Agenzia per l'Energia Alto Adige - CasaClima
Agentur für Energie Südtirol - KlimaHaus

Technical Guideline for New Buildings

April 2021 ver. 1.2

CONTENTS

1 GENERAL PRELIMINARY REMARKS

1.1 The Technical Guidelines

The "Technical Guidelines on CasaClima - New Building", hereinafter referred to as Technical Guidelines, are the basis for every new building. They define all the minimum requirements necessary for CasaClima certification, the calculation method, evidence, documents and processes.

1.2 Definitions

All the necessary definitions for the application of the Technical Guidelines are contained in the state and national legal regulations and technical standards to which reference is made at this point. Reference is made in these guidelines to European standards which are applied in the member states of the EU. In all other countries, reference can be made to other equivalent standards.

1.3 Validity

These Technical Guidelines become effective on 1 January 2021. They will remain valid until the publication of a new edition. The provisions of the Technical Guidelines apply to all applications submitted after these guidelines come into effect.

1.4 Parties involved in the certification process

The main parties involved in a certification are defined below:

Agency:
The Agency for Energy South Tyrol - KlimaHaus, hereinafter referred to as the Agency or KlimaHaus, and the partner agencies are the technical and administrative body for the service of certifications, the processing of applications and for carrying out checks and inspections. Only the Agency for Energy South Tyrol - CasaClima or one of the partner agencies may issue the CasaClima certificate and award the corresponding CasaClima plaque .

Applicant:
The applicant can be any individual or legal entity who or which applies for certification.

Certification consultant:
During the certification process, the consultant is the sole contact person for the Agency. They coordinate all relevant parties (planners, specialist planners, contractors), collect the necessary documents and evidence and forward them to the Agency.

CasaClima auditor:
The CasaClima auditor is an engineer commissioned by the Agency to carry out the project and construction site controls (audits) that are part of the certification process.

1.5 CasaClima protocol

The following certification procedure is defined in the CasaClima protocol:

1.5.1 Pre-certification

The application for certification must be submitted before construction begins. A prerequisite for the acceptance of submitted certification applications is their formal completeness in accordance with the present guidelines. During pre-certification, compliance with technical requirements (energy calculations, structural certificates, plan drawings, technical documentation, etc.) is verified. Following successful completion, a pre-certification code and a corresponding logo is provided, which can be used by the customer from that point on.

1.5.2 Certification

During the certification phase, the site audits are carried out and, if necessary, the documentation and calculations are updated (audits - controls on-site, follow-up controls and updating of the energy calculation, review of the submitted documentation, measurements and test reports, etc.).

The Agency checks the documentation according to the requirements of the Technical Guidelines and randomly verifies the conformity of the construction details relevant for certification at the construction site.

CasaClima auditors are appointed by the Agency for these controls during the construction phase and after completion of the work. They carry out the intended local inspections (audits). The auditor logs the technical requirements checked at the construction site, which are necessary for certification, in the audit record.

The Agency receives the final project status and all necessary data from the consultants or the auditors to complete the certification.

1.6 Responsibilities, duties and liabilities

The engineer appointed by the client (certification consultant) must provide the Agency with all the necessary documents and calculations for the certification of a building.

Upon conclusion of the contract, the client will declare that all information, documents and details provided to the Agency via the consultant are in accordance with the truth and that the consultant is authorized to lawfully disclose them - including personal data.

The client undertakes to comply with all statutory provision in connection with the work to be carried out. They will assure the Agency that there has been ~~smooth and~~ constructive cooperation with the technical personnel and contractors they have commissioned and guarantee that the consultant named for this purpose acts in their name and is the sole contact person for the Agency in all matters concerning the delivery of the service in question. If the client appoints a new consultant, the Agency must be informed immediately and in writing.

The liability of the Agency is limited exclusively to the services related to the certification process and its technical requirements and is in any case limited to the foreseeable losses which are typical of this type of contract, but not exceeding the sum of the certification costs.

Liability for indirect and unforeseeable damage, loss of production and use, lost profits, savings and financial losses due to third-party claims is excluded.

Furthermore, the Agency is not liable - regardless of the legal nature of the asserted claim - for any concerns whatsoever. In particular, not for those which are not part of the certification and which are the responsibility of the client or third parties (e.g. planners, specialist planners, contracting firms, etc.).

In particular, the Agency will not be liable for separately commissioned planning services, construction management, execution work or other services in connection with the work being carried out. The client will relieve the Agency of any responsibility with regard to all services not explicitly commissioned to the Agency and the associated liability, any construction defects or similar, associated depreciation in value or necessary expenses for their elimination.

2 DOCUMENTATION

The documents required for certification should be sent to the following address:
technik@klimahausagentur.it

Tabular overview of the required documents:

Certification phases	REQUIRED DOCUMENTS For the BUILDING ENVELOPE and BUILDING SERVICES	DIGITAL MEDIUM
Project	Application form	**PDF or similar**
	Building concession, building permit, or equivalent	**PDF or similar**
	CasaClima calculation	**ProCasaClima-Export-File (.xlsx)**
	Planning documents and details of the building envelope and building services equipment and, if applicable, the documents required for the sustainability seals (Nature, Hotel, Wine, Work&Life, School, ...)	**PDF or similar*1**
	Structural evidence of the building connections (also using the CasaClima component catalog)	**PDF or similar*2**
Building	Technical data sheets, performance records and certificates of building products and components Photo documentation of execution details	**PDF or similar**
Final inspection	Test report of the blower door test and, if necessary, further evidence which are required for the sustainability seals (Nature, Hotel, Wine, Work&Life, School, ...)	**PDF or similar**
	CasaClima calculation, updated	**ProCasaClima-Export-File (.xlsx)**

Note:
**1 If the control of the energy calculation and the building envelope reveals any deviations or data do not meet the standard, the Agency may reject the project (building envelope, gross volume, net floor area, heat transfer peripheral surface) in a vectorial format.*

**2 Alternatively the execution details can be enclosed.*

2.1 Application form

The application form for certification is a file to be filled in electronically (PDF). The start of the certification is the date of receipt of the application.

2.2 Certification phases

2.2.1 Review of the project

DOCUMENTS
Planning documents: Planning documents and details of the building envelope and building appliances and equipment and, if applicable, the documents required for the sustainability seals (Nature, Hotel, Wine, Work&Life, School, ...) are to be submitted together with the application form (PDF). All information, calculations and documents in this regard are assumed to be true and correct.
The existing structural evidence, also using the CasaClima component catalog.
CasaClima calculation: Together with the application (PDF), only the export file of the official KlimaHaus calculation program has to be submitted.

2.2.2 Review of the construction work

DOCUMENTS
Photo documentation and CasaClima calculation: Update of the export file of the CasaClima calculation and other technical documents (planning documents, evidence of component connections which were used in the execution phase in accordance with the CasaClima catalog).

2.2.3 Final inspection of the project

DOCUMENTS
Technical report of the **blower door test**, as defined in the document "CasaClima criteria for the execution of airtightness tests" (BDT guidelines). Update of the export file of the energy calculation as well as further evidence which is required for the sustainability seals (Nature, Hotel, Wine, Work&Life, School, ...)

2.2.4 Control

The Agency will review the submitted documents and may request additions to the data entered in the official CasaClima calculation program.

The Agency reserves the right to request additional documents for energy certification and to carry out its own inspections of the building.

3 CASACLIMA ENERGY CERTIFICATION

3.1 CasaClima classes

The CasaClima classes, which are listed in the table, refer to the energy KPIs (energy efficiency of the building envelope, equivalent primary energy demand (only heating/only cooling), total energy efficiency heating and cooling), whose heating degree days (20°C/12°C) [Kd/a] depend on the location and were calculated on the basis of the daily average value.

The climate data of the site may refer to national standards of the country. Alternatively, on request and subject to availability, the site data can be calculated and accessed by the Meteonorm software. In any case, the monthly data (outdoor temperature and total radiation horizontal and oriented) must be available over a period of at least 10 years.

The CasaClima class of the building corresponds to the lower class from the classifications of the energy efficiency of the building envelope and the overall energy efficiency. The limit values of the classes (residential buildings) are specified in the table.

The CasaClima class to be maintained*) depending on the heating degree days are:

Up to 3000 Kd/a: CasaClima A

From 3000 Kd/a to 4000 Kd/a: CasaClima B

From 4000 Kd/a: CasaClima C

Klima Haus class	Energy efficiency of the building envelope **EGH_{WGB}** [kWh/m²a]	Equivalent primary energy demand only heating **PEH_{WBG}** [kg $CO_{2\ eqv}$/m²a]	Equivalent primary energy demand (only cooling) **PEK_{WBG}**** [kg $CO_{2\ eqv}$/m²a]	Overall energy efficiency (heating and cooling) **GEE_{WBG}** (= PEH_{WBG}+ PEK_{WBG}) [kg $CO_{2\ eqv}$/m²a]
Gold*	≤ 10	≤ 10	≤ 5	≤ 15
A*	≤ 30	≤ 20	≤ 10	≤ 30
B	≤ 50	≤ 35	≤ 15	≤ 50
C	≤ 70	≤ 50	≤ 20	≤ 70
D	≤ 90	≤ 65	≤ 25	≤ 90
E	≤ 120	≤ 90	≤ 30	≤ 120
F	≤ 160	≤ 120	≤ 40	≤ 160
G	≤ 160	>120	>40	>160

*) *Depending on the general building standard in certain regions, the CasaClima Agency can adjust these requirements to the country- and market-specific situations.*

Notes:

* *A CasaClima Class A or Gold building (energy efficiency of the building envelope and overall energy efficiency) corresponds to a so-called "nZEB" - Nearly Zero Energy Building, according to the European Directive 2010/31/EU Art.2(2).*

** *The limit values for the "equivalent primary energy demand (only cooling)" are zero if no cooling system is available.*

Equation symbols:

$\mathbf{EGH_{WBG}}$	=	energy efficiency of the building envelope, residential buildings
$\mathbf{EGH_{NWBG}}$	=	energy efficiency of the building envelope, non-residential buildings
$\mathbf{PEH_{WBG}}$	=	equivalent primary energy demand without cooling, residential buildings
$\mathbf{PEK_{WBG}}$	=	equivalent primary energy demand with cooling, residential buildings
$\mathbf{GEE_{WBG}}$	=	overall energy efficiency (PEH_{WBG}+PEK_{WBG}), residential buildings, relative to the provincial capital
$\mathbf{GEE_{WBG,\ location}}$	=	overall energy efficiency (PEH_{WBG}+PEK_{WBG}), residential buildings, relative to the local town
$\mathbf{GEE_{NWBG}}$	=	overall energy efficiency (PEH_{WBG}+PEK_{WBG}), non-residential buildings, relative to the provincial capital
$\mathbf{GEE_{NWBG,\ location}}$	=	overall energy efficiency (PEH_{WBG}+PEK_{WBG}), non-residential buildings, relative to the local town
HDD	=	heating degree days

3.2 Energy efficiency of the building envelope EGH and overall energy efficiency GEE

In the case of **non-residential buildings** (NWGB), the EGH and GEE limits are to be calculated as follows:

$$EGH_{NWGB} = \max\left(EGH_{WGB} \times \frac{Net\ volume}{(3 \times NGF)}; EGH_{WGB}\right) \quad (2.1)$$

$$GEE_{NWGB} = \max\left(GEE_{WGB} \times \frac{Net\ volume}{(3 \times NGF)}; GEE_{WGB}\right) \quad (2.2)$$

$$NGF = Heated\ net\ floor\ area$$

In the case of **commercial accommodation** (hotels) the EGH and GEE limits are to be calculated as follows:

$$EGH_{HOTEL} = EGH_{NRES} \quad (3.1)$$

$$GEE_{HOTEL} = 2 \times GEE_{RES} \quad (3.2)$$

4 REQUIREMENTS FOR CERTIFICATION

4.1 Thermal bridges

New buildings must comply with the requirements regarding energy efficiency during the heating period, which are specified in chapter 4 and in the CasaClima catalog.

For connections that are not listed in item 4.2 and/or in the CasaClima catalog or are not thermally comparable, two-dimensional evidence (FEM calculation according to EN ISO 10211) must be submitted, which proves the surface temperature inside with a temperature **Ti ≥ 17.0°C without a ventilation system or Ti ≥ 12.6°C with a ventilation system**. **The ventilation system must maintain an air exchange rate of 0.3 Vol/h**. The following exceptions are not affected by this regulation:

a) In the case of buildings of Gold class, two-dimensional evidence (FEM calculation according to EN ISO 10211) of Ti ≥ 17.0°C with or without a ventilation system must always be submitted, including for building connection details that are listed in the CasaClima catalog or in point 4.2.

b) All building locations with a HDD rating ≥ 2000 Kd/a: for doors, French Windows, sliding doors with a low floor threshold, a temperature of ≥ 12.6°C must be verified at the floor threshold connection.

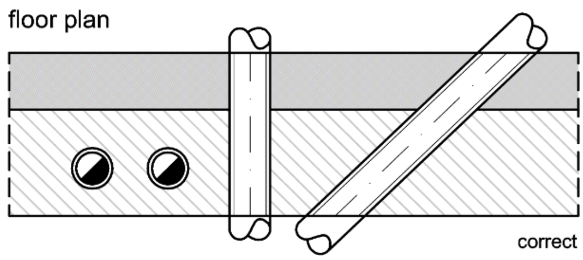
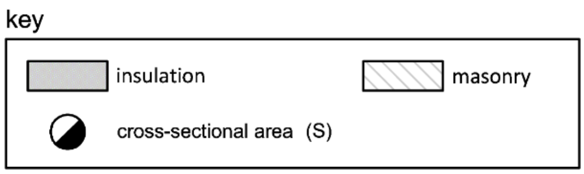
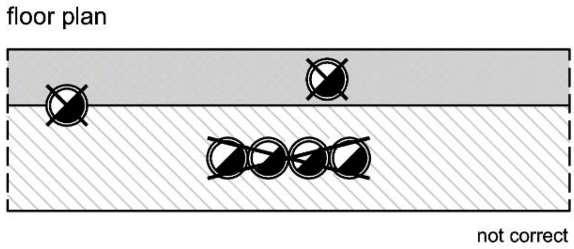
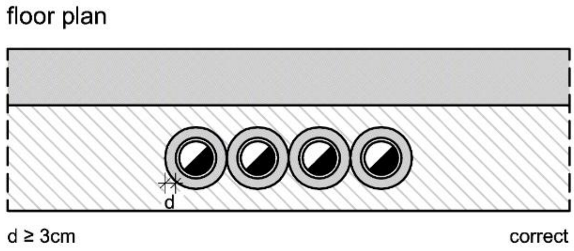
c) Building locations with a HDD rating ≥ 3000 Kd/a: It is possible to dispense with the requirement of minimum surface temperature at the point where the window/French door connects to the structure if it is not possible to meet this requirement for technical reasons and the connection is designed according to the state of the art.

d) Evidence of the window/French door connection is not required in the case of windows with the "CasaClima Quality Window" seal of approval.

4.2 Standard solutions

The Agency has developed standard solutions for frequent, linear thermal bridges. The following data are to be regarded as minimum requirements, which are also listed in the CasaClima catalog.

4.2.1 Installation shafts and ducts in the components of the building envelope

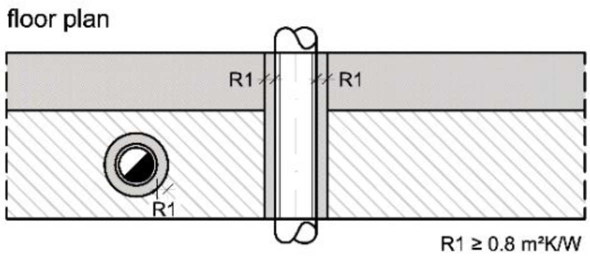
Case 1: OPEN CHANNELS AND INSTALLATION SHAFTS (COLD)	
Single, with one cross-sectional area	**S < 100 cm²**
Ventilation ducts, electrical cables, small technical components, etc. with a **cross section of S < 100cm²** installed in heat-emitting components do not need to be insulated if they are separate.	 
Adjacent with one cross-sectional area	**S ≥ 100 cm²**
Adjacent shafts/ducts with a **cross-section of S ≥ 100cm² must be insulated with an insulation layer of R_1 ≥ 0.8 m²K/W.** (Insulation thickness d ≥ 3cm with a thermal conductivity λ ≤ 0.04 W/mK or equivalent) No installation lines (electrical lines, gas or water lines, down pipes, etc.) must be laid in the thermal insulation layer (ETICS).	 

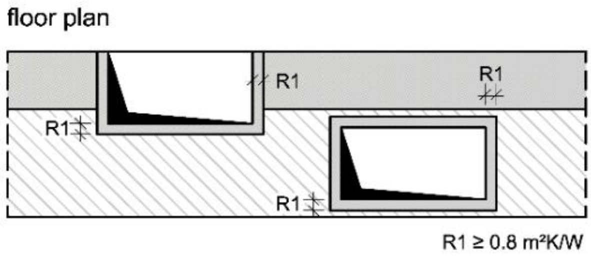
Case 2: DUCTS AND INSTALLATION SHAFTS WITH A CROSS-SECTIONAL AREA $100\ cm^2 \leq S \leq 5000\ cm^2$

Ventilation ducts, electrical lines, small technical parts etc. with a **cross-section of $100cm^2 \leq S \leq 5000cm^2$** located in the heat-transferring components (horizontal and vertical) **must be insulated with an insulation layer of $R_1 \geq 0.8\ m^2K/W$.**

(Insulation thickness d ≥ 3cm with a thermal conductivity λ ≤ 0.04 W/mK or equivalent)

Exceptions to this are chimneys that are completely integrated into the heat-transferring component and have their own insulation system.

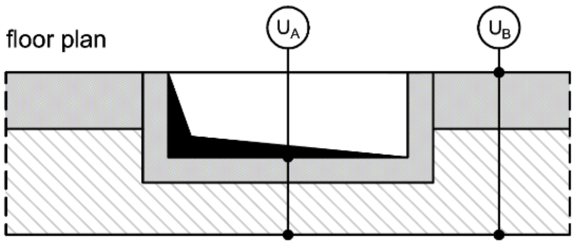


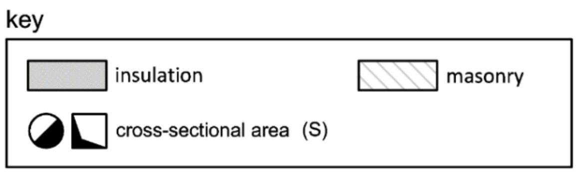


Case 3: DUCTS AND INSTALLATION SHAFTS WITH A CROSS-SECTIONAL AREA $S > 5000\ cm^2$

Open shafts and ducts in connection with the outside air with a **cross-section of $S > 5000cm^2$, are to be considered as separate heat-transferring components** if the heat transfer coefficient is **$U_A > U_B$**.

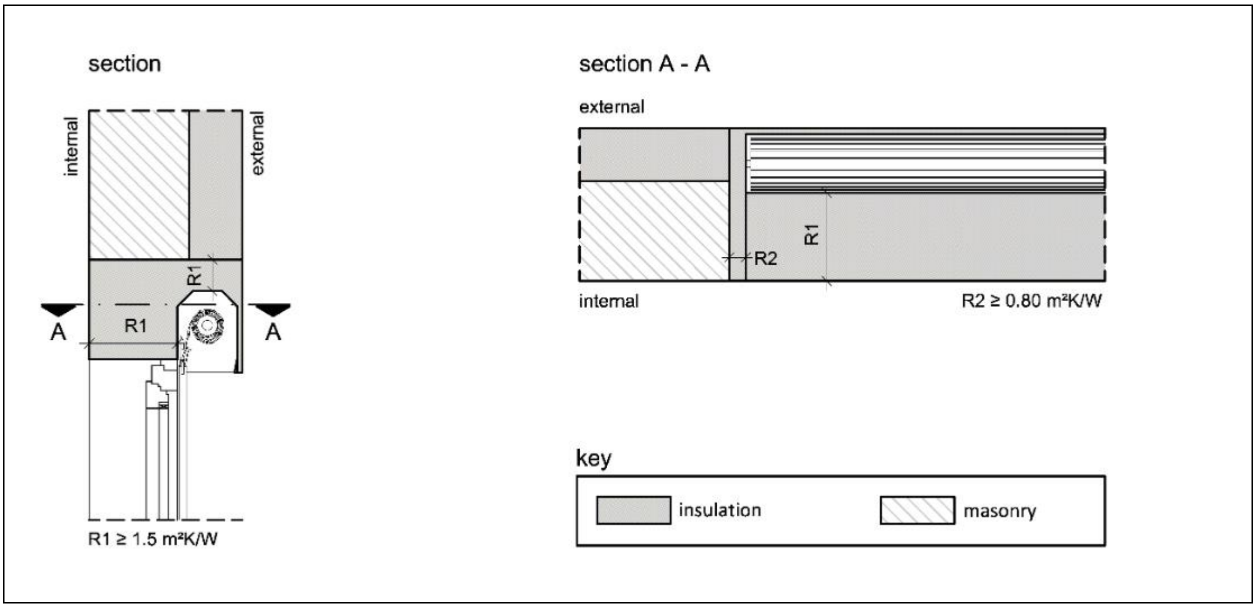
This also applies to chimneys that are not completely integrated in the heat-transferring component





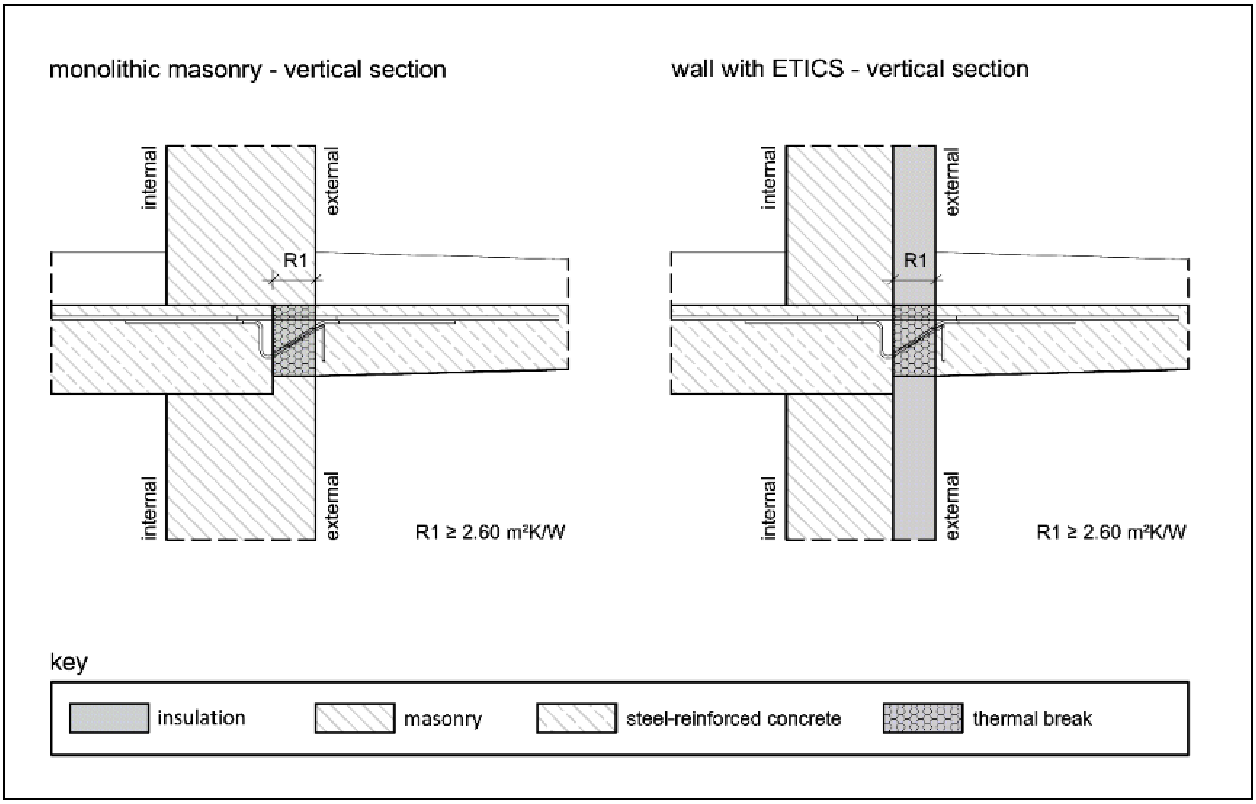
4.2.2 Roller shutter boxes

Roller shutter boxes with maintenance opening to the interior must be airtight when closed. Please refer to chapter 4.5 for the structural evidence for the avoidance of condensation.

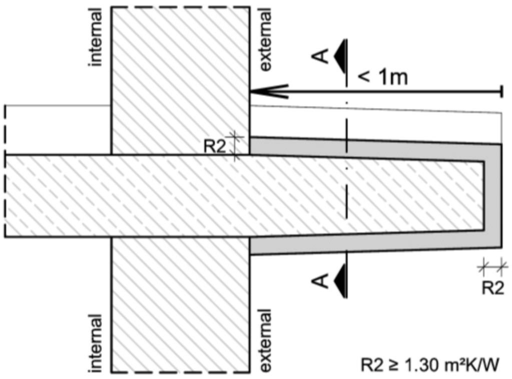


4.2.3 Overhanging building components

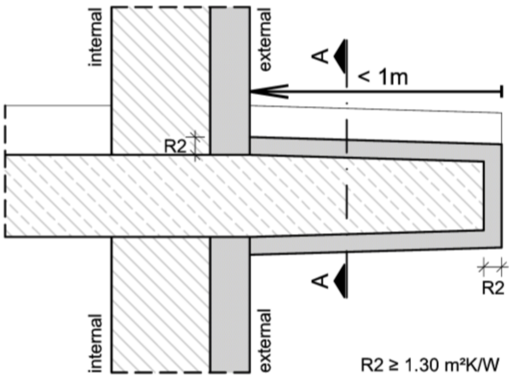
Please refer to chapter 4.5 for the structural evidence for the avoidance of condensation.



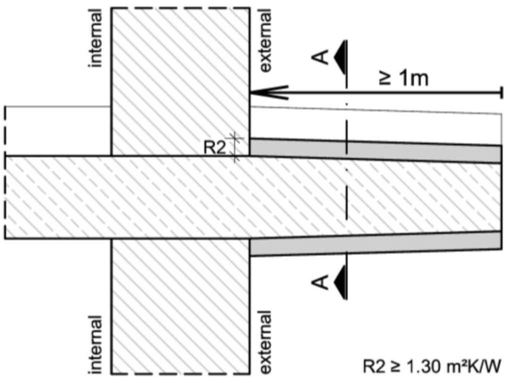
monolithic masonry - vertical section



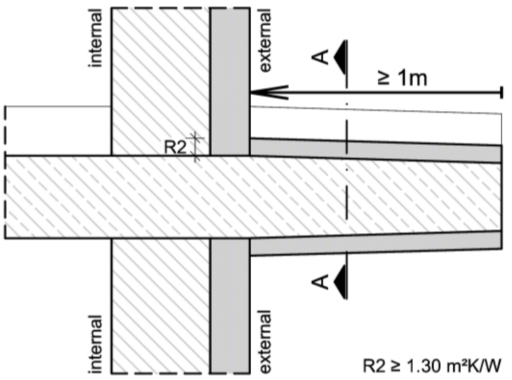
wall with ETICS - vertical section



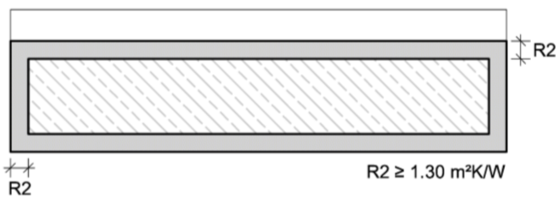
monolithic masonry - vertical section



wall with ETICS - vertical section



section A - A



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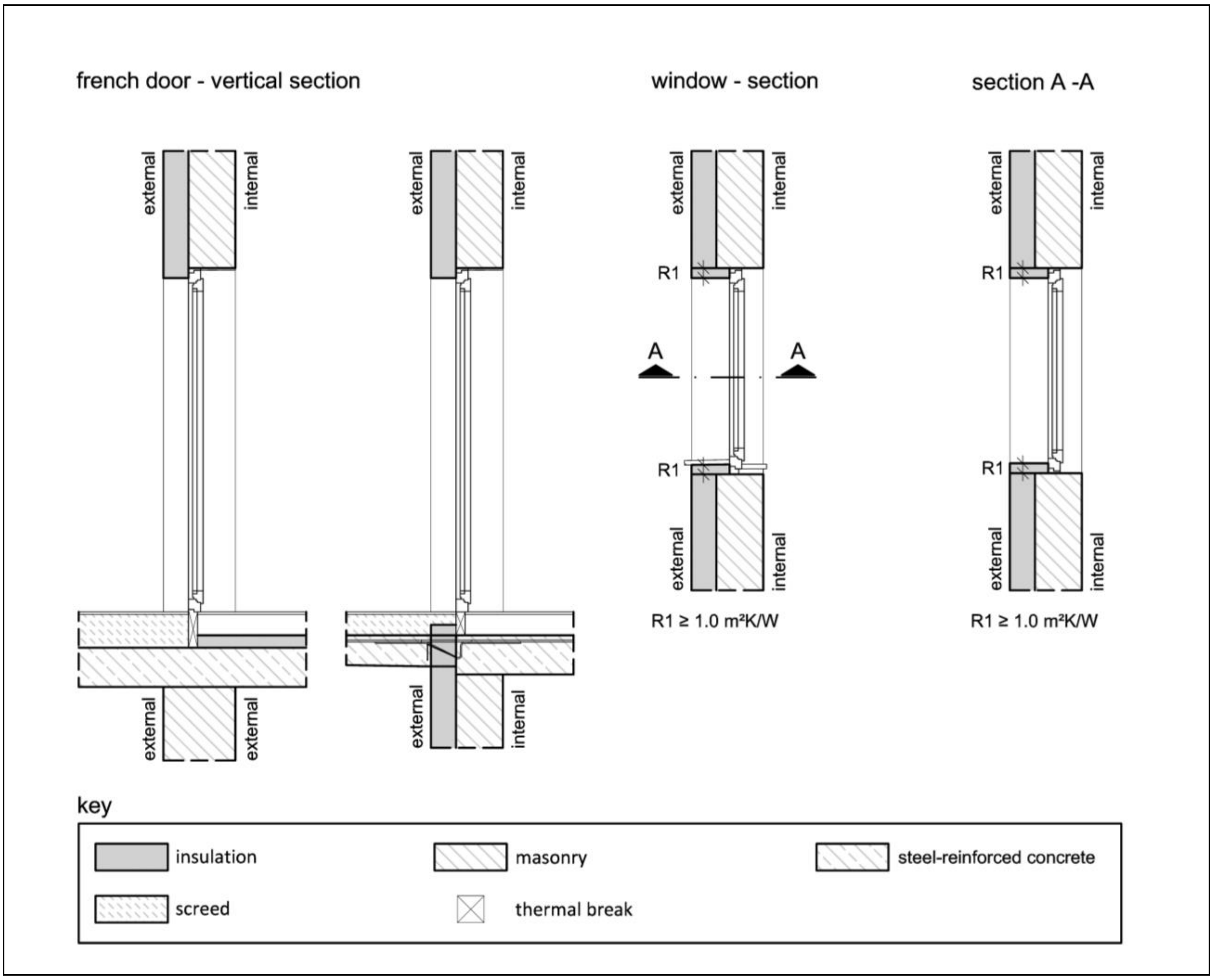
4.2.4 Windows

Building connections of windows and doors meet the minimum thermal requirements if:

- **the window reveal** is insulated;
- **the window sill is not continuous;**
- **the floor structure is thermally separated through to the structural slab** and runs in continuity with the thermal building envelope; ground sills should be thermally separated;
- **Subframes are continuous on all four sides** and run in continuity with the thermal building envelope;
- **Metal subframes are thermally separated.**

Please refer to chapter 4.5 for the structural evidence for the avoidance of condensation.



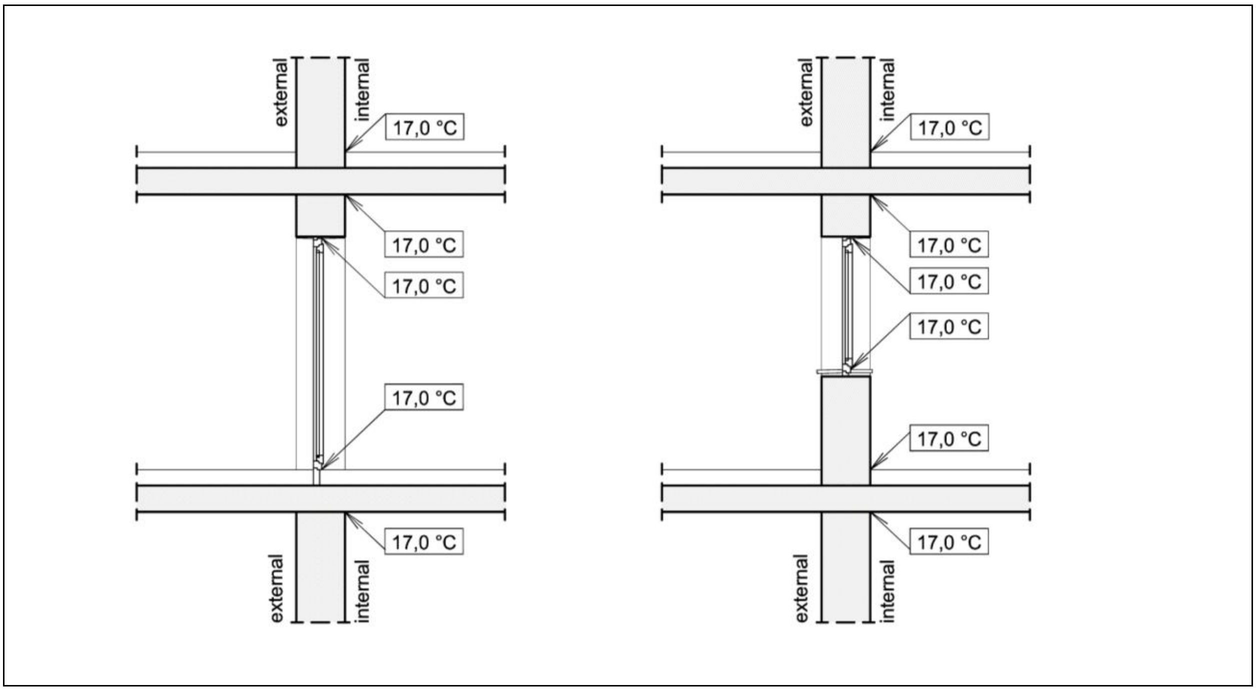
4.3 Verification of surface temperature

4.3.1 Minimum surface temperature, room side

The surface temperature is to be verified with an FEM calculation on a two-dimensional model.

The surface temperature inside in the corners of the components and at the point where the window/French door connects to the structure must maintain a temperature of $T_i \geq 17.0°C$.

The exceptions are listed in point 4.1.



4.3.2 Boundary conditions for the calculation

The following boundary conditions apply to the FEM calculation (validated according to EN ISO 10211) on a two-dimensional model.

CONDITION FOR THE AMBIENT TEMPERATURE	**T_i/T_e**
Indoor air, heated	20 °C
Outdoor air	Average temperature of the coldest month at the building location
Indoor air, not heated (θe x f_i)	Temperature correction factor in accordance with EN ISO 13788 (see chapter 6.2)
Indoor air, areas in contact with the ground (θe x fi)	in accordance with EN ISO 13788

<table>
<tr><th colspan="4">HEAT TRANSFER RESISTANCES (EN ISO 13 788)</th><th>Rse / Rsi [m²K/W]</th></tr>
<tr><td>Outside</td><td colspan="3">for all surfaces</td><td>0.04</td></tr>
<tr><td rowspan="5">Inside</td><td colspan="3">for all non-transparent surfaces (also for corners, furniture, curtains)</td><td>0.25</td></tr>
<tr><td colspan="3">for surfaces behind cabinets</td><td>1.0</td></tr>
<tr><td rowspan="3">for all surfaces
of windows and doors</td><td rowspan="3">Direction
of heat flow</td><td>up</td><td>0.10</td></tr>
<tr><td>horizontal</td><td>0.13</td></tr>
<tr><td>down</td><td>0.17</td></tr>
</table>

4.4 External insulation with external thermal insulation composite systems

If there is currently no national regulation, the Agency recommends, as technical proof for the external insulation (durability while maintaining unaltered physical properties), so-called external thermal insulation composite systems (ETICS) with a European Technical Assessment (ETA), and the installation of the system according to the manufacturer's instructions (see also "Best Practice" such as ETICS, etc.).

4.5 Building components with internal insulation or core insulation

Verification of condensation risk I is required in accordance with one of the following standards for building components with internal insulation or core insulation, and for non-ventilated flat roofs in timber construction:

- EN ISO 13788 (monthly calculation or by Glaser method, monthly)
- EN 15026 (hourly calculation)

4.5.1 Conditions for the calculation according to EN ISO 13788

The verification will be performed under the following boundary conditions:

Indoor climate: according to EN ISO 13788

Outdoor climate: according to national standards, Meteonorm or equivalent

Evidence: accumulated condensation water quantity less than the absorbable condensation water quantity according to EN ISO 13788 - national annex. The accumulated condensation water quantity must escape within the calculation period (1 year).

If phenomena that are not described in EN ISO 13788 are relevant or the results of the evidence according to EN ISO 13788 are negative, the evidence procedure according to EN 15026 can be applied.

4.5.2 Conditions for the calculation according to EN ISO 15026

According to EN 15026, the verification has to be carried out with a simulation program for the calculation of coupled heat and moisture transport in building components.

The verification will be performed under the following boundary conditions:

Indoor climate: The moisture load is "normal" for residential buildings according to EN 15026 if there is no system for air humidity control present to be taken into account when determining the primary energy requirement for heating and cooling.

Outdoor climate: hourly calculation with data from climate databases for the building location, possibly taking artificial shading into account (neighboring buildings, etc.).

Input of the component structure: Subdivision of the structure into 1cm layers in the critical areas. For the identification of the critical areas, i.e. areas where the relative material moisture φ exceeds 90% or 95%, the animation of the dynamic behavior is to be used. (see $LIM_{BAU}I/LIM_{BAU}II$).

Monitor position: positioning in the middle of the critical points.

Simulation period: at least three years, albeit until the construction is in a state of dynamic equilibrium at least, i.e. until there is no increase in moisture content from one year to the next.

Verification: verification is provided by compliance with the limit values of material moisture according to the following table:

Limit value of material moisture

MATERIAL	MAX. MATERIAL MOISTURE of the layer m [%]	LIMIT VALUE FOR RH, if m is without a limit value [%]
Solid wood	< 20%	- for materials that are biodegradable: $LIM_{BAU}I$: 90% - for materials that are not biodegradable: $LIM_{BAU}II$: 95%
Timber building materials or building materials of plant origin	< 18%	

In addition, evidence of any risk of icing or corrosion must be provided.

Evidence of the dynamic simulation is to be provided by the following documents:

- Technical report with evaluation of the result, written by an engineer
- Printout (report) of the simulation program
- Data file of the simulation program
- "Climatic analysis" and "Animation" screenshot
- "Water content in the critical layers" diagram

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4.6 Requirements for thermal insulation (protection overheating summer period)

Buildings in climate zones with more than 4000 HDD can be exempted from sections 4.6.1, 4.6.2, 4.6.3, 4.6.4 and 4.6.5 if the shading requirements are met

4.6.1 Building envelope

The sensitive cooling requirement $\mathbf{Q_{c,sens}}$ of a building is defined with the location-related energy efficiency of the building envelope in the cooling period, and calculated with the official CasaClima calculation program.

The following limit values for the **sensitive cooling requirement** must always be observed:

Residential buildings and school buildings: $\mathbf{Q_{c,sens} \leq 20\ kWh/m^2a}$

Non-residential buildings: $\mathbf{Q_{c,sens} \leq 30\ kWh/m^2a}$

This can be waived if all glass surfaces of the building (except those facing north only) are equipped with a fixed or movable sun protection system. The sun protection system must meet the requirements specified in the following chapters.

4.6.2 Non-transparent components

Components (exterior wall, roof) that are exposed to direct solar radiation must meet the following minimum requirements:

CLIMATE ZONE CONVERTED TO HDD	PHASE SHIFT	ATTENUATION FACTOR (24h)
A, B, C, D (< 2000 Kd/a)	≥ 12 h	≤ 0.30
E, F (≤ 4000 Kd/a)	≥ 9 h	-
F (> 4000 Kd/a)	-	-

Internal admittance of Y_{11} ≥ 2.0 W/m²K is only prescribed for summer thermal insulation in the case of buildings with a location of up to 2000 Kd/a. Otherwise, cooling with 100% coverage of cooling energy demand must be provided.

4.6.3 Transparent components

All transparent surfaces (glass surfaces) of the building must be equipped with a movable or fixed sun protection system, unless the energy calculation shows that the limit value for the sensitive cooling requirement is complied with (for limit values, see section 4.6.1).

This does not apply to glass surfaces that face north.

4.6.4 Mobile sun protection systems

Requirements for the sun protection system that is not integrated into the window and accessible:

- must be mounted on the outside of the glazing
- when closed, more than 90% of solar radiation must be screened (g_{tot} ≤ 0.1 in accordance with EN 13 363-1/-2)

Requirements for the sun protection system that is integrated into the window and accessible:

- must be mounted on the outside between weather protection pane and insulating glass
- when closed, more than 80% of solar radiation must be screened (g_{tot}≤ 0.2)

4.6.5 Fixed and/or permeable sun protection systems

The total energy transmittance g_{tot} of fixed shading systems and permeable solar control systems must not exceed the values given in the table:
(g_{tot} = multi-pane insulating glass + solar control system)

TOTAL ENERGY TRANSMITTANCE g_{tot}							
Vertical surfaces, oriented in the following directions:							Horizontal surfaces
South	Northeast	East	Southeast	Southwest	West	Northwest	
0.27	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Any type of sun protection system must always be installed on the outside of the glass surfaces. The value of the total energy transmittance g_{tot} can be used in the CasaClima program as g - value of the glazing.

4.6.6 Building overhangs

Shading caused by vertical or horizontal overhangs of the building, which guarantee a total energy transmittance according to the table above, replace the requirements according to 4.6.3, 4.6.4 and 4.6.5. The total energy transmittance g_{tot} of the overhang must be verified with the CasaClima program.

4.7 Airtightness of the building envelope

The blower door test is used to measure the airtightness of the building envelope or to determine the air permeability of the building. This test is mandatory for residential buildings. This test is not required for non-residential buildings and hotels.

4.7.1 Performing the blower door test

The blower door test has to be carried out according to the blower door test CasaClima criteria and the execution of the airtightness tests according to EN ISO 9972.

The blower door test should always be carried out in individual dwelling units, not on the entire building. If there are apartments on the top floor, at least one test must be performed in one of these apartments.

If there are leaks to other dwelling units, a test can be carried out on the entire building with the approval of the Agency.

4.7.2 Number of dwelling units to be tested

The measurement of the airtightness of a building with the blower door test is carried out randomly in different dwelling units.

The table shows the minimum number of dwelling units to be tested.

NUMBER OF DWELLING UNITS IN THE BUILDING	MIN. NUMBER OF DWELLING UNITS TO BE TESTED
≤ 5	1
≤ 10	2
≤ 15	3
≤ 22	4
> 22	5

4.7.3 Limit values to be observed

In the case of multi-dwelling buildings, the limit value n_{50} for the entire building is to be given as the calculated average value from the individual measurements of the dwelling units.

ENERGY EFFICIENCY CLASS OF THE BUILDING ENVELOPE	LIMIT VALUES
A and B	$n_{50,lim} \leq 1.5\ h^{(-1)}$
Gold	$n_{50,lim} \leq 0.6\ h^{(-1)}$

Note: The permissible tolerance of the measured values is +0.1 h(-1) at most.

5 BUILDING SERVICES INSTALLATIONS

Building services installations (BSI) are important components of a building. The energy efficiency of the BSI has a strong impact on the overall energy efficiency (OEE). The limit values are defined in chapter 3.1.

In addition to minimum requirements, technical recommendations (best practices) to guarantee energy-efficient BSI are also listed below.

5.1 Installations for heat generation – Heating of building

The Agency **requires** heat pumps with the following characteristics:

HEAT PUMPS
With power control by speed (e.g. inverter) (1)
Notes (1) Only applies to electric heat pumps. The minimum requirement is the change of the ventilation fan speed. The Agency recommends heat pumps with modulating compressors.

The Agency has a list of heat pumps available for the purposes of review and input of the values into the energy calculation. It can be found in the Download area of the Agency's website and is regularly updated.

If a product that is not in the list is selected:

- The manufacturer's data for the ecological design requirements of space heaters and combined heaters is to be used.
- The information provided by the manufacturer and mentioned in the test report conducted by an independent institution is used.
- If no declarations of performance or test reports are available, the values specified by the manufacturer are used in the energy calculation, with a reduction of 20%.

The Agency **recommends** heat generators with the following characteristics:

OIL OR GAS CONDENSING BOILER
$\eta_{tu} > 93 + 2\log P_n$ **e** $\eta_{tu,30} > 88 + 3\log P_n$
Air and gas supply: multistage, modulating when switching off the combustion air supply
High temperature systems: $T_{rit,H} \leq 45°C$
Low temperature systems: $T_{rit,H} \leq 35°C$
Notes: High temperature systems have heat emitters with $T_{input} \geq 45°C$ At Pn > 400kW, the limit value is 400 kW η_{tu} and $\eta_{tu,30}$ for high temperature systems at 80°/60°C or for boilers for heating water η_{tu} and $\eta_{tu,30}$ for low temperature systems at 50°/30°C

HEAT PUMPS WITH ELECTRICALLY DRIVEN COMPRESSORS

	HEATING			COOLING		
	Outside	Inside	COP_{min}	Outside	Inside	EER_{min}
Air - Air	$\theta_{b,s} = 7°C$ $\theta_{b,s} = 6°C$	$\theta_{b,s} = 20°C$ $\theta_{b,u} = 15°C$	3.9	$\theta_{b,s} = 35°C$ $\theta_{b,u} = 24°C$	$\theta_{b,s} = 27°C$ $\theta_{b,u} = 19°C$	3.1
	$\theta_{b,s} = -7°C$ (1)	$\theta_{b,s} = 20°C$ $\theta_{b,u} = 15°C$	2.7			
Air - Water ($P_n < 35kW$)	$\theta_{b,s} = 7°C$ $\theta_{b,s} = 6°C$	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	4.1	$\theta_{b,s} = 35°C$ $\theta_{b,u} = 24°C$	$\theta_{H2O,in} = 23°C$ $\theta_{H2O,out} = 18°C$	3.5
	$\theta_{b,s} = -7°C$ (1)	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	2.7			
Air - Water ($P_n > 35kW$)	$\theta_{b,s} = 7°C$ $\theta_{b,s} = 6°C$	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	3.8	$\theta_{b,s} = 35°C$ $\theta_{b,u} = 24°C$	$\theta_{H2O,in} = 23°C$ $\theta_{H2O,out} = 18°C$	3
	$\theta_{b,s} = -7°C$ (1)	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	2.7			
Base - Air	$\theta_{sal,in} = 0°C$	$\theta_{b,s} = 20°C$ $\theta_{b,u} = 15°C$	4.3	$\theta_{sal,in} = 30°C$ $\theta_{sal,out} = 35°C$	$\theta_{b,s} = 27°C$ $\theta_{b,u} = 19°C$	4
Base - Water	$\theta_{sal,in} = 0°C$	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	4.3	$\theta_{sal,in} = 30°C$ $\theta_{sal,out} = 35°C$	$\theta_{H2O,in} = 23°C$ $\theta_{H2O,out} = 18°C$	4
Water - Air	$\theta_{H2O,in} = 15°C$ $\theta_{H2O,out} = 12°C$	$\theta_{b,s} = 20°C$ $\theta_{b,u} = 15°C$	4.7	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	$\theta_{b,s} = 27°C$ $\theta_{b,u} = 19°C$	4
Water - Water	$\theta_{H2O,in} = 10°C$	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	5.1	$\theta_{H2O,in} = 30°C$ $\theta_{H2O,out} = 35°C$	$\theta_{H2O,in} = 23°C$ $\theta_{H2O,out} = 18°C$	4.5

Notes:
COP and EER measured according to EN 14511 and EN 14825.
(1) Minimum requirement for buildings at a location ≥ 4000 Kd/a: COP value must also take defrosting cycles into account.

HEAT PUMPS WITH A GAS ENGINE DRIVE					
	HEATING				COOLING
	Outside	Inside		GUE_{min}	GUE_{min}
Air - Air	$\theta_{b,s}$ = 7°C $\theta_{b,s}$ = 6°C	$\theta_{b,s}$ = 20°C		1.46	0.6
	$\theta_{b,s}$ = -7°C(1)	$\theta_{b,s}$ = 20°C		1.10	
Air - Water	$\theta_{b,s}$ = 7°C $\theta_{b,s}$ = 6°C	$\theta_{H2O,in}$	H2O,out	1.38	
		30°C	40°C (2)		
		30°C	35°C (3)		
	$\theta_{b,s}$ = -7°C(1)	30°C	40°C (2)	1.10	
		30°C	35°C (3)		
Base - Air	$\theta_{sal, in}$ = 0°C	$\theta_{b,s}$ = 20°C		1.59	
Base - Water	$\theta_{sal, in}$ = 0°C	$\theta_{H2O,in}$	$\theta_{H2O,out}$	1.47	
		30°C	40°C (2)		
		30°C	35°C (3)		
Water - Air	$\theta_{H2O,in}$ = 10°C	$\theta_{b,s}$ = 20°C		1.60	
Water - Water	$\theta_{H2O,in}$ = 10°C	$\theta_{H2O,in}$	$\theta_{H2O,out}$	1.56	
		30°C	40°C (2)		
		30°C	35°C (3)		

Notes:
- GUE measured in accordance with EN 14 511 (for heat pumps with endothermic engines) and EN 12 309 (for Gas Absorption adsorption HPs. Test values relative to the lower calorific value)
- A primary energy-to-electricity conversion factor of 0.4 is applied for endothermic heat pumps.

(1) Minimum requirement at a location ≥4000 Kd/a: COP value must also take defrosting cycles into account.
(2) Gas Absorption heat pumps
(3) Endothermic heat pumps

ELECTRICAL HEATING

If electric heating is the only heating system in the building, the following specifications apply:

- Heat output $P_1 < 15\ W/m^2$
- Electronic priority test (limitation of the required electrical power)

HEAT GENERATOR WITH BIOMASS				
Control of power, ventilation, buffer tank(1)				
Biomass boiler $P_n \leq 500$ kW	**Biomass boiler $P_n > 500$ kW**	**Pellet stoves**	**Wood-burning stoves**	**Wood stoves**
$\eta_{tu} \geq 87\%+\log P_n$(6)	$\eta_{tu} \geq 89\%$(6)	$\eta_{tu} \geq 85\%$(6)		
Storage room for biomass: volume > 0.9 m^3/kW with additional ventilation openings				
Recommended design notes for pellet storage: Storage with an opening for filling and an opening for venting, inner walls inclined at 45°, foam rubber on the walls opposite the filling opening so that the pellets are not damaged during insertion, compliance with fire safety regulations.				
Notes (1) A heat accumulator is recommended for biomass boilers with a manual fuel supply. It should be dimensioned according to EN 303-5. A heat accumulator of at least 20 dm^3/kW_t is recommended for boilers with an automatic fuel supply. (2) Manufacturer's information with type of fuel				

ELECTRIC WATER HEATERS
Insulation: min. 8 cm thickness (λ_{max} = 0.050 W/m^2K) or equivalent thermal resistance. If the storage tank is located in heated rooms, the thermal resistance can be halved. The storage tank must not be installed outdoors.
The Agency also recommends one of the following typologies or configurations: • DHW heat pump with COP ≥ 2.6 (1) • DHW preparation connected to solar thermal system (2) • DHW preparation with heat recovery from cooling (2) • DHW preparation with additional installation of a photovoltaic system (3)
Notes (1) COP measured according to EN 16147 (2) Possibly also connected with a DHW heat pump (3) Control unit that switches on an electrical resistor when electrical energy from the photovoltaic system is available

5.2 Regulation

The Agency has the following minimum **requirements** (required by law):

REGULATION
Heat consumption meters in each dwelling unit in residential buildings with central heating. Single-family houses are excluded.
Programmable temperature control unit for each heat generator, so that the flow temperature can be regulated depending on the load.
Programmable temperature control unit with one or more room temperature sensors, so that the room temperature can be programmed and regulated on two temperature levels over 24 hours.

The Agency **also recommends**:

- A programmable temperature control unit with outside temperature display per heat generator, which is mounted in a shaded position and controls the temperature of the heat-transferring flow medium based on the outside climate or the flow temperature based on the return temperature
- A programmable temperature control unit per dwelling unit; weekly or monthly programming to shut down or switch off the systems during periods of low usage
- Devices for automatic temperature control of individual rooms or areas with similar use and exposure (e.g. thermostatic valves)
- In the case of area-specific regulation, the engineer will decide on the combination of different rooms depending on use and exposure in order to avoid overheating of individual rooms by solar heat gains.

5.3 Heat distribution

The Agency has the following minimum **requirements**:

HEAT DISTRIBUTION
All pipes **must** be insulated, as required by law.

The Agency also **recommends**:

- to have the correctly performed hydraulic system balancing confirmed in writing by the competent engineer for central heating systems.

5.5 Storage system

The Agency has the following minimum **requirements**:

STORAGE SYSTEM
Insulation: min. 8 cm thickness (λ_{max} = 0,050 W/m²K) or equivalent thermal resistance. If the storage tank is located in heated rooms, the thermal resistance can be halved.
Storage tanks installed in heated or unheated rooms, not outdoors(1)
Notes (1) The storage tank may only be installed outside if it is connected to a solar collector and boiler.

5.6 Electrical auxiliary power

The Agency has the following minimum **requirements**:

ELECTRIC AUXILIARY POWER
Pumps with an IEE < 0.23, apart from pumps in a solar heating system
Air heating: fans with speed control (modulating)
Humidification and dehumidification: humidity sensors for control, which switch off the system when the desired humidity is reached.

5.7 Mechanical Ventilation (MV)

The Agency recommends the installation of mechanical ventilation (MV) with air exchange and heat recovery.

In multiple-dwelling buildings, a controlled mechanical ventilation system with heat recovery must be installed in each unit so that the heat recovery can be allocated to the entire building in the energy calculation.

The minimum requirements specified below apply to all units with heat recovery or an enthalpy heat exchanger. A distinction is made between centralized systems with ventilation ducts for the distribution of air and decentralized systems without ventilation ducts

5.7.1 Ducted mechanical ventilation (DMV)

The Agency has the following minimum **requirements**:

- At least one device must be installed per dwelling unit or ventilation must be provided in all dwelling units. This is not required for other heated areas with the exception of point 4.1.
- Bypass of heat recovery (or similar technologies, e.g. variations in the speed of the enthalpy heat exchanger). This is necessary for "free-cooling" during the cooling period when the outside temperature is below the inside temperature. Buildings at a location of 4000 Kd/a or more are excluded.
- Variable volumetric flow rate for residential buildings: the fan must have at least three speed levels that can be easily selected by the user (directly on the control panel).
- For residential buildings: selection of a ventilation unit with rated volumetric flow rate: $q_{v,d} \leq 0{,}7 \cdot q_{v,max}$ where $q_{v,max}$ is the maximum volumetric flow rate of the product.

The Agency also **recommends**:

- In the case of residential buildings, it is advisable to design the rated volumetric flow to ensure air exchange with outside air of at least n = 0.4 vol/h
- Project planning with positioning and dimensioning of the air outlets
- Reduction in the outside air volumetric flow rate to at least 0.2 vol/h when residents are not present
- Possible increase of the outdoor air volumetric flow rate during the summer "free cooling", but without living comfort being impaired by drafts or noise
- Automatic and modulating control of the ventilation fan by an inverter controlled by indoor air quality sensors or presence sensors
- Adjustment of the supply and exhaust air by controlling the ventilation flows (e.g. VAV box) or a control unit for the fan speeds integrated into the system.

5.7.2 Un-ducted mechanical ventilation (UMV)

Decentralized ventilation systems are divided into two typologies:

Type A: Unit with continuous air flow
(split ventilation duct for separate supply and exhaust air)

Type B: Unit with noncontinuous air flow
(a ventilation duct for unidirectional air flow – push&pull)

The Agency has the following minimum **requirements**:

- In the case of Type A systems, the blades of all air outlets (inside and outside) must be directed opposite to the supply and exhaust air.
- The following apply to residential buildings:
  - There must be at least one device installed per accommodation unit. If rooms are insulated on the inside or if there is insulation between the layers of building components, one device must be installed in each room. This is not required for other heated areas with the exception of point 4.1.
  - With variable volumetric flow: the fan must have at least three speed levels that can be easily selected by the user (directly on the control panel).
  - Selection of a ventilation unit with rated volumetric flow: qv,d ≤ 0.7-$q_{v,max}$, where $q_{v,max}$ is the maximum volumetric flow rate of the product.

The Agency **also recommends**:

- In the case of residential buildings, a total rated volumetric flow of $q_{v,d,tot}$ designed in such a way that air exchange with the outside air of n=0.4 vol/h is ensured
- Reduction in the volumetric flow rate to at least 0.2 vol/h when residents are not present
- Energy-equivalent continuous sound level of $L_{A,eq}$ ≤ 24 dB(A) ,measured with lowest setting
- Automatic and modulating control of the fan by an inverter controlled by CO_2 indoor air quality sensors or presence sensors
- Adjustment of the supply and exhaust air through dynamic control of the ventilation flows (e.g. VAV box) or automatic control of the fan speeds.

5.7.3 Assessment of power characteristics

5.7.3.1 Data required for the calculation

The following data must be entered in the energy calculation:

- Rated volume flow $q_{v,d}$
- Heat recovery, recovered coefficient $\eta_{\theta,d}$ (if present)
- Heat recovery, recovered moisture coefficient $\eta_{\theta,d}$ (if present)
- Power consumption SFP_d
- Ventilated net volume of the building V_N
- System uptime

5.7.3.2 Data sources

A "list of MV with heat recovery" for the data input in the energy calculation and as evidence of power characteristics is available for download on the Agency's website. The list is updated regularly.

If a ventilation unit that is not on the list is selected, the required data must be documented with a **test report** in accordance with the EN 13141 series of standards from an accredited institution.

If no test report is submitted, MV will only be considered with the following values:

TYPE Living room ventilation	DUCTED	UNDUCTED	
		Type A with continuous air supply	Type B with discontinuous air supply (Push&Pull)
$\eta_{\theta,d}$	70%	50%	20%
$\eta_{x,d}$ (1)	50%	30%	20%
SFP_d	0.40 Wh/m³	0.40 Wh/m³	0.40 Wh/m³

The specified heat output is reduced by 10% for devices with an integrated heat pump.

(1) Only for enthalpy heat exchangers with moisture recovery, otherwise 0%.

The heat recovery rate of prototypes or systems designed for special requirements, with a flow rate $q_{v,max} \geq 600$ m³/h, can be measured on site or calculated by the manufacturer (e.g. Eurovent).

5.7.3.3 Determination of $\eta_{\theta,d}$ and SFP_d at rated volumetric flow

The heat recovery rate $\eta_{\theta,d}$ (heat recovery coefficient) and the current consumption SFP_d are to be determined at the rated volume flow $q_{v,d}$ as indicated below. The same procedure shall also be applied for enthalpy heat exchangers to determine the heat recovery efficiency $\eta_{x,d}$ (moisture recovery coefficient).

Ventilation units with at least two tested degrees of heat recovery ($\eta_{\theta,1}$, $\eta_{\theta,2}$) and indication of power consumption (SFP_1, SFP_2) at different volumetric flow rates ($q_{v,1}$, $q_{v,2}$)

If $q_{v,d} \leq q_{v,1}$	$\eta_{\theta,d}$	$= \eta_{\theta,1}$
	SFP_d	$= SFP_1$
If $q_{v,1} < q_{v,d} \leq q_{v,2}$	$\eta_{\theta,d}$	= linear interpolation between $\eta_{\theta,1}$ and $\eta_{\theta,2}$
	SFP_d	= linear interpolation between SFP_1 and SFP_2
If $q_{v,d} > q_{v,2}$	$\eta_{\theta,d}$	= linear extrapolation between $\eta_{\theta,1}$ and $\eta_{\theta,2}$
	SFP_d	= linear extrapolation between SFP_1 and SFP_2

Ventilation units with more than two tested degrees of heat recovery at different volumetric flow rates. The above procedure is to be applied, i.e. linear interpolation for heat recovery rate and power consumption at the relevant volumetric flow rate and linear extrapolation in accordance with the last value.

Ventilation units with only one tested degree of heat recovery $\eta_{\theta,1}$ and indication of power consumption SFP_1 at a volumetric flow rate of $q_{v,1}$.

If $q_{v,d} \leq q_{v,1}$	$\eta_{\theta,d}$	$= \eta_{\theta,1}$	SFP_d	$= SFP_1$
If $q_{v,d} \geq q_{v,1}$	$\eta_{\theta,d}$	= 50%	SFP_d	= 0.5 Wh/m^3
	$\eta_{x,d}$	= 30%		

Ventilation units with heat recovery via an integrated heat pump: The equivalent degree of heat recovery can be calculated with the CasaClima program; based on the power consumption and the corresponding heat output under the following conditions:

$A_{-7°C}/A_{20°C}$, $A_{2°C}/A_{20°C}$, $A_{7°C}/A_{20°C}$

This data can be taken from the "List of MV with heat recovery". If the selected ventilation unit is not included in the list, the planner must provide the relevant test reports issued in accordance with the technical standards for this product.

Ventilation system with heat recovery or an enthalpy heat exchanger coupled with a geothermal heat exchanger. The degree of utilization is to be increased according to the following formula:

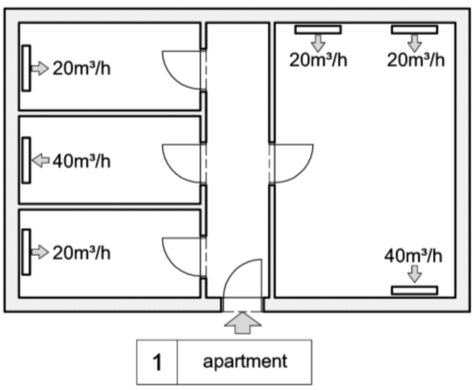
$$\eta_{\theta,d} = 1-(1-\eta_{\theta,d})\cdot(1-\eta_{sgt})$$

With a value of η_{sgt} = 15% if the length (L) of the horizontal geothermal heat exchanger is ≥ 25 m and it has a depth of t ≥ 1.2 m.

Definition: rated volumetric flow, ventilated volume and operating time
The rated volumetric flow $q_{v,d}$ must be dimensioned by the system planner.

LIVING ROOM VENTILATION TYPE	RATED VOLUME FLOW ($q_{v,d}$)
Ducted MV	Sum of the volumetric flow rates at the outlets under normal conditions
Unducted MV - Type A with **continuous** air supply	Sum of the volumetric flow rates (supply air) of the individual units under normal conditions
Undducted MV - Type B with **discontinuous** air supply	Halved sum of the volumetric flow rates (supply air) of the individual units under normal conditions

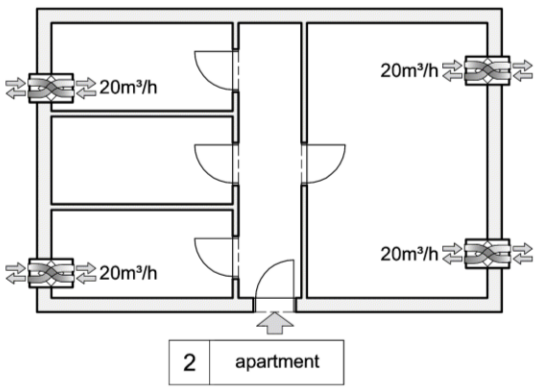
ducted ventilation



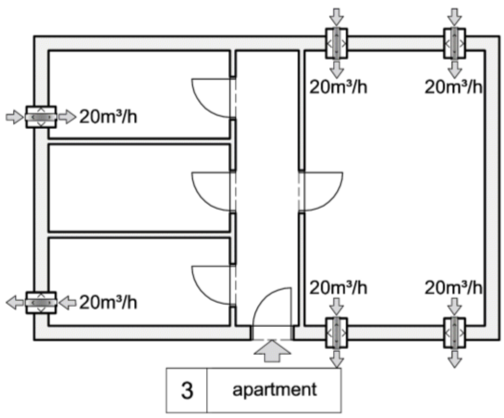
calculation of nominal volumetric flow

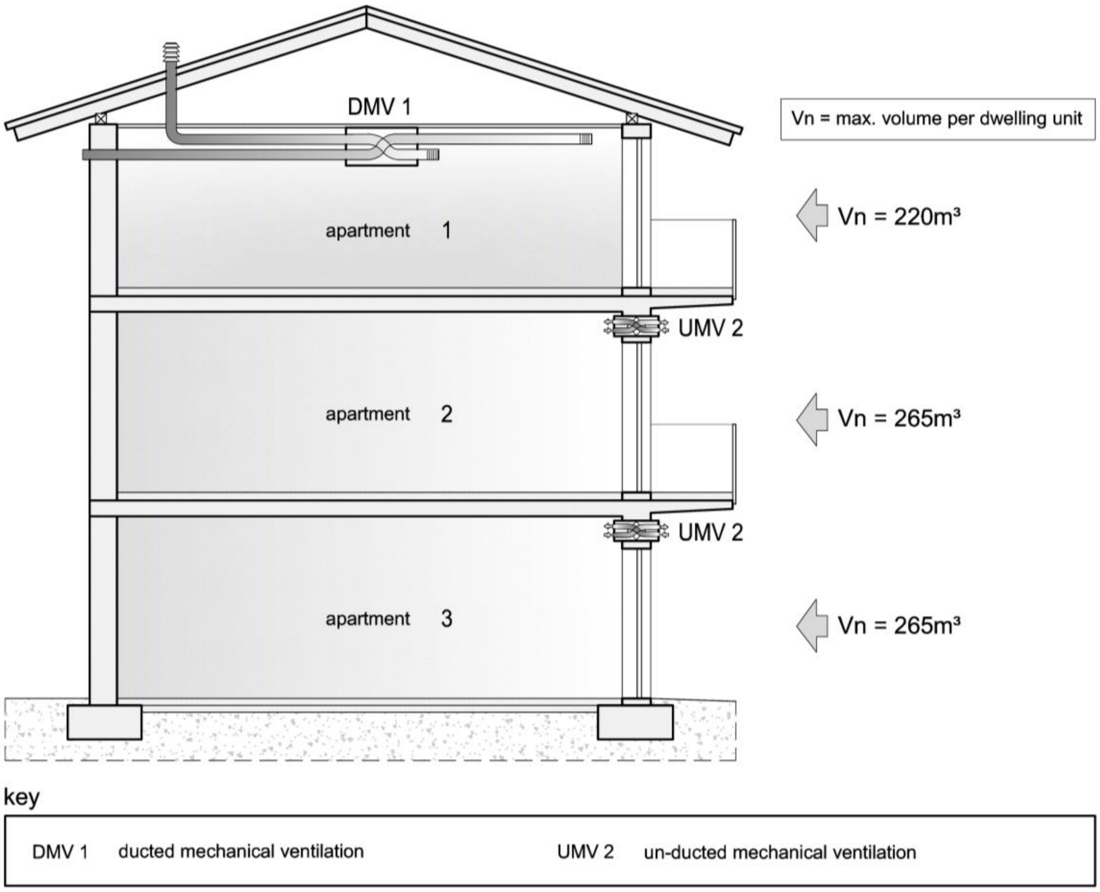
1	apartment	q v,d =	80m³/h
2	apartment	q v,d = (20 x 4) =	80m³/h
3	apartment	q v,d = (20 x 6) / 2 =	60m³/h

unducted ventilation units with continuous air flow



un-ducted ventilation units with discontinuous air flow (push & pull)





The ventilated net volume (V_N) is the sum of the net volumes in a building unit in which there is at least one opening for supply air or exhaust air.

The daily operating time for mechanical ventilation units is set as follows:

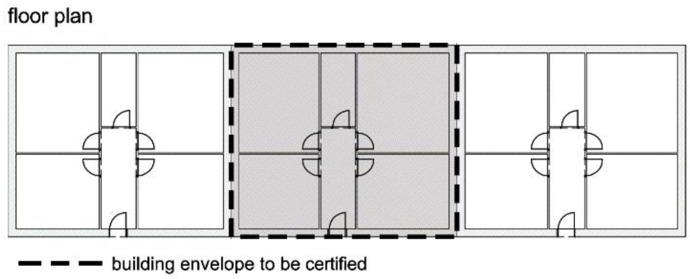
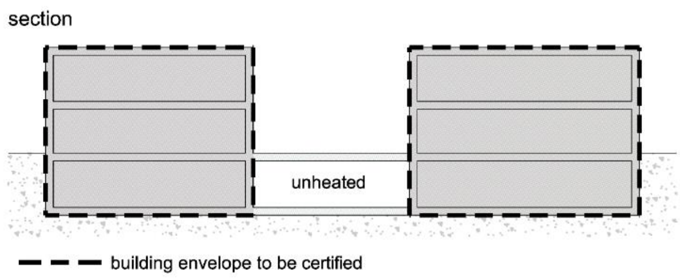
BUILDING UTILIZATION	DAILY OPERATING TIME (t)
Residential buildings	24h
Office buildings	12h
Buildings with other uses	Corresponds to the utilization period of the building

For ventilation systems with sensor-controlled operating time, the daily operating time can be calculated up to a period of 12 hours if the sensors (e.g. CO_2, humidity, presence sensors) have been installed in each room of the dwelling unit.

6 THE BUILDING ENVELOPE

6.1 Definition of the building envelope

The thermal building envelope is limited by the heat transfer peripheral surfaces of the building, or part of the building.

DETERMINATION OF THE BUILDING ENVELOPE	
Where buildings are arranged in rows (e.g. townhouses), a building can be considered thermally independent if it has its own building structure (building partition wall), which is continuous from the foundation to the roof.	
In the case of unheated basements with "n" building envelopes "above ground", "n" certification applications must be submitted, even if the building has a centralized building services installation (central heating). Areas of the building that are used for a different purpose than the main areas do not have to be taken into consideration in the energy calculation.	

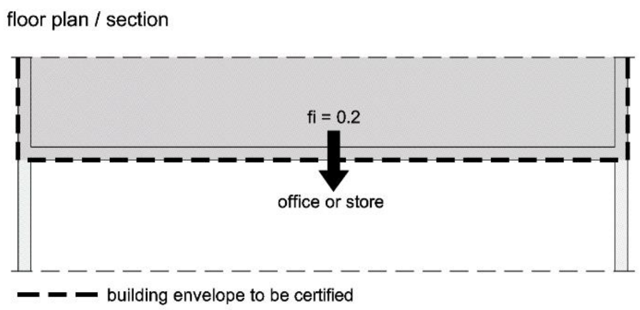
6.2 Temperature correction factor

The temperature correction factor $\mathbf{f_i}$ is used to adjust the heat flow to the temperatures of the components that do not border on the outside air. The heat flow between heated and unheated rooms or in contact with the ground is reduced by applying the temperature correction factor.

$$fi = \frac{(20°C - \vartheta \ \ unheated\ area)}{(20°C - \vartheta \ \ outside)}$$

The temperature correction factors $\mathbf{f_i}$ are preset in the official CasaClima calculation program.

The temperature correction factor $\mathbf{f_i}$ can be calculated by the engineer and factored into the energy calculation if parts of the building are heated differently from the standard indoor climate conditions (20°C) and for heating periods that vary from those of the corresponding climate zone.

TEMPERATURE CORRECTION FACTOR		$\mathbf{f_i}$
Components in contact with a heated room used for the same purpose	Ceilings and walls in contact with a heated room or which can be defined as such	**0**
Components in contact with a heated room	Ceilings and walls in contact with heated rooms with a standard heat generator (boiler)	**0**
	Ceilings and walls in contact with heated rooms, with heat generators with condensing boiler technology, heat pumps, and/or connection to the district heating network	**0.5**
Components in contact with a heated room used for a purpose other than the building's main use	Ceilings and walls in contact with offices/shops, stores 	**0.2**
Components in contact with a garage, basement, storage room, etc.	Ceilings and walls in contact with closed garages (also applies to overground garages)	
	• ventilated (same as "in contact with the outside air")	**1**
	• not ventilated - not airtight when closed (same as "in contact with an underground garage")	**0.8**
	• not ventilated - airtight when closed (same as "in contact with an unheated room")	**0.5**
	Ceilings and walls in contact with an open basement, e.g. access to underground car park (same as "in contact with outside air"	**1**

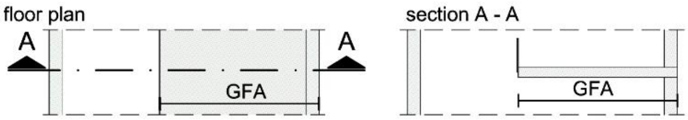
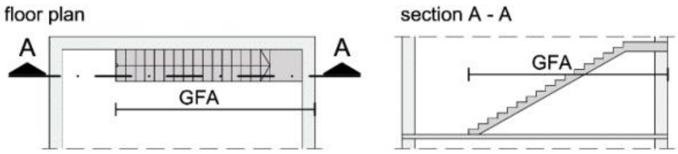
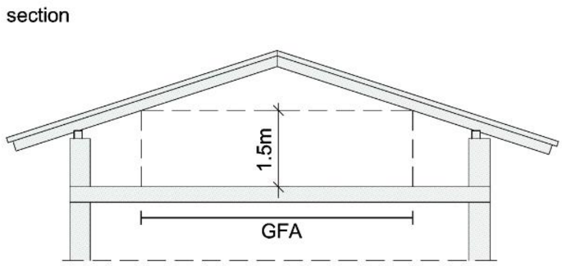
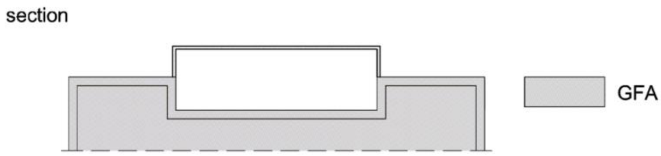
6.3 Heated gross floor area GFA_H

The heated gross floor area GFA_H is the area on each story enclosed by the external building components that form the heated building envelope, including the thickness of the external component, such as an external wall.

The sum of the heated gross floor areas (GFA_G) of a building and the associated gross volume (V_G) must be entered in the energy calculation.

If the sum of the heated net floor areas NFA_H is entered in the energy calculation, the heated net volume V_N must also be entered. This corresponds to the internal dimensions of the building envelope, without ceiling thicknesses and without internal wall thicknesses.

The following special cases must be taken into account when calculating the GFA_H:

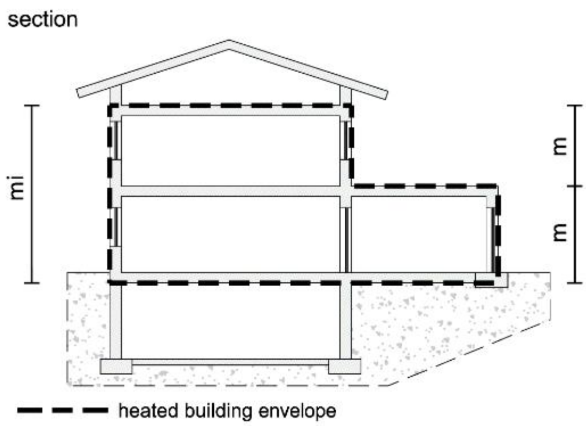
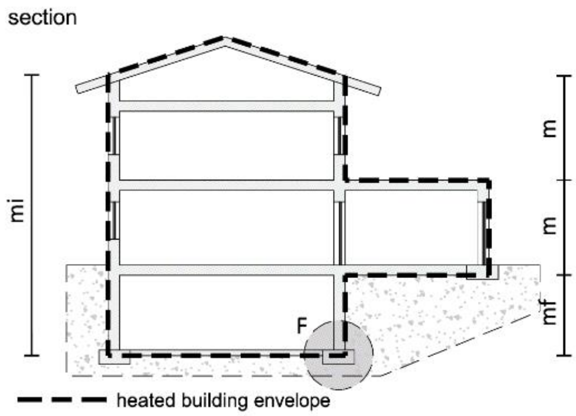
SPECIAL CASES FOR CALCULATING THE GFA_H	
Areas under ceiling openings: (for example, areas with double room height), are not included in the calculation of the **GFA_H**.	
Stairs in the heated building envelope: are to be factored into the **GFA_H** based upon their area in the floor plan projection (per story)	
Heated lofts under sloped roofs: The **GFA_H** corresponds to the area with a clear room height of at least 1.5 m. (Heated means connected to the heating system)	
Unheated conservatories, sunrooms which are glazed and enclosed on all sides: The **GFA_H** is limited by the wall separating the heated building envelope from the unheated conservatory or from the sunroom.	

6.4 Heated gross volume V_G

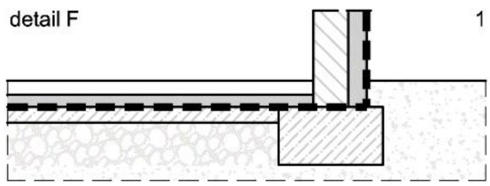
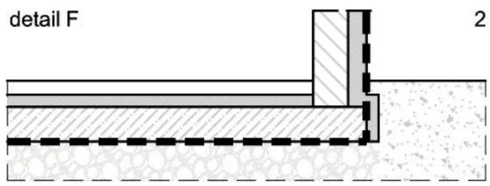
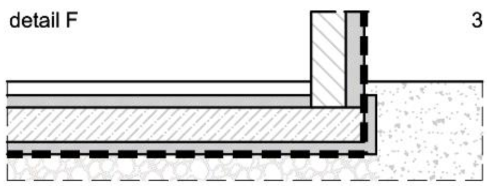
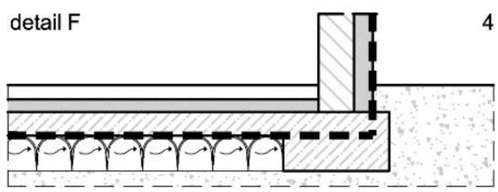
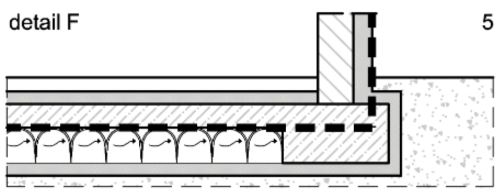
The heated gross volume V_G is the volume enclosed by the heated building envelope. This usually corresponds to the external dimensions of the building.

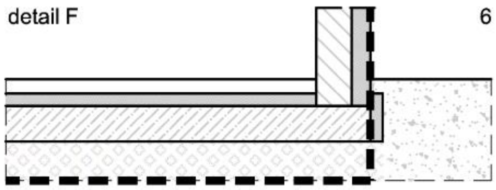
6.5 Heat transfer peripheral surfaces

Heat transfer peripheral surfaces are the gross floor areas of the building components that form the thermal building envelope.

LIMITS OF THE PERIPHERAL AREAS	
The height $\mathbf{m_i}$ of the heat transfer surfaces must be measured on the outside, i.e. from the top edge of the loft floor to the bottom edge of the basement ceiling, including the ceiling thickness and the floor structure.	
The height $\mathbf{m_i}$ of the heat transfer surfaces must be measured on the outside, i.e. from the top edge of the roof to the point where the building connects with the foundations. The heights $\mathbf{m_i}$ **and** $\mathbf{m_f}$ depend on the type of foundation. Refer to the following table of foundation connections "Detail **F**$_\mathbf{i}$"	

In the case of heated rooms whose floors (floor slabs) are in contact with the ground, a distinction must be made between the foundation types listed below. The height **m_f** of the heat transfer surface must be taken to the dotted line, as shown in the detail of the foundation connections.

FOUNDATION TYPE	FOUNDATION CONNECTION	NO.
Strip foundation		1
Slab foundation		2
Slab foundation, fully insulated		3
Base plate, ventilated		4
Base plate, ventilated, insulated underneath Only the component structure up to the air layer is taken into account when calculating the heat transfer coefficient U.		5

Base plate on cellular glass fill or similar insulating material. This only applies if the insulation is not in water. Otherwise, the "slab foundation" type (No. 2) must be used.	

6.6 Thermal conductivity of material

The thermal conductivity values λ given in the database of the official CasaClima calculation program can be used for the energy calculation, or otherwise the values shown on the CE label or the declaration of performance can be entered.

If the thermal conductivity values of the database of the official CasaClima calculation program are used, no further evidence of the values is required (e.g. no technical data sheet).

6.6.1 Walls made from formwork/concrete shuttering blocks

Formwork/concrete shuttering blocks consist of different components, e.g. concrete, ceramic, wood chip concrete and thermal insulation materials.

The thermal resistance and the equivalent thermal conductivity of such walls must be verified with a three-dimensional model with a numerical calculation (FEM) (conforming to EN ISO 10211). Other simplified calculation methods cannot be used.

6.7 Stairwells and elevator shafts

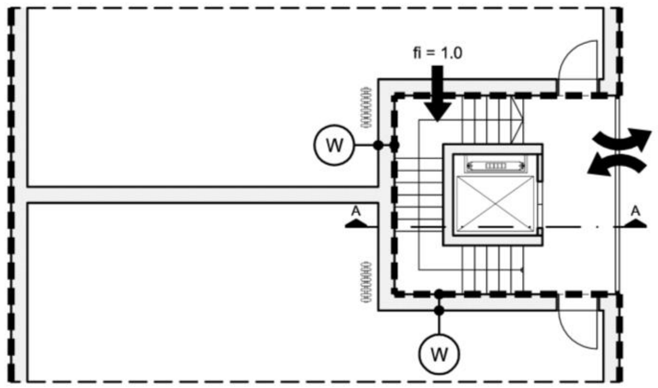
Stairwells and elevator shafts are to be considered differently in the energy calculation depending on their typology. In addition to the determination of the building envelope, the requirements specified for each type must be met.

The tabular overview summarizes the possible typologies of stairwells/elevator shafts.

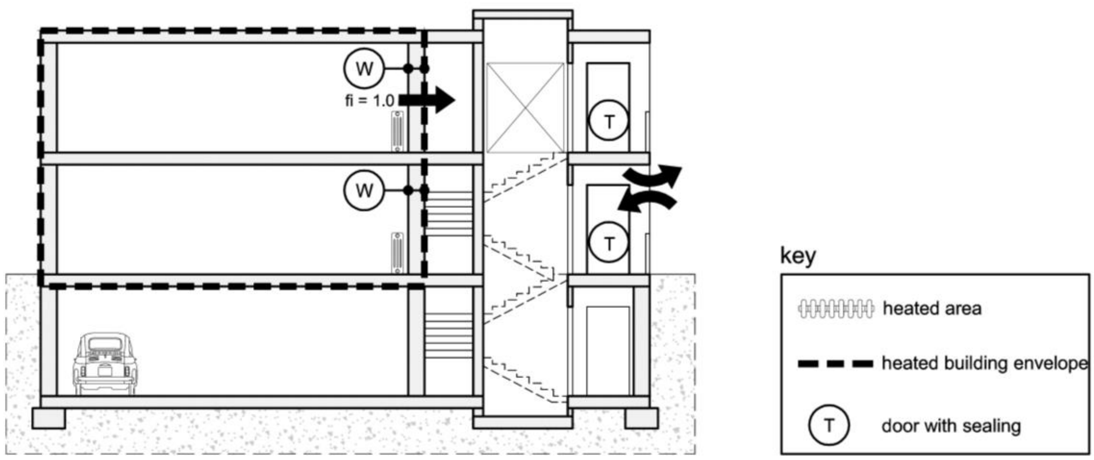
TYPE NO.	TYPOLOGIES OF THE STAIRWELL/ELEVATOR SHAFT	
1	Stairwell/elevator shaft excluded from the heated building envelope	**Variant V1:** Stairwell/elevator shaft, open plan
		Variant V2: Stairwell/elevator shaft, closed – not heated
2	Stairwell/elevator shaft included in the heated building envelope	Stairwell/elevator shaft, closed – heated

TYPE 1 – V1:	**STAIRWELL/ELEVATOR SHAFT, OPEN PLAN**
Excluded from the heated building envelope not included in the calculation of heat transfer surfaces and gross volume of the building	
Heat transfer surface To be considered in the calculation	**Wall (W) in contact with outside air where f_i = 1**
Doors of the apartments	with thermal separation and a circumferential sealing profile
Doors of the stairwell/elevator shaft	No specifications
Thermal bridges	Solution to be found or evidence to be supplied in accordance with the Technical Guidelines

floor plan



section A - A

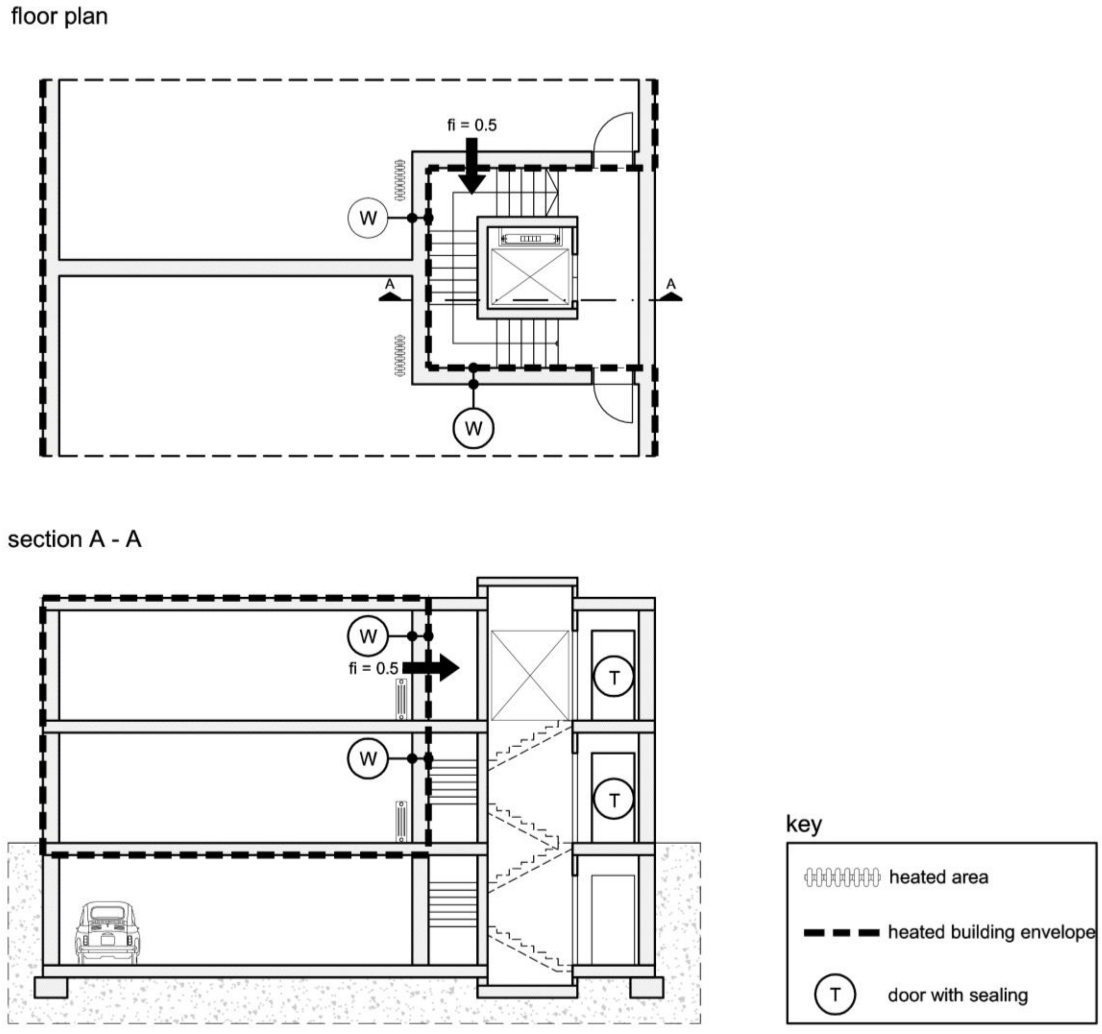


TYPE 1 – V2: STAIRWELL/ELEVATOR SHAFT, CLOSED – NOT HEATED

Excluded from the heated building envelope
not included in the calculation of heat transfer surfaces and gross volume of the building

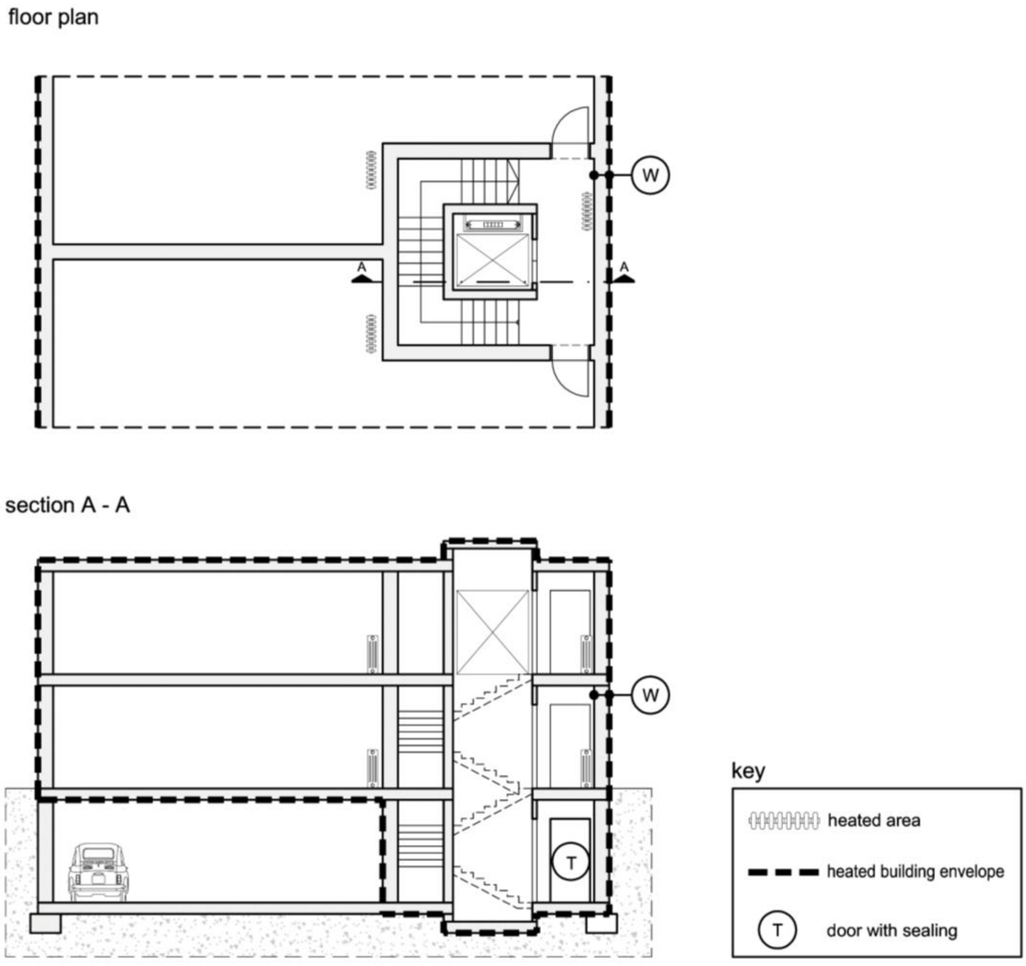
Heat transfer surface To be considered in the calculation	**Wall (W) in contact with an unheated room where f_i = 0.5**
Doors of the apartments	with thermal separation and a circumferential sealing profile
Doors of the stairwell/elevator shaft	**Door** of the **stairwell** with a circumferential sealing profile **Door** of the **elevator shaft** without direct access to the outside nor to the apartments

Thermal bridges	To be resolved or evidence to be supplied in accordance with the Technical Guidelines



TYPE 2: **STAIRWELL/ELEVATOR SHAFT, CLOSED – HEATED**	
Included in the heated building envelope included in the calculation of heat transfer surfaces and gross volume of the building	
Heat transfer surface To be considered in the calculation	**Outside wall (W) where f_i = 1**
Doors of the apartments	circumferential sealing profile

Doors in the basement of the stairwell/elevator shaft	**Door of the stairwell** with a circumferential sealing profile **Door** of the **elevator shaft** without direct access to the outside nor to the apartments
Windows of the stairwell	not to be included in the energy calculation
Thermal bridges	Solution to be found or evidence to be supplied in accordance with the Technical Guidelines



6.8 Dormers

Dormers of buildings with a location of 3000 Kd/a or more do not have to be entered as separate components in the energy calculation. Their heat transfer surface can be considered as a continuous opaque roof surface provided the following conditions are met:

- The window surfaces must have sun protection
  (except north-facing windows and buildings with a location of 4000 Kd/a or more)
- $\mathbf{U_{DG} = U_T}$ U_{DG} = heat transfer coefficient of dormer walls
  U_T = heat transfer coefficient of the roof
- There must be a thermal solution applied to the structural connection between the roof and the dormer.
- The simplification must be applied to all dormers of the building

6.9 Windows and doors

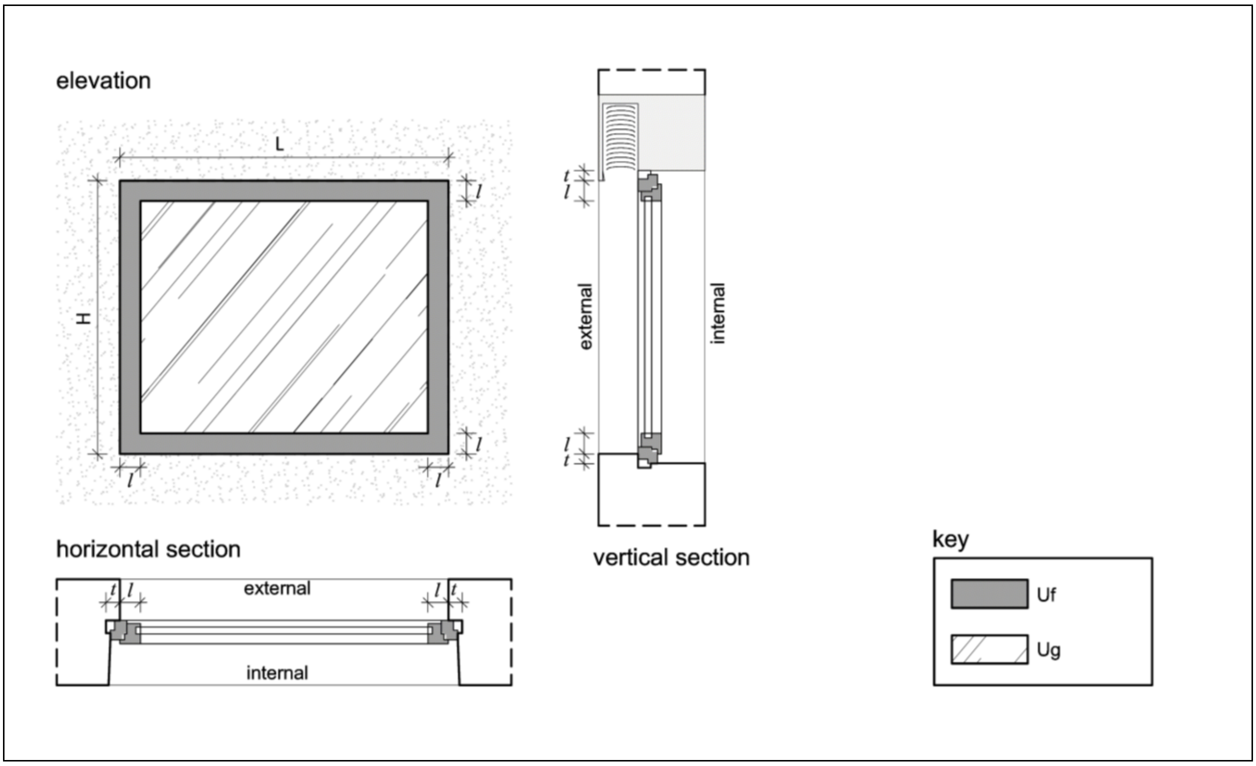
The window dimensions to be entered into the calculation program (H = height, L = length) are the finished outer dimensions (plaster or other surface).

The symbols in the figure are defined as follows:

H = outside visible window height **L** = outside visible window width

l = visible width of the window frame
(window frame consisting of fixed window frame and sash; measured from the finished outer edge of the window opening to the glass surface)

t = non-visible width of the window frame (relevant only for CasaClima Nature)
(wall and insulation layer integrated part of the window including the subframe;
)



The following energy properties of the windows are to be entered into the energy calculation:

- **Heat transmission coefficient U_w** and **total energy transmittance g** of each window, only the declaration of performance serves as evidence (according to the Construction Products Regulation (CPR))

Alternatively, the following values can be entered:

- **Heat transfer coefficient of the window frame U_f**
  (according to EN ISO 10077-1, EN ISO 10077-2 or EN ISO 124567-2) according to product standard EN 14351-1
- **Heat transfer coefficient of the multi-pane insulating glass U_g**
  (according to EN 673 or EN ISO 10077-1)
- **Total energy transmittance g** (according to EN 410)

French windows leading to balconies, patios and similar are to be entered as windows in the energy calculation.

Apartment front doors or entrance doors to buildings are to be entered as windows in the energy calculation. The dimensions of the doors are to be calculated by analogy to those of the windows, i.e. to the finished external dimensions of the door opening. The **heat transfer coefficient of the door U_D** must be entered in the energy calculation, according to the product standard EN 14351-1.

6.10 Roller shutter boxes

Roller shutter boxes need not be entered as separate components in the energy calculation with their **heat transfer coefficient U_{sb}** if the requirements of section 4.2.2 of the CasaClima catalog are met.

In this case, the heat transfer surface of the roller shutter box is equated to the surrounding outer wall surface and the corresponding surface of the roller shutter box is considered as outer wall surface

6.11 Shading (heating period)

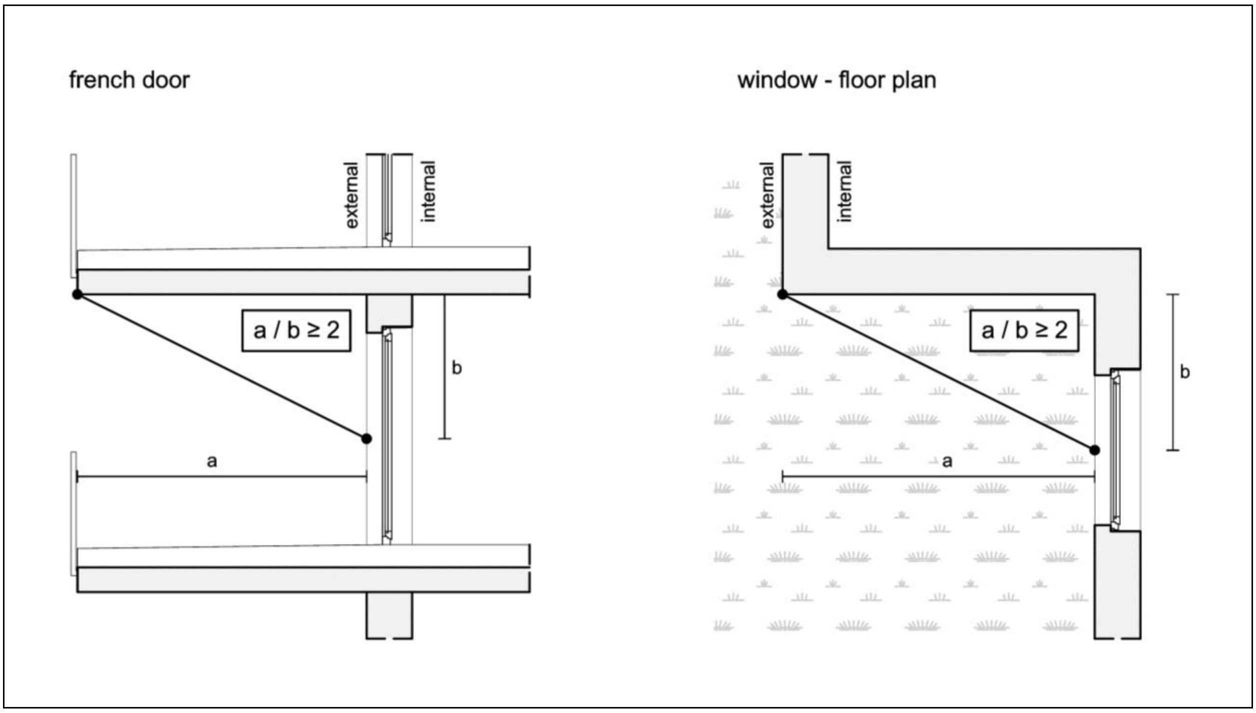
Shading is defined in the energy calculation as shading attributable to the shape of the building, e.g. overhangs or building projections.

A window is considered shaded if the ratio of the depth of the overhang **a** and the height of the distance of the window **b** is greater than two.

a = length from the front edge of the component to the outer line of the wall

b = height from the center of the window to the lower edge of the overhang

This ratio is to be applied by analogy to shading in the floor plan by building projections and recesses.
Shading facing northwest, north and northeast is not to be considered



Windows with fixed sun protection systems, e.g. fixed-mounted blinds or glass facades, must always be entered as "shaded windows" in the energy calculation.

7 SYMBOLS

7.1 Heat and humidity

SYMBOL	PHYSICAL VARIABLE	UNIT
A	Area	m²
c	Specific heat capacity	Wh/kg K
d	Layer thickness	m
f_P	Primary energy factor	-
f, f_{Rsi}	Temperature correction factor	-
F_C	Reduction factor for sun protection equipment (due to shading)	-
g	Total energy transmittance of the glazing	-
g_{total}	Total energy transmittance including sun protection	-
l	Length, characteristic length	m
n	Air exchange rate	h^{-1}
q	Heat flow density	W/m²
Q	Heat quantity	kWh - kJ
R	Thermal resistance	m^2 K / W
R_{se}	Heat transfer resistance, outside	m^2 K / W
R_{si}	Heat transfer resistance, inside	m^2 K / W
s_d	Water vapor diffusion equivalent air layer thickness	m
T	Thermodynamic temperature	K
U	Heat transfer coefficient	W/(m^2 K)
U_f	Heat transfer coefficient of the frame	W/(m^2 K)
U_g	Heat transfer coefficient of the glazing	W/(m^2 K)
U_W	Heat transfer coefficient of the window	W/(m^{2*} K)
U_D	Heat transfer coefficient of the door	W/(m^{2*} K)
V	Volume	m³
V_B	Heated gross volume	m³
V_N	Heated net volume	m³

7.2 Abbreviations (Greek letters)

SYMBOL	DESIGNATION	UNIT
α	Radiation absorption coefficient	-
Δ	Difference (e.g. $\Delta\theta$ for temperature difference [K])	-
ε	Emissivity	-
θ	Celsius temperature	°C
λ	Thermal conductivity	W/(m K)
μ	Water vapor diffusion resistance factor	-
ρ	Bulk density	Kg/m³
τ	Radiation transmittance	-
φ	Relative humidity	%
Φ	Heat flow	W
χ	Point thermal transmittance (chi)	W/K

ψ	Linear thermal transmittance (psi)	W/(m K)

7.3 Indices

CODE	STANDS FOR	ENGLISH
d	design	design
e	external	external
eq	equivalent	equivalent
i	internal	internal
v	ventilated	ventilated

7.4 Plant technology

SYMBOL	DESIGNATION	UNIT
C	Cooling	-
COP	Coefficient of performance for heat pumps	-
EER	Energy Efficiency Ratio for heat pumps	-
IEE	Energy Efficiency Index - EEI	-
GUE	Performance coefficient for absorption heat pumps	-
H	Heating	-
HDD	Heating degree days	Kd/a
P	Heat output	kW
P_n	Rated heat output	kW
W	Domestic Hot water (DHW)	-
η	Efficiency	-
η_{tu}	Thermal efficiency at 100% rated output	-
$\eta_{tu,30}$	Thermal efficiency at 30% rated output	-
V_N	Volume of the building ventilated with LRV	m^3
$\eta_{\theta,d}$	Heat recovery, heat recovery coefficient (design)	%
$\eta_{x,d}$	Heat recovery, moisture recovery coefficient (design)	%
SFP	Specific fan power (specific power consumption of MV)	$W/(m^3/h)$
SFP_d	Design specific fan power (specific power consumption of MV at the design flow rate)	$W/(m^3/h)$
$q_{v,d}$	Rated volumetric flow of MV (design)	m^3/h
$q_{v,max}$	Maximum volumetric flow of MV	m^3/h
$\Theta_{b,s}$	Dry bulb temperature of the outside air	°C
$\Theta_{b,u}$	Wet bulb temperature of the outside air	°C