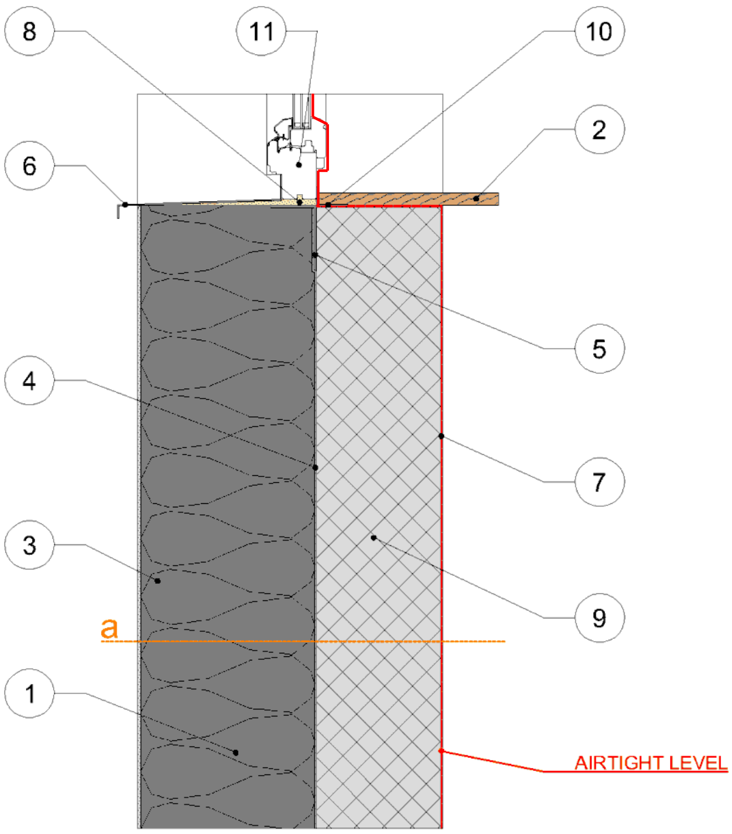
project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-21**		
connection detail:	**window inst. in ext. wall - venetian blind - side**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,007	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	17,1	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,90	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.3.3 Window connection bottom

Massive Construction **Window installation in external wall – venetian blind - bottom**	Abbreviation Detail A3-22	JUB

Construction drawing - vertical section



Airtight level:

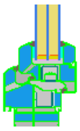
In order to achieve airtightness of the contact between window frame and external wall, it is necessary to use suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210).

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From indoor to outdoor	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
7	Plaster (Jubolin + Jupol)	0,91	0,3				
9	Reinforced concrete	2,30	20				
4	Jubizol Adhesive mortar	0,91	0,5				
1	Jubizol EPS F-G	0,039	28				
3	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				2	Internal wooden window sill	0,13	1,8
				5	Metal profile (steel suports of window)	50,00	0,4
				6	Metal window sill (aluminium)	generic	0,1
				8	PU foam	0,029	1
				10	Sealing tape	generic	0,05
				11	Window frame	generic	N/A

Graphical presentation of the results (A3-22):

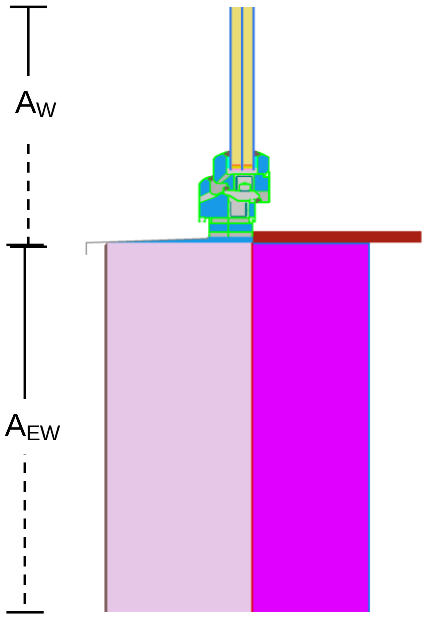
Materials

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	PVC, hart	0.170			
	Aluminium	160.000			
	Hartholz ca. 700kg/m³	0.180			
	Stahl	50.000			
	Thermix Ersatz	0.440			
	PU-Schaum 40kg/m³	0.029			
	JUBIZOL Adhesive mortar	0.910			
	Stahlbeton	2.300			
	Aussenputz JUBIZOL	0.910			
	EPDM	0.250			
	Polysulfid	0.400			
	JUBIZOL EPS F-G	0.039			
	Molekularsieb	0.100			
	Innenputz JUBOLIN+Jupol)	0.910			
	GFK	0.190			
	Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
	innen (reduziert) 20°C 5W/m²K			20.0	5.00
	SZR 16 mm 0.7	0.026			
	Glas	1.000			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70



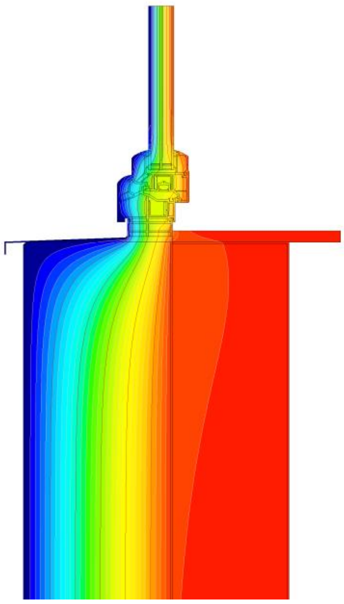
Passive house suitable window, standard size
$U_f \leq 0,75$ W/(m^{2}K)
$U_g = 0,70$ W/(m^{2}K)
$\Psi_g \leq 0,035$ W/(mK)

Model



Temperature [°C]

Isotherms

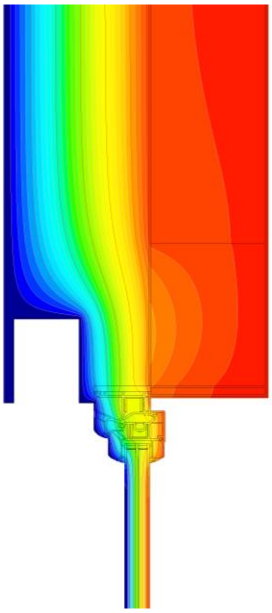
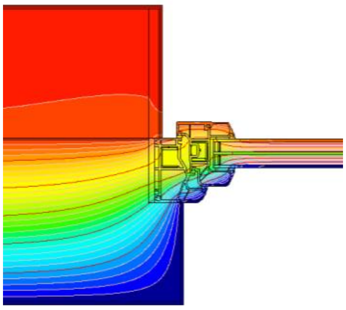
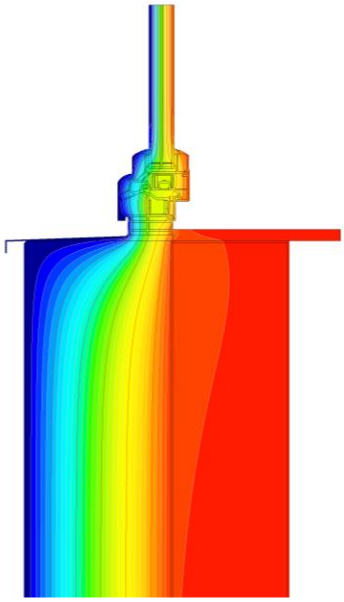


Calculation results according to DIN EN ISO 10211 (A3-22):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-22**		
connection detail:	**window inst. in ext. wall - venetian blind - bottom**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,018	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	15,9	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,86	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.3.4 Window installation in external wall, venetian blind – overview of results

Window installation situation h = 1.48 m / b = 1.23 m		
Window lintel	Window reveal	Window sill
		
Ψ_a = 0,026 W/(mK)	Ψ_a = 0,007 W/(mK)	Ψ_a = 0,018 W/(mK)
A3-20	**A3-21**	**A3-22**

Resulting installation situation	$U_{w,installed}$ [W/(m²K)]
Installed window frame – exterior wall	**0,84**

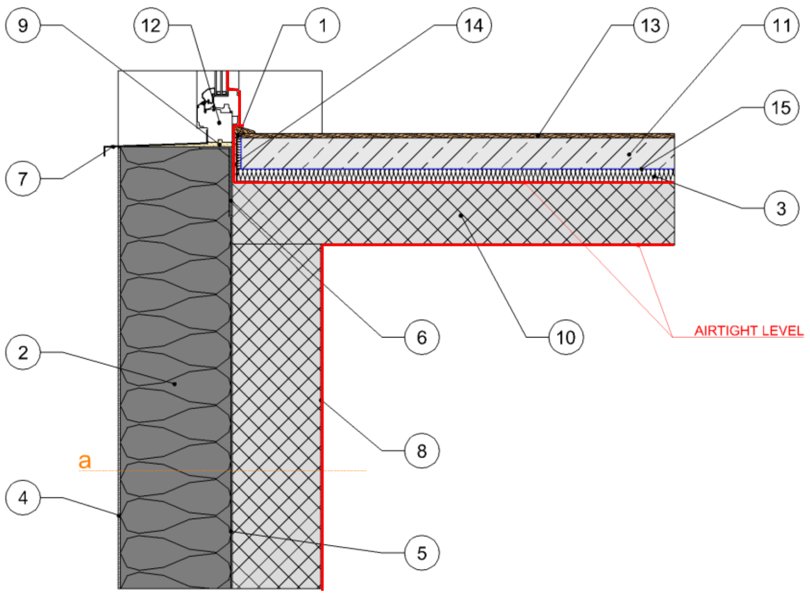
With the use of the Passive House suitable window with the standard dimensions, the window installation situation meets the described criteria. The following Seal (illustration) is to be used when required:

5.4.4 Window installation in external wall – French window

5.4.4.1 Window connection bottom

Massive Construction **Installation of French window in external wall - bottom**	Abbreviation Detail A3-23	JUB

Construction drawing - vertical section



Airtight level:

Airtightness is achieved with use of suitable adhesive sealing tape (like ILLBRUCK ME500 or FF210), which is placed from window frame through Wood-cement panel to the concrete slab (ceiling).

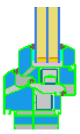
Joint between wood flooring and window frame is in the end made with Acrylic sealant.

	From indoor to outdoor	λ [W/(mK)]	Thick. [cm]		From below	λ [W/(mK)]	Thick. [cm]
General component : External wall (a)				General component :			
8	Plaster (Jubolin + Jupol)	0,91	0,3				
10	Reinforced concrete	2,30	20				
5	Jubizol Adhesive mortar	0,91	0,5				
2	Jubizol EPS F-G	0,039	25				
4	Jubizol (base coat + finishing coat)	0,91	0,5				
General component :				Other materials (materials not included in general component) :			
				3	Eurotherm EPS T	0,051	3
				7	Metal window sill (aluminium)	generic	0,1
				(6)	Metal profile (steel support of window)	50,00	0,4
				9	PU foam	0,029	1
				11	Screed	1,40	7
				12	Window frame	generic	N/A
				13	Wood floring - hardwood	0,18	1
				14	Wood cement panel	0,28	1,2
				15	PE foil	generic	0,05
				1	Sealing tape	generic	0,05

Graphical presentation of the results (A3-23):

Materials

	Name	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]
	PVC, hart	0.170			
	Aluminium	200.000			
	Hartholz ca. 700kg/m³	0.180			
	Stahl	50.000			
	Thermix Ersatz	0.440			
	PU-Schaum 40kg/m³	0.029			
	Aussenputz (JUBIZOL)	0.910			
	Stahlbeton	2.300			
	EPDM	0.250			
	Estrich	1.400			
	Polysulfid	0.400			
	Eurotherm EPS-T	0.051			
	JUBIZOL Adhesive mortar	0.910			
	Molekularsieb	0.100			
	Wood-cement panel	0.280			
	GFK	0.190			
	Vorlege-/Kompriband (Einbaufuge Fenster)	0.060			
	innen (reduziert) 20°C 5W/m²K			20.0	5.00
	SZR 16 mm 0.7	0.026			
	Innenputz (JUBOLIN+Jupol)	0.910			
	Glas	1.000			
	JUBIZOL EPS F-G	0.039			
	außen -10°C 25W/m²K			-10.0	25.00
	innen Wand 20°C 7.69W/m²K			20.0	7.70



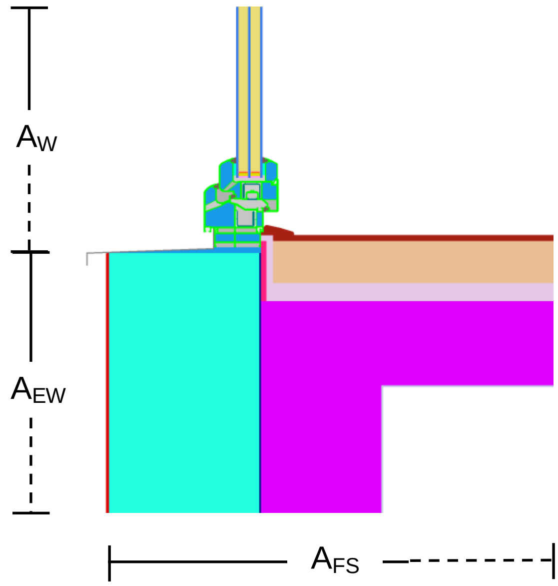
Passive house suitable window, standard size

$U_f \leq 0,75$ W/(m²K)

$U_g = 0,70$ W/(m²K)

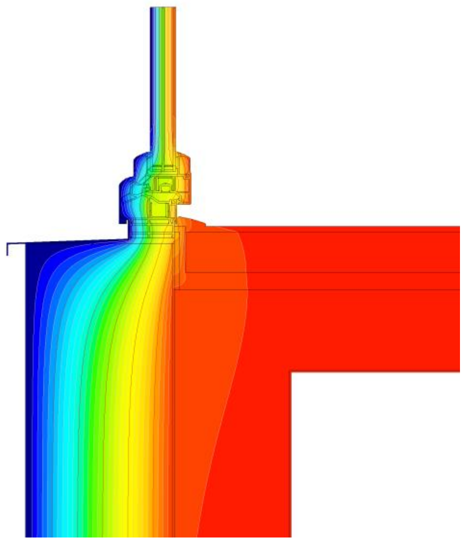
$\Psi_g \leq 0,035$ W/(mK)

Model



Temperature [°C]

Isotherms

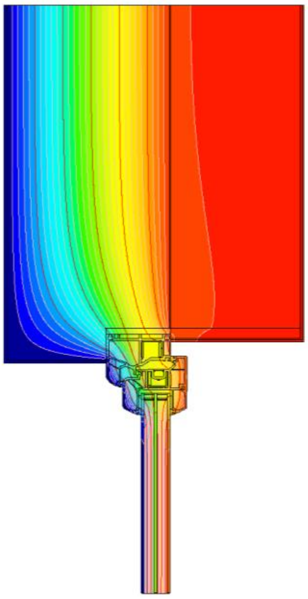
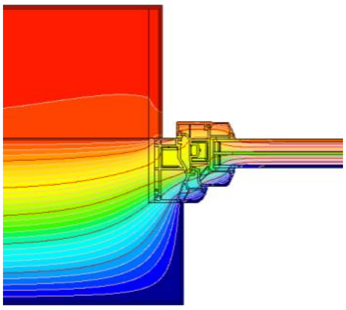
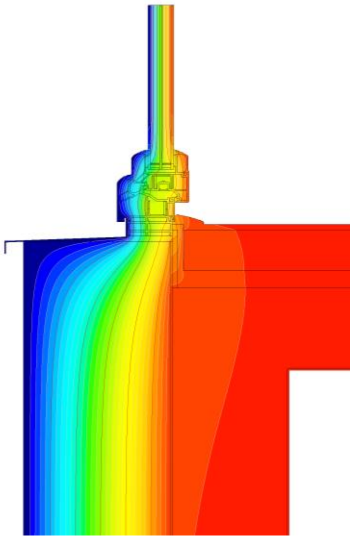


Calculation results according to DIN EN ISO 10211 (A3-23):

project:	**K1305ws_Wall System-TRC-JUB**		
detail number:	**A3-23**		
connection detail:	**inst. of French window in ext. wall, exit - bottom**		
description	**symbol**	**value**	**unit**
base values			
permissible limiting value for absence of thermal bridge	Ψ_a	0,01	W/(mK)
external temperature	ϑ_e	-10,00	°C
room temperature	ϑ_i	20,00	°C
ground/basement temperature	ϑ_g	10,00	°C
exterior heat transfer resistance	R_{se}	0,04	(m²K)/W
exterior heat transfer resistance (exterior wall, ventilated)	R_{se}	0,13	(m²K)/W
exterior heat transfer resistance (roof, ventilated)	R_{se}	0,10	(m²K)/W
interior heat transfer resistance, upwards	R_{si}	0,10	(m²K)/W
interior heat transfer resistance, horizontal	R_{si}	0,13	(m²K)/W
interior heat transfer resistance, downwards	R_{si}	0,17	(m²K)/W
heat transfer resistance to the ground	R_{sg}	0,00	(m²K)/W
heat transfer coefficients			
External Wall	U_1	0,15	W/(m²K)
Standard window	U_2	0,00	W/(m²K)

results			
reference temperature difference of the heat transfer coefficient	$\Delta\vartheta$	30	K
linear thermal bridge loss coefficient	Ψ_a	0,015	W/(mK)
minimal interior surface temperature at -10°C	ϑ_{min}	15,7	°C
temperature factor at Rsi = 0.25 (m²K)/W	$f_{Rsi=0.25}$	0,86	-
Further results: see under overall evaluation of the relevant installation situations			

5.4.4.2 Window installation in external wall, French window – overview of results

Window installation situation	h = 1.48 m / b = 1.23 m	
Window lintel	Window reveal	Window sill
		
Ψ_a = 0,007 W/(mK)	Ψ_a = 0,007 W/(mK)	Ψ_a = 0,015 W/(mK)
A3-14	**A3-15**	**A3-23**
Resulting installation situation		$U_{w,installed}$ [W/(m²K)]
Installed window frame – exterior wall		**0,83**

With the use of the Passive House suitable window with the standard dimensions, the window installation situation meets the described criteria. The following Seal (illustration) is to be used when required:

CERTIFIED COMPONENT
Passive House Institute

6 Airtightness

6.1 Criteria

Airtightness of the building envelope is an essential requirement for Passive Houses. This is tested by means of a Blower-Door test and may not exceed 0,6 1/h at a negative pressure of 50 Pa. This is necessary in order to ensure that a major part of the air exchange inside the Passive House is supplied via the ventilation system with heat recovery and in order to prevent structural damage from air and moisture transfer. The information provided by the applicant relating to airtightness is as follows:

6.2 Airtightness concept

The airtight layer was designed so that it is complete and without any interruption. There is only one airtight plane. It is marked with red pen in connection details.

Regular Airtightness Layer

The regular airtightness layer consists of:

• Exterior walls
Smooth layer of continuous interior plaster in conjunction with reinforced concrete

• Floor slab
Reinforced concrete slab connected airtightly with the interior plaster of the wall

• Basement ceiling
Reinforced concrete slab connected airtightly with the interior plaster of the wall

• Flat roof
Reinforced concrete slab connected airtightly with the interior plaster of the wall

• Pitched roof
A continuously installed airtight membrane (vapour barrier) connected airtightly with the exterior wall

Connection details: Airtightness

The following principles have been applied:

• For flat roof (detail no. 02) the airtight level is formed by interior plaster (self-levelling compound + paint), which is continuously connected with interior plaster of the wall.
Additional measures to contribute to airtightness can be taken as follows:
- coating contact surfaces with bonding mortar prior concreting different concrete elements. In this case coating of headspace of exterior wall prior concreting roof slab.
- avoiding contacts between thermal insulation slabs in the plane of connection of concrete elements (wall-roof slab)

• For ceiling (detail no. 08, 11, 12, 13) the airtight level is formed by interior plaster (self-levelling compound + paint), which is continuously connected with the floor (concrete slab) and/or ceiling.
Additional measures to contribute to airtightness can be taken as follows:
- coating contact surfaces with bonding mortar prior concreting different concrete elements. In this case coating of headspace of exterior wall prior concreting roof slab.
- avoiding contacts between thermal insulation slabs in the plane of connection of concrete elements (wall-roof slab)

• For pitched roof (detail no. 03, 04) the airtight level is formed by vapour barrier, which is airtightly connected to the concrete wall with suitable adhesive tape. Adhesive tape has to be on joint gap continuously connected to other strips of adhesive tape.

Additional measures to contribute to airtightness can be taken as follows:
- coating contact surfaces with bonding mortar prior concreting different concrete elements. In this case coating of headspace of exterior wall prior concreting roof slab.
- avoiding contacts between thermal insulation slabs in the plane of connection of concrete elements (wall-roof slab)

• For floor slab (detail no. 09, 10) the airtight level is formed by interior plaster (self-levelling compound + paint), which is continuously connected with the floor (concrete slab).
Additional measures to contribute to airtightness can be taken as follows:
- coating contact surfaces with bonding mortar prior concreting different concrete elements. In this case coating of headspace of exterior wall prior concreting roof slab.
- avoiding contacts between thermal insulation slabs in the plane of connection of concrete elements (wall-roof slab)

• For airtight window installation in external wall (detail no. 14, 15, 16, 17, 18, 19, 20, 21, 23) appropriate adhesive sealing tape (vapour barrier) must be used (e.g. Illbruck ME500 or FF210).

6.3 Ducts and pipes

The method for achieving airtightness in case of routing of pipes, ventilation ducts and other lines through the wall and roof (working temperature lower than 100°C) is as follows:

In case of penetrations, first cut a smaller hole (30mm on each side) in the relevant position. Push the pipe through the hole carefully and extend the PE membrane around the pipe. After that, wrap a 40mm wide tape around the extended membrane and pipe (3 circle) in order to close the seam.

Then wrap a rubber band around the pipe. Apply butyl sealant between the rubber band and the pipe. Attach the rubber band to the linear panel and seal it with double-sided butyl adhesive tape.

7 Legal information

The following information must be kept in mind when planning and executing the detail solutions documented in this report:

The detail drawings in this documentation are schematic diagrams which must be adapted for the specific construction with regard to planning. Sealing of the construction against moisture is not shown in the detail drawings and was not the subject of this examination. Where necessary, this should be carried out in accordance with the accepted technical standards. The absence of condensation in the construction details was also not examined by the Passive House Institute. The responsibility for checking the above mentioned points lies with the applicant for the certification procedure and/or the user of the details shown.

The present system was certified according to the criteria for cool, temperate climates. Suitability of the examined constructions and detail solutions for the climatic conditions prevailing at the specific location must be evaluated by the planner in charge of the work.

As a rule, the rated values of the thermal conductivities of the insulation materials have been verified in [W/(mK) for the Passive House relevant materials by means of available general building approvals (abZ) for Germany with Ü or CE labelling, or legally equivalent documents. Specification of these values and their assigned results in this report does not absolve the planner in charge of the responsibility for carrying out independent examinations with regard to the use of the thermal conductivities mentioned here in project-specific verification.

The present documentation does not allow conclusions to be drawn regarding other characteristics of the examined construction that may determine its performance and quality. In particular, this documentation is not a substitute for building authority approval.

The scope of the examination and accountability of the submitted certification is limited to the testing routines with regard to compliance with the stated criteria of the Passive House Institute. A legal basis for making any claims against the Passive House Institute – Dr. Wolfgang Feist based on the information provided in this report is excluded.

8 Evaluation

The examined building system with the indicated details meets the PHI criteria for Passive House suitable components of building systems because:

1. The U-values of the standard exterior building components comply with the limit value of 0,15 W/(m²K), possibly with reduction due to fx factors.
2. The main connection details meet the simplified criterion $\Psi_a \leq 0.01$ W/(mK) for absence of thermal bridges.
3. The surface temperatures of the connection details (except for windows) meet the requirement of 17°C at a temperature of ϑ_a = -10°C and ϑ_i = 20°C.
4. The explanations for the creation of the airtight layer for this building system are plausible.