The Belgian view on the E-value

HAMK
HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

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Charles Deryckere

ABSTRACT

HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

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Author Charles Deryckere **Year** 2017

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Supervisor(s) Olli Ilveskoski

ABSTRACT The E-value is a measure of the energy performance of a building and its fixed installations in standard conditions. In Belgium the system called EPB (energy performance of buildings) is used to study the energy performance of buildings. The maximum E-value in Flanders, Belgium currently is E50 but for the year 2020 is set for E35. The main factors that influence the E-value are: the insulation grade of the building, air tightness of a building, compactness, orientation and overheating. The insulation grade is in the centre of the U-value of the walls, roof and windows combined with the thermal bridges. Insulation and minimizing thermal bridges are key aspects to reduce heat loss resulting in more energy efficiency. Next to these key aspects the following topics also play a role in the E-value. The airtightness of a building is its ability to keep air currents from the inside in and vice versa. Currently there is no set limit in Belgium but the aim is to keep it as low as possible. The compactness of a building is defined as the ratio of the protected volume over the total loss of the surface area, this comes down to the more compact the building the more energy efficient it is. The orientation plays a key role in optimizing heat gain by the sun. A good orientation for a passive house can make a 60-70% positive heat gain difference and for a regular home 5-20%. This makes a big difference in energy costs. This is gained by having a low g-factor in the windows. When talking about installations the following subject are included: heating systems, ventilation systems, Renewable systems and lights (only in industrial buildings). Overheating is a subject which is negative for the E-value because it works against all the factors that improve the E-value. Because when overheating occurs you want to get rid of the heat inside a building which is the exact opposite of the previously mentioned importance of insulation.

Keywords E-value, Belgium, insulation, energy efficient

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2 INTRODUCTION

Currently energy efficiency is a worldwide and thriving topic. Nowadays energy efficiency is a highly discussed topic concerning global warming and the construction industry is one of the biggest polluters of the industry. This is mainly caused by human activities, which emit greenhouse gasses such as carbon dioxide (CO_2). To reduce carbon emission, constructing a building with energy efficiency or low carbon emission is of crucial importance in the construction industry. To achieve a building with low or even zero carbon emission, the equipment used for the building and the design is crucial and must be energy efficient. (All Answers Ltd, 2015)

This thesis shows a review about the E-value in Flanders, Belgium. The general idea of this value is to describe the energy use in a building over the time period of a year. The E-value entails: the insulation grade, air-tightness of a building, compactness, orientation, the installation in the building and overheating.

The E-value is a method which shows the role of the Belgian governments in setting rules and regulations to reduce the heat loss in buildings.

The study will mainly include the E-value of a building. The main focus here is preventing heat loss because this is the biggest factor in increasing the E-value. The information is mainly found on sites of the Belgian government and from the EPB-software which is an energy efficiency calculator implemented by the government.

The aim of this thesis is to make the reader aware of the importance of the up until now unknown E-value. This includes all the different topics mentioned before. After reading this thesis I hope to have inspired the reader to give more thought to energy efficiency.

3 WHAT IS THE E-VALUE

3.1 General definition on the E-value

Every country has a different view on the E-value but the general idea of this value is to describe the energy use in a building over the time period of a year. The energy value obtained is based on the net heated interior area. The value of the area is modified with a lot of weighted energy form coefficients and by what type of building it is (residential/industrial Etc.).

(Green Building Council Finland, n.d.)

3.2 Belgian definition on the E-value

The E-Value is a measure of the energy performance of a building and its fixed installations in standard conditions. The lower the E-level, the more energy-efficient the building is. The E-value depends on the thermal insulation, air tightness of a building, compactness, orientation and the sun time of the building. In addition, the fixed installations (for heating, hot water supply, ventilation, cooling and lighting) of the building affect this value.

3.2.1 Software packet for calculating the E-value

In Belgium, the E-value is an element which is part of a bigger system called EPB (energy performance of buildings). The Belgian government created a software packet in order to ensure that every engineer who studies the energy performance of buildings uses the same coefficients. This inhibits engineers from playing with the energy factors of a building. This software is free for everyone to download from the official site. In Belgium it is obligatory to have a certificate of this programme containing all the values of the home before construction may start. The values have to be below the maximum limits set by the Flemish or the Walloon or the Brussels government. These values differ due to geographical and leniency differences between the Flemish, the Walloon and the Brussels part of Belgium. In this thesis the Flemish side of the E-value will be used, because it is the most common used because more people live there.
(De Vlaamse Overheid, 2016)

,Maximum values for the E-value

In Belgium there are different E-values for the different jobs carried out at a construction site. There is a difference between constructing a completely new building and renovating an existing building that already has an E-value which probably exceeds the maximum allowed E-value in Belgium. Currently, the highest E-value of a newly build building in Belgium is E50. When a building has a value lower than E50, the government grants financial support because the building is very energy efficient. The government does this to motivate people to build energy efficiently. For all the buildings to be built in the year 2020 Belgium has set an E-value limit of E35 and for the year 2021 a NZEB (nearly zero emission building), case study of a nearly zero emission building can be found in appendix 1. For the renovation of a house, there are two possibilities: normal renovation and energetic renovation. In an energetic renovation, the systems (ventilation and heating) are completely replaced and at least 75% of the existing and new partitions, which are bound to the outside environment (not the floors), are isolated. If the above-mentioned definition is not met, then the works will not be covered by the energetic renovation but as a normal renovation where the requirements are less strict. Currently the value of an energetic renovation is E90, but this will drop in the future. The normal renovation does not have a set E-value, but that does not mean that there are no requirements for this renovation. The specific list of requirements is added in the appendix (appendix 2).
(Agentschap Informatie Vlaanderen, 2017)

3.3 **What influences the E-value**

3.3.1 Main factors that influences the E-value

The E-value is a combination of different factors. These are:

- The insulation grade of the building (k-value)
- Air-tightness of the building
- Compactness
- Orientation
- The installations in the building
- Overheating

4 THE INSULATION GRADE OF A BUILDING (K-VALUE)

The insulation grade of a building is defined by how low the U-value of the walls, floors, roofs, windows and doors are. The higher the R-value of every material used, the lower the k-value will be. The thermal bridges in the building also play a major role in the k-value. Later on will be explained why and how.

4.1 Defining the right values for a wall

The following wall will be used as example.

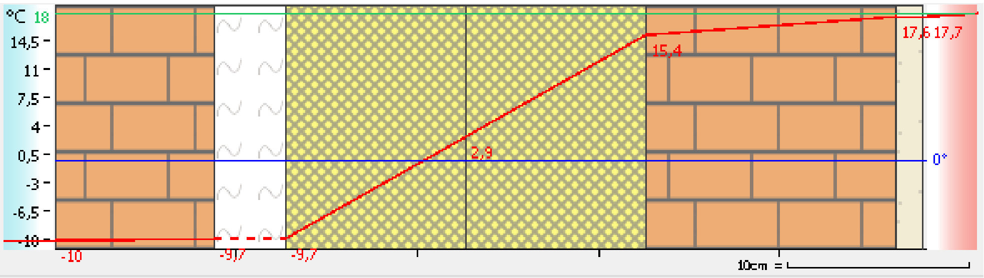


Figure 1. Wall structure

This is a typical example of a Belgian wall. From outside to inside it has a brick wall (U=0.56 W/m²K) with a width of 8.8 cm, air pocket 4 cm, twice 10cm of insulation material (U=0.01 W/m²K), another brick wall 13.8cm (U=0.16), plasterwork 1.5cm (U=0.52 W/m²K) and mortar (U=1.5 W/m²K).

First, the dimensions of the brick wall need to be found for this example these are 188x65x50. These dimensions are needed to calculate the brick and mortar percentage in the wall. The architect has set the thickness of the mortar between each stone at 12 mm. The last piece of information needed of the wall is whether the wall has been pierced or not. With all these elements, the programme or engineer can calculate the R-value of the wall.
In regard the air pocket only the total area of the ventilation holes in the outside wall expressed in mm²/m needs to be known.

The method of fixating the insulation to the wall needs to be known because there is a difference if the insulation layer is pierced while fixating it or not. If this is known the next part can be started. If the fixations has a lower λ than 1W/mK there is no need to continue but if it is higher the program needs more information. For example how much fixations in one m², how deep the fixation pierces trough the insulation, the section of one fixation in mm² and what kind of material it is with all the necessary information. (figure 2)

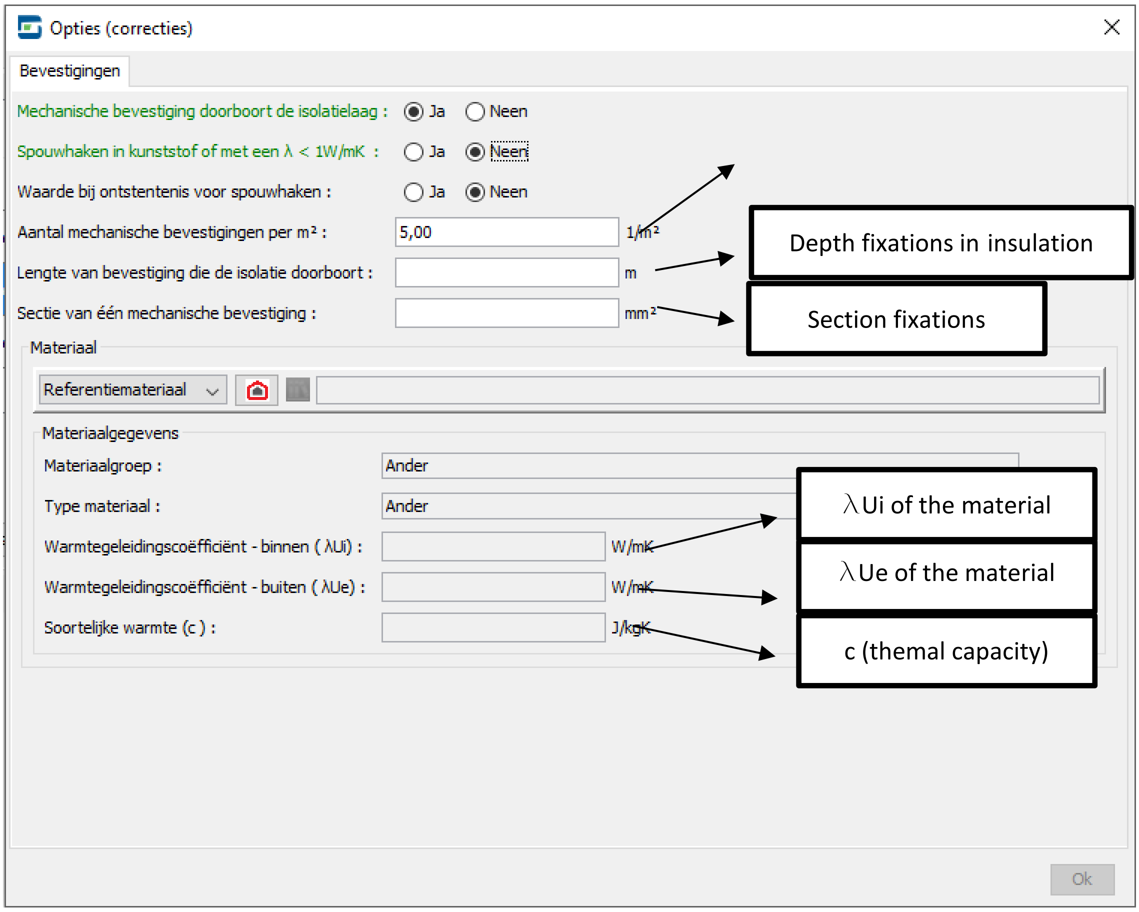


Figure 2. Options Insulation fixation

After filling in all this information the structural brick wall is given. The same thing can be done for the outer brick wall. If the architect decided to bond the bricks together with glue, nothing has to be done just click on “ja” which mean yes. This means that the height of the mortar level is lower than 3mm. Which is the case when bricks are bond together.

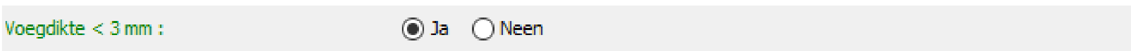


Figure 3. Bonding bricks

For the plasterwork, the corresponding U-value of the plaster that is going to be applied to the wall needs to be found. This is found in the measuring state.

At the beginning or the end it is possible to enter how much m² of that kind of wall is present and to what it is connected (outdoor/corridor/another building etc.)

4.2 Defining the right values for a roof

This is almost the same as with a wall but the roofs slope needs to be indicated.

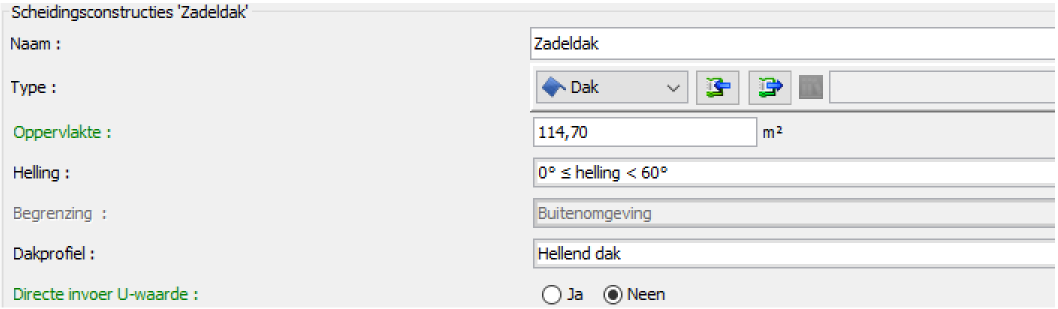
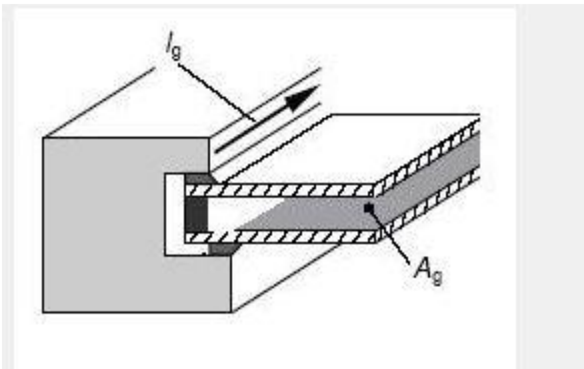


Figure 4. Options roof

If there is insulation between a wooden structure, there is a trick called ''Composite layer'' that can be applied. This can be entered into the programme by pressing the Composite layer button and putting the two materials that are in the library of the programme in, or if the correct information about the material is available it can manually be put in. Now the fraction of the wood and the insulation need to be calculated. The last part again concerns how the insulation is fixated, how to do so can be seen in paragraph3.1.1.

4.3 Defining the right values for windows



For the k-value the U-value of the window and the frame is needed. After that the fraction of the window and the frame need to be calculated. In a window there are spacers of which the overall length needs to be known and if they are thermal improved or not. It is a thermal spacer if:

Figure 5. Spacer

$$\Sigma\,(d \times \lambda) \leq 0.007\ W/K$$

Where: d (m) : the thickness of the wall of the spacer.
λ (W / mK): the thermal conductivity of the material of the spacer.
(De Vlaamse Overheid, 2016)

4.4 Thermal bridges

Thermal bridges are very common in a building it is impossible to build something without them. The heat lost can be minimized threw the connection of the building. The first step in improving those connections is by knowing where a thermal bridge is located. The most common in Belgium are:
- The transition between foundations and walls of walls and columns in concrete.
- Balconies of which the concrete flows through the inside area.
- Floorboards in contact with the outside of the cavity wall.
- Lentils, beams and columns arranged against the cavity wall.
- Window sills.
- Neglects.
- Floors and inner walls against outside walls in case of indoor insulation.
- The edging of the roof.
- Headings at the height of an insulated attic floor.
- The joints between partition walls and floors in unheated adjacent spaces.
- Thickness change in the building shell (a much thinner part can form a cold bridge).
- Materials in the building shell with different thermal conductivity coefficients.

(NVJ, n.d.)

To know the difference between all these thermal bridges is important because there are different ψlim-coefficient or χlim-coefficient for all these different kind of thermal bridges. The ψlim-coefficient is when a thermal bridge is linear and the χlim-coefficient used when it is a point thermal bridge.
(Bouwfysica. Principe van thermische bruggen, 2015)

Figure 6. Thermal bridge

5 AIR TIGHTNESS OF A BUILDING

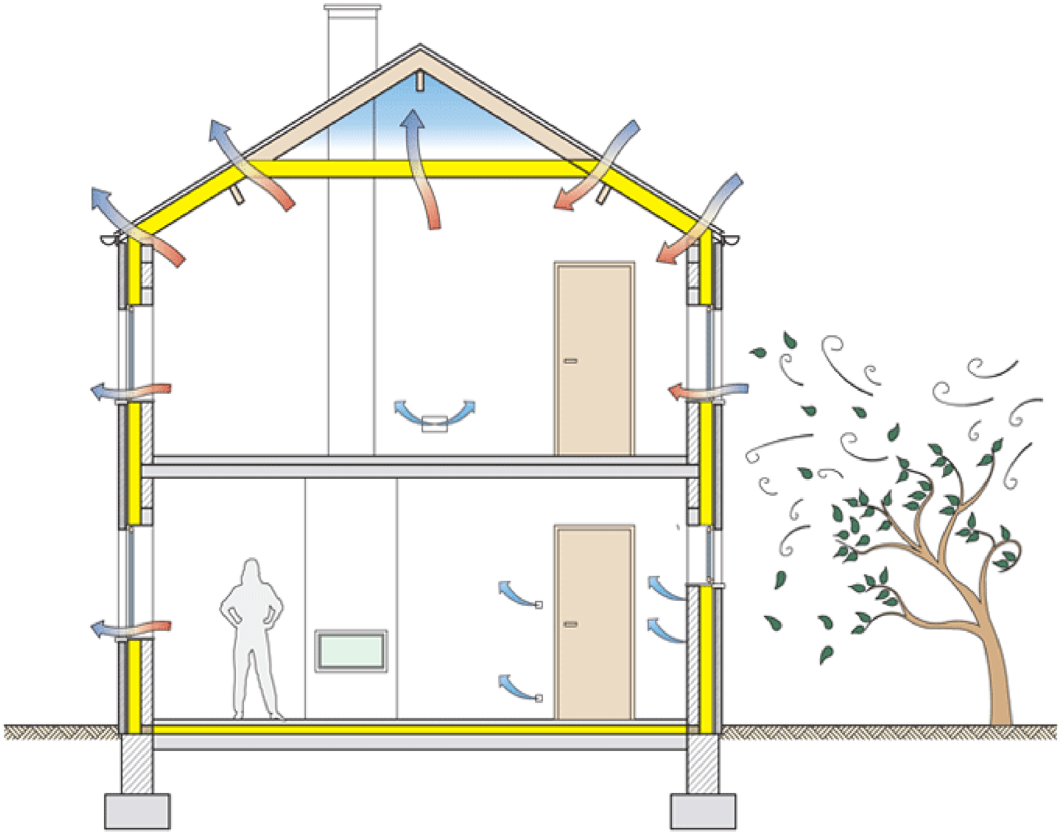


Figure 7. The air tightness of a building

The airtightness of a building is its ability to keep air currents from the inside in and vice versa. This property is quantified by the leak rate through the building shell at a given pressure difference between the indoor and outdoor environment. In Belgium, the air density is expressed at a pressure difference of 50 Pa. (Caillou, 2009)

In Belgium there is not a real limit for how high the airtightness of a building can be. The government recommends to build as airtight as possible. If the airtightness of the building is unknown, the standard value of 12 m^3/hm^2 is used. However, this value is outdated. The overall airtightness of a building for residential purposes in Belgium is 7.8 m^3/hm and that for new residential purposes is 3.2 m^3/hm^2. The only limit Belgium has set is when wanted to build a NZEB which 0.6 m^3/hm^2. For this value, a lot of attention is set to the design and construction of the building. The lowest value seen in Belgium was 0.16 m^3/hm^2, which is very low.

So, what are the differences between those airtightness factors in a building? The following example shows this on E-value level and heat losing level.

Figure 8. E-value example 12 m³/hm².

Figure 9. E-value example 7.8 m³/hm².

Figure 10. E-value example 3.2 m³/hm².

Figure 11. E-value example 0.6 m³/hm².

As shown the value between the E-value is enormous. 12 E-value points can be gained when switched from the standard value to the value of NZEB. Therefore it is definitely worth building as airtight as possible.

Primair energieverbruik verwarming (en bevochtiging als EPU) (MJ)	43 685,80

Figure 12. The amount of MJ to heat up the building 12 m^3/hm^2

Primair energieverbruik verwarming (en bevochtiging als EPU) (MJ)	33 969,64

Figure 13. The amount of MJ to heat up the building 7.8 m^3/hm^2

Primair energieverbruik verwarming (en bevochtiging als EPU) (MJ)	23 842,79

Figure 14. The amount of MJ to heat up the building 3.2 m^3/hm^2

Primair energieverbruik verwarming (en bevochtiging als EPU) (MJ)	18 467,99

Figure 15. The amount of MJ to heat up the building 0.6 m^3/hm^2

The above Figures (12-15) show the amount of MJ a year the heating of the house drops if the airtightness decreases. This is because the heat cannot escape the building that easily. In addition, the difference between the building with an air tightness of 12m^3/hm^2 and the one of 0.6 m^3/hm^2 is 25217 MJ. This equals around 7000KWh. In Belgium, this would result into paying 1250€ more electricity a year for heating your home. For heating up using gas it would results into 450€ more a year.
(GoLanTec, 2016)

6 COMPACTNESS

The compactness of a building is defined as the ratio of the protected volume (V) over the total loss of surface area (At). The more compact the building (the larger the V / At) the smaller the energy consumption of the building per m² floor area. Large buildings are compact because they include a very large volume and terraced houses are compact because they have a smaller loss surface (the inner walls to the neighbours fall away). Detached houses are much less compact because the smaller the volume of the building, the worse the compactness. (Bouw-energie, 2017)

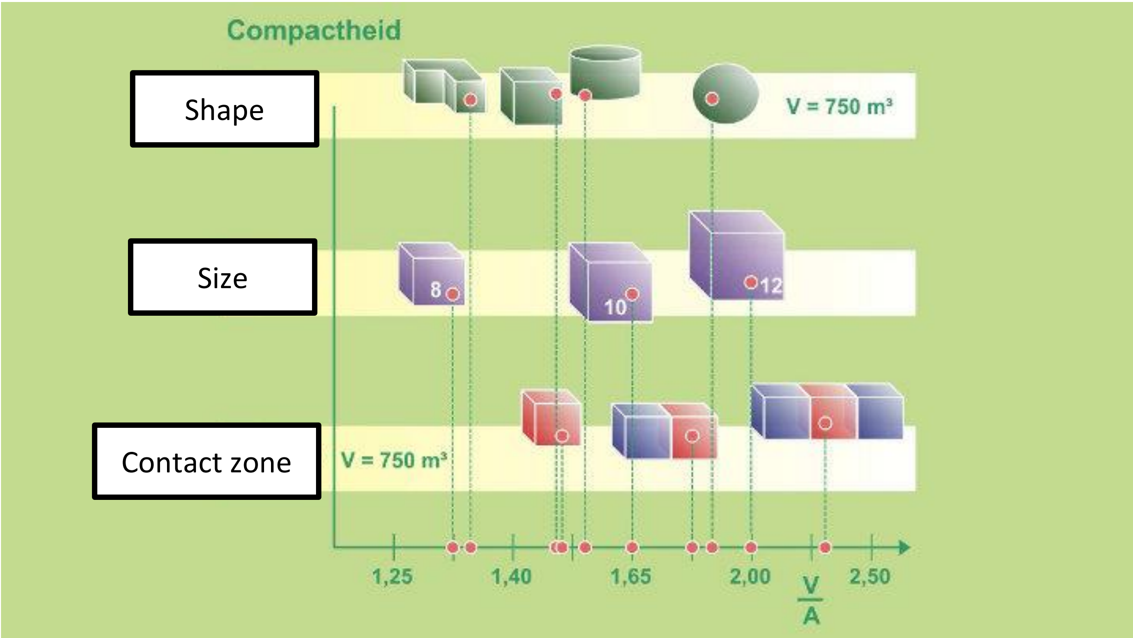


Figure 16. Compactness

Figure 17 shows that the most compact figure is a sphere. Even more compact would be to build row houses. Because there is no heat loss from the 6 sides of the building but only from 4 sides (2 walls, the floor and the ceiling). The heating bill will be less if the house is more compact.

7 ORIENTATION

The importance of the orientation of the house is strongly underestimated in Belgium. A good orientation however has a major impact on the comfort and energy cost of the property. The orientation plays a key role in optimizing heat gain through the sun. For passive houses the orientation makes a difference of 60 to 70% of heat gain and for a regular home this fluctuates between 5 and 20%. As far as energy consumption is concerned, compared to optimal southern orientation, the orientation to the west is least favorable with a 9.2% energy cost, followed by 6.5% for the north and 5.1% for the east. In a simulation on a house with large windows, the additional cost has shown to increase to 20%. (Shift Networks bvba, 2017)

7.1 The g-factor

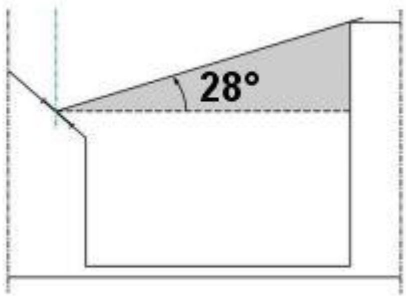
The g-factor (the solar correlation factor) is a factor that every window has. The solar correlation factor of glazing is the ratio between sun flow entering a glass window and the exposure to sun on the glazing. The solar correlation factor includes the direct, the diffuse transmission and the indirect gains that are the result of the absorption of the sun flow. For the comparison of glazing systems, the solar correction factor will use the direct sun radiation perpendicular to the window. The higher the g-factor the more heat that can be gained through a window.

7.2 Shadowing of the windows

A sun-receiving surface can be shaded by building-alienated environmental elements, called hindrances, and by building-bound elements, horizontal or lateral overhangs. Barrier shields of the direct sunlight when the sun drops below a certain height. Vertical crossing shields of direct sunlight when the sun is above a certain height and lateral overlays shield of the direct sunlight if the sun is not turned far enough or too far relative to the separation structure. Obstacles are surrounding buildings, trees and hills. Vertical crossings are translucent roof edges, balconies, horizontal awnings and translucent sidewalls. The shading of any transparent separation structure must be taken into account. If shadowing is not analyzed in detail, the value in case of absence should be used. This value can be found in the law.

There are 4 different kind of shadow angles: Horizon angle, vertical crossing angle, right crossing angle and left crossing angle.

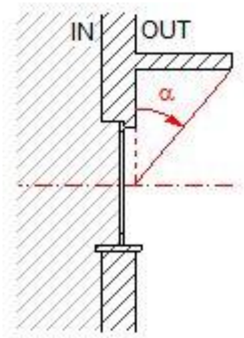
7.2.1 Horizon angle



The horizon angle is the angle between the horizontal plane and the connection line of the centre of the sun-receiving plane with the upper edge of the obstruction plane. Obstructions are schematized into a single vertical obstruction.

Figure 17. Horizon angle

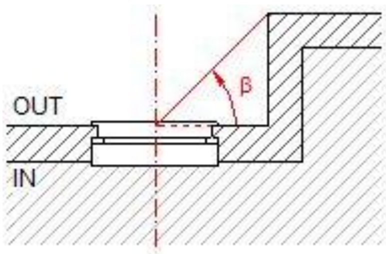
7.2.2 Vertical crossing angle



This is the angle between the plane of the solar-receiving element and the centre line of the sun-receiving plane with the lower edge of the overhang of a building bound environmental element that causes shadowing (a balcony). The vertical crossing angle is 0° if no overhang is present. The maximum value is 180°. The built-in depth of the solar receiving area may be taken into account.

Figure 18. Vertical crossing angle

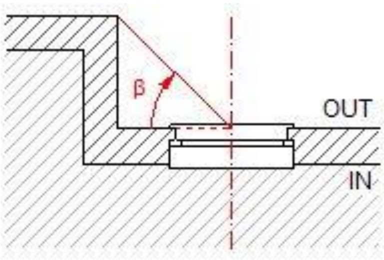
7.2.3 Right crossing angle



The right overhang angle is the angle between the plane of the sun-receiving element and the centre line of the sun-receiving plane with the side edge of a right positioned building-bound environmental element that causes shadowing. The right overhang angle is 0° if no overhang is present. The maximum value is 180°.

Figure 19. Right crossing angle

7.2.4 left crossing angle



The left overhang angle is the angle between the plane of the sun-receiving element and the centre line of the sun-receiving plane with the side edge of a left positioned building bound environmental element that causes shadowing. The left overhang angle is 0° if no overhang is present. The maximum value is 180°.

Figure 20. Left crossing angle

8 INSTALLATIONS

8.1 Heating systems

Heating systems can be divided into two groups: mixed heating systems and separate heating systems. Mixed heating systems are systems that heat up the building and the domestic hot water. When separate heating systems are used there will be 2 heat installations with lower energy consumption each but in total it can be higher than one system.

8.1.1 Where do they get their energy

All the different kind of heating systems need to be powered by something. The base they use for this can influence the E-value to a large extent. A building should never be heated up by electrical energy, as this produces too much waste. There is also the possibility to use fossil fuels. This way is already better for heating up a building and/or the domestic water. The most sustainable way to heat up a building is by using renewable energy like a solar boiler or a heat pump.

8.1.2 Factors that can improve the E-value

There are a lot of small factors that can influence the E-value, for example the location of the heating system, if it is located in the protected volume (area of a building that is isolated and heated) or not. The locations of the pipelines of the heating system, if the heat lose heats up areas that need to be heated this heat loss turns into a heat gain. The length of the pipelines, the longer the pipelines the more energy the heating system needs to produce. If there is a storage vessel used when heating up the domestic water, the storage vessel will always contain a certain volume that needs to be hot even if there is no use for it (night times). This will use more energy than when the domestic heating system only produces hot water when needed. The location of the storage vessel of a domestic water system, if it is inside or outside the protected volume. The heat loss of this storage can heat up the room in order to limit the loss

8.2 Ventilation systems

Ventilation system A: natural supply and natural output. This system realizes a shear effect based on wind pressure and air pressure. This is not, or very limited, controllable. With large amounts of wind, the heat loss will be big that this ventilation system is not energy efficient anymore. In other weather conditions, the ventilation may not be sufficient. This system was mainly used in older buildings.

Ventilation system B: mechanical supply and natural output. There is a mechanical supply of fresh air through electric fans in the dry areas. The output of contaminated air happens naturally in wet rooms via vertical drainage ducts that are as close to the outside as possible. This ventilation system is only used when a building is heated by air heating, as it can only work efficiently in those conditions.

Ventilation system C: natural supply and mechanical output. There is a natural supply of fresh air through supplied grids in windows or walls. The output of contaminated air in wet rooms occurs mechanically, by electric fans. It's a certified ventilation system if there are sensors in the building that activate the ventilation system when an excessive moisture content or CO_2 level is measured. This prevents the ventilation system from rotating throughout the day, even when it is not necessary. This has a positive impact on the E-value of the building.

Ventilation system D: Mechanical supply and mechanical output. There is a mechanical supply of fresh air through electric fans in the dry areas. Output of contaminated air in wet rooms occurs mechanically, by electric fans. With this system, you can invest more in heat recovery. A large part of the heated output air is recycled and reused to preheat the (cold) supply air. This allows control and minimisation of ventilation, with approximately 75% less energy loss (depending on the heat exchanger efficiency). However, this investment is only economically relevant if the system is integrated into a very well-insulated building. One should also ensure that the system is placed by professionals and that the filters in the system are cleaned on time. Otherwise, the system may become dirty, resulting in an unhealthy indoor climate. (Bouw-Energie, 2017)

8.3 Renewable systems

In Belgium, there are 6 different renewable systems that can be used in a building. This is a must for buildings that are constructed after 1 March 2017. The following systems are allowed:

- Sun boiler
- Solar panels
- Biomass kettle/boiler
- Heat pump
- District heating or cooling
- Participation

8.3.1 Sun boiler

A sun boiler is an installation that allows the energy of the sun to be collected to heat up domestic water. The installation consists of a solar collector installed on the roof, a water reservoir and accessories such as a circulation pump to transfer the solar energy from the collector to the water reservoir or a heat exchanger and an additional water heating system for when the light intensity is not strong enough for the hot domestic water demand.
The law in Belgium states that the panels must be orientated to the east, south or west and lie under and angle between 0° and 70°otherwise this installation will not be seen as renewable energy system.

8.3.2 Solar panels

A solar panel is a collection of solar cells that can convert light directly into electricity. By combining multiple solar panels, it is possible to generate all the electricity a building needs. There are two different kinds of solar panels: crystalline and amorphous solar panels. Crystalline solar panels have a higher efficiency (12-19%) than amorphous solar panels (5-11%) but are more expensive and robust. A solar panel produces direct current (DC). In order to be able to use the power produced by solar panels in a home or to put it over the net, it must be converted to a 230 V alternating current (AC). This is the reason one uses an inverter, which is integrated into the electrical circuit, just after the solar panels are placed.
The orientation of the solar panels matters a lot, facing south and being under and angle of 35° are the best circumstances in Belgium. If the panels are faced southeast or southwest the efficiency already drops with 5%. The law in Belgium states that the panels must be orientated to the east, south or west and lie under and angle between 0° and 70°otherwise this installation will not be considered as renewable energy system.

8.3.3 Biomass kettle/boiler

Biomass is a collective name for all renewable raw materials of plant (or animal) origin: wood blocks, wood pellets, cereals, rapeseed, sunflower seeds etc.
By using bio energy, there is no additional CO_2 emission. Because of the conversion (by fermentation, burning or gasification) of biomass to usable electricity the amount of CO_2 released is as much as the plants and trees take in during the course of their life.
The Belgium law states that the efficiency of the installation should be higher than 85% and the emission level should be lower than the value of phase 3 of the KB October 2010 (Royal Decree) and this is 150 mg/Nm^3.

8.3.4 Heat pump

A heat pump is an economical alternative to traditional boilers. The technology even produces up to 75% of the heat a building needs. The remaining 25% comes from natural gas or electricity. The operation of a heat pump is: thermal energy is extracted from the environment (water, air, soil) which is then released in the form of heat in to the heating system connected to the heat pump. The Belgium law states that the season performance factor (SPF) has to be bigger than 4, otherwise this installation will not be seen as a renewable energy system. The season performance factor is the number that indicates the heat pump efficiency + the delivery system (under floor heating, radiators, etc.)

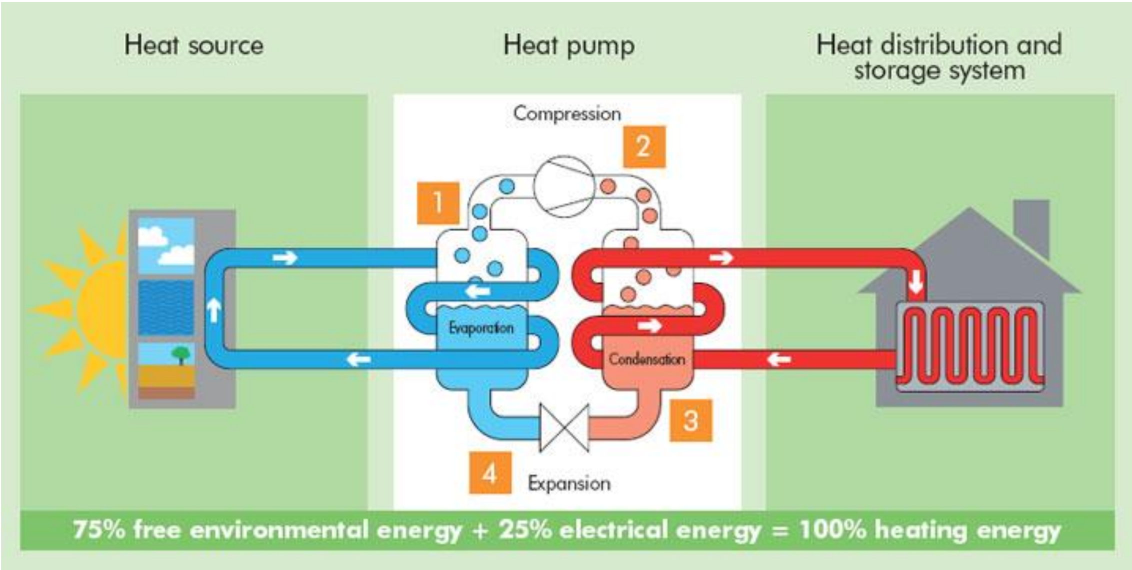


Figure 21. Working of a heat pomp

8.3.5 District heating or cooling

When generating energy in power plants, a huge amount of heat is released. This heat will be harnessed and send to houses close to the power plants. Each house that is heated this way equals the CO_2 savings of 12 solar panels on a houses roof. The Belgian law states that at least 45% of the energy needs to come from renewable sources.

8.3.6 Participation

Participation is something that needs to be done if a company/family did not choose one of the renewable energy systems mentioned above. The person in question has to support a renewable project and, as a result, has to pay a certain amount based on the raw floor area of the building. The calculation goes as following: they multiply the raw floor area with 7kWh/m² and this they multiply by the price that 1kWh will cost at that time.

8.4 **Lights**

In Belgium the lights only make a difference on the E-value if the building is industrial. Houses are too small to take this into account.

There are two options that can be used in Belgium: the value in case of absence or search for every different kind of light and get the electric power (in Watt) and the optical characteristics. These consist of three parts: the CIE flux codes (.N2, .N4 and .N5), the luminous flux per lamp (in lumen) and the number of lamps. The optical features should be requested from the people who install the lighting, but this is often a hard part because most of them do not know the values. The light current for each lamp and the number of lamps for each armature can be found easily, but the CIE flux codes are a lot more difficult to obtain. First of all, the installers of the lights should seek this information from the manufacturers of lamps, but even manufacturers may find it difficult to send the right information. What they always can send is the polar diagram, the CIE flux codes can be derived from this.

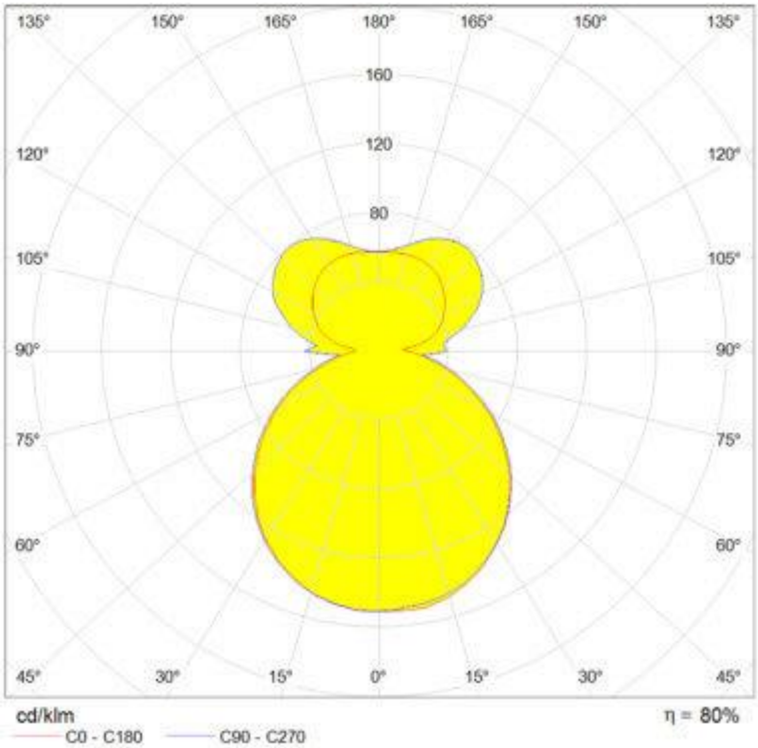


Figure 22. Polar Diagram

Formulas for CIE flux codes:

$$.N2 = \frac{FC2}{FC4}$$

$$.N4 = \frac{FC4}{F}$$

$$.N5 = \frac{F}{PHIS}$$

Where:

FC2 = supplied light current under an opening angle 60°
FC4 = supplied light current under an opening angle 90°
F = supplied light current under an opening angle 180°
PHIS = total supplied light current

.N5 should be equal to the return which can be found in the bottom right corner in the polar diagram, in this case 80%. (Bouw-Energie, 2017)

9 OVERHEATING

Overheating of a building mainly occurs in the summer, due to all the measurements taken to prevent heat loss in a building during the other seasons. During the summer most of the heat needs to be taken out of the building. There are a lot of measurements for this but most of them will enhance the E-value, for example: use less insulation, use windows with a higher g-factor and do not put major window sections in the south etc.. These are solutions that will raise the heat loss in the winter. Fortunately there are some measurements that will help without losing any heat in the winter for example, putting sun blinds in front of the windows (manual or automatically) or retractable awnings above the windows and if the building uses a ventilation system D, the system should have a summer by-pass. If all these measurements have been taken and the overheating is still above the maximum limit of 6500 Kh (Kelvin hour) there is one last trick that can be used:

This trick allows to decrease the overheating by 'opening' windows. This is something people usually do when it is too hot in their home. Still, there are some restrictions. The windows can only be taken in account when they are 'burglar free'. Windows are not burglar free when they are in the easily accessible facades or on low roofs (lowest point > 2.40m). The accessible facade is a 2.40 meter high plane on the horizontal surface of where a burglar could be. That horizontal plane is the ground floor or an area of at least 60cm by 60cm. This can maximally be 3.50 m above the ground or floor or above another accessible 60cm by 60cm surface with a slope of maximum 30° (the surface can also be a sloping roof). The width of the accessible vertical facade is the width of the horizontal plane with 60cm extra on either side, which corresponds to the average arm's length. Each horizontal plane (with a maximum inclination of 30°) with a surface area of at least 60cm X 60cm, that is accessible via a fixed ladder (for example a fire ladder) is also considered as a reachable plane, regardless of the height of the plane relative to the ground or floor or another reachable plane.

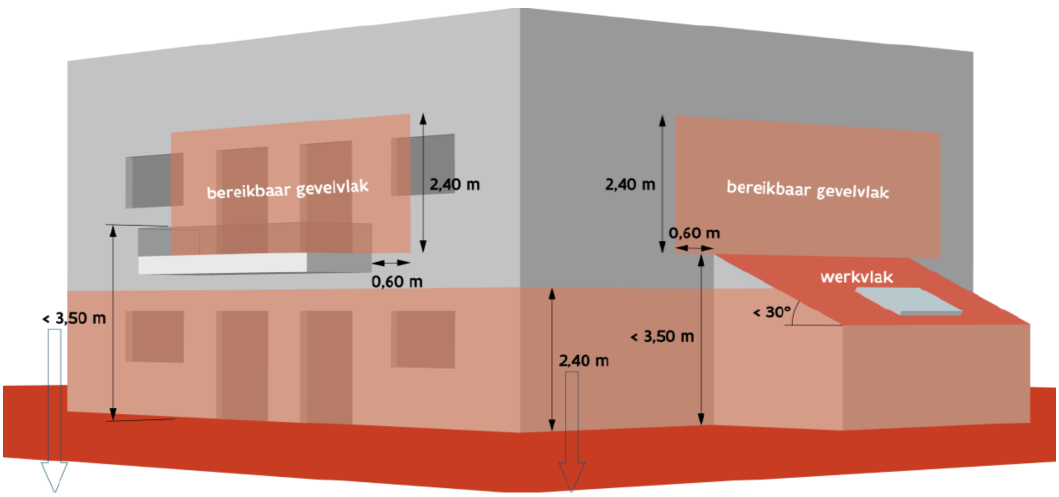


Figure 23. Burglar free zones of a building (appendix 3)

10 CONCLUSION

Overall, the core subject of this thesis is saving or gaining energy in a building. Gaining energy from natural influences and saving energy when you need to add extra energy to heat up the building or for using electrical machines.

This can be done by a lot of different methods like: using more insulation, building airtight, using the sun gains in the advantage of the building etc. All these factors are concluded in the E-value. The E-value measures and determines the energy performance of a building and is currently (2017) set at E50 in Belgium. However, this E-value needs to drop, as for the year 2021, the determined value is E30. This means all the newly build buildings in Belgium will be NZEB-buildings.

This thesis extensively discussed the factors that influence the Belgian E-value: The Insulation grade, air tightness of a building, compactness, orientation, overheating and the installations used in it. This thesis aimed to prove the importance and relevance of taking these factors into account.

I also recommend future research in come kind of schooling of the construction laborers. Because all the right materials can be used in a building but if the laborers do not have the right schooling they maybe make a mistake in the implementation of a installation or a technique.

I strongly encourage to do more research about this topic because it is an booming subject in the modern construction world.

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Appendix 1

Energy performance and indoor climate of buildings

EPB-Rapport

Administrative data of the project

Name Project	**V752_DERYCKERE_CHARLES_VRIJSTAAND**		
Street Village	**Munkendoornstraat**	Number	**115**
Reference land register	**Kortrijk**	Zip code	**8500**
	10-C-38		

Presentation of the report

Display order of report

Results of all EPB units per demand

Displayed EPB units in the report

- ☑ Building "Gebouw 17"
  - ☑ Unité PEB "Gebouw17"

List of persons involved

Architect of the project

Naam	**Hespel**	Voornaam	**cedric**
Firma naam	**Hespel bvba.**		
Straat	**Jacob besagestraat**	Nummer	**46** Bus
Postcode	**8450** Gemeente **Bredene**	Landcode	**België**
Telefoon	**0470258369**		

EPB-reporter

Naam	**Deryckere**	Voornaam	**Charles**
Firma naam			
N° PEB	**EP12345**		
Straat		Nummer	Bus
Postcode	Gemeente	Landcode	**België**
Telefoon			

Summary of the requirements for each building

Building "Gebouw17" (naam van het gebouw)

Nature of the works: Newly build (or equivalent)

Protected volume: 1.058,77 m³

Volume "K-Volume_vrijstaandeWoning"

EPB-eenheid "Gebouw17"

Destination of the EPB-eenheid: Leving (EPW)

Area: 297,52 m²

Requirements at the level of the EPB unit:

Umax / Rmin	K-value	E-value	Etech	NE	Oververh.	Ventilation	HE
✓	✓ 19.0	✓ 16.0		✓ 14.65	✓ (orange)	✓	✓
zie fiche 1 voor meer info.	zie fiche 2 voor meer info.	zie fiche 3 voor meer info.			zie fiche 3 voor meer info.	zie fiche 4 voor meer info.	zie fiche 5 voor meer info.

Method thermal bridge: Option B : EPB-accepted method

This EPB unit meets the requirements for a NZEB building.

Belgian logo for NZEB-buildings

BEN stands for Nearly zero emission building. constructing a building according to the BEN principles will be the standards for new buildings in Flanders from 2021. BEN-building is today the smartest choice, more information at. www.energiesparen.be/BEN.

Sheet 1: Requirements U / R values

Gebouw "Gebouw17"

Nature of the works: Newly build (or equivalent)

Volume "K-Volume_vrijstaandeWoning"

EPB-eenheid "Gebouw17"

1.1. TRANSPARANT SEPARATION STRUCTURES

Uw (moderate)	0,69	✓

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
GLVL_raam_Oost	Window	0,72	0,50	-	-	-	-	✓
GLVL_raam_naast_voord	Window	0,87	0,50	-	-	-	-	✓
GLVL_schuifraam_Zuid_k	Window	0,69	0,50	-	-	-	-	✓
GLVL_raam_Zuid_zithoek	Window	0,63	0,50	-	-	-	-	✓
GLVL_raam_Zuid_zithoek	Window	0,70	0,50	-	-	-	-	✓
GLVL_schuifraam_west	Window	0,69	0,50	-	-	-	-	✓
GLVL_raam_West_eetho	Window	0,68	0,50	-	-	-	-	✓
GLVL_raam_Noord_burea	Window	0,62	0,50	-	-	-	-	✓
GLVL_raam_West_burea	Window	0,72	0,50	-	-	-	-	✓
VR1_Raam_Oost	Window	0,82	0,50	-	-	-	-	✓
VR1_Raam_Zuid_Slaapk	Window	0,69	0,50	-	-	-	-	✓
VR1_Raam_Zuid_Slaapk	Window	0,71	0,50	-	-	-	-	✓
VR1_Raam_Zuid_Nachth	Window	0,76	0,50	-	-	-	-	✓
VR1_Raam_Zuid_Kinderk	Window	0,76	0,50	-	-	-	-	✓
VR1_Raam_Zuid_Kinderk	Window	0,71	0,50	-	-	-	-	✓
VR2_Raam_Zuid_Zolder_	Window	0,67	0,50	-	-	-	-	✓
VR1_Raam_West_Slaapk	Window	0,71	0,50	-	-	-	-	✓
VR1_Raam_West_Slaapk	Window	0,76	0,50	-	-	-	-	✓
VR1_Raam_West_Kinder	Window	0,74	0,50	-	-	-	-	✓

1.2.1 Roofs and ceilings

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
Zadeldak	Roof	0,07	-	-	-	-	-	✓
Platdak	Roof	0,07	-	-	-	-	-	✓

1.2.2. Walls not in contact with the ground, except for the walls referred to in 1.2.4.

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
Buitenmuur	Wall	0,09	-	-	-	-	-	✓
Hoekpannel_ramen	Wall	0,11	-	-	-	-	-	✓

1.2.4. Vertical and inclined partition constructions in contact with a crawl space or basement with an outside of the protected volume

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
Keldermuur	Wall	0,19	-	5,12	-	-	0,17	✓

1.2.6. Other floors (floors on full ground, above a craw room or above a basement outside the protected volume, dug basement floors)

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
Vloer_Gelijksvloer	Floor/Ceiling	0,10	-	10,16	-	0,09	-	✓

1.3. DOORS AND GATES (including the frame)

Name	Type	U	Ug	R	b.Ui	a.Ueq	b.Ueq	OK?
GLVL_VoorDeur	Door	1,27	-	-	-	-	-	✓
GLVL_Deur_Oost	Door	1,27	-	-	-	-	-	✓
Kelder_deur	Door	1,27	-	-	-	-	-	✓

Sheet 2: Requirements K-peil

Building"Gebouw17"

Nature of the works: Newly build (or equivalent)

K-volume: K-Volume_vrijstaandeWoning

Results:

Total heat lossing area of a building:	734,64 m^2
Protected volume:	1.058,77 m^3
Compactness:	1,44 m
Average U-Value:	0,21 $W/m^2.K$
K-value	19,00

Destination of the EPB unit:

Gebouw17 : living (EPW)

sheet 3: Requirements E-value and overheating (with annual total per item)

Building "Gebouw17"

Nature of the works: Newly build (or equivalent)
EPB-unit: Gebouw17

Destination of the EPB unit: Living (EPW)

Overheating	Indicator	chance
Energiesector_	2 017,47	18,50 %

Summary of the results of the EPB unit

Compartments	Annual total
Primary energy consumption of heating (and humidification as EPU) (MJ)	17 627,69
Primary energy consumption of cooling (MJ)	1 772,64
Primary energy consumption domestic hot water (MJ)	17 357,28
Primary energy savings by solar panels (MJ)	-27 985,91
Primary energy auxiliary energy (MJ)	23 283,75
Primary energy saving by cogeneration(MJ)	-0,00
Characteristic primary energy consumption (MJ)	32 055,45

Primary energy consumption heating (and humidification as EPU)

Compartments	Annual total
Transmission losses (MJ)	37 995,13
Ventilation losses (MJ)	7 008,37
Internal Profit (MJ)	-29 308,80
Solar gains (MJ)	-33 750,41
Net energy demand heating (MJ)	15 698,10
Gross energy demand heating (MJ)	18 468,35
Energy for heating produced by solar Energy (MJ)	-0,00
Gross energy demand covered by heating system (MJ)	18 468,35
End energy consumption heating - Preferential (MJ)	17 627,69
End energy consumption heating - non-preferential (MJ)	0,00
End energy consumption heating (MJ)	17 627,69
Primary energy consumption heating (and humidification as EPU) (MJ)	17 627,69

Primary energy consumption of cooling

Compartments	Annual total
Transmission losses (MJ)	57 718,82
Ventilation losses (MJ)	35 235,74
Internal Profit (MJ)	-29 308,80
Solar gains (MJ)	-22 787,90
Net energy demand cooling (MJ)	1 595,38
End energy consumption cooling (kWh)	196,96
Primary energy consumption cooling (MJ)	1 772,64

Primary energy consumption of domestic hot water

Compartments	Annual total
Net energy demand hot domestic water (MJ)	7 509,73
Gross energy demand hot domestic water (MJ)	8 678,64
Energy for hot domestic water produced by solar Energy (MJ)	-0,00
Gross energy demand covered by hot domestic water system (MJ)	8 678,64
End energy consumption hot domestic water - Preferential	17 357,28
End energy consumption hot domestic water - non-preferential (MJ)	0,00
End energy consumption hot domestic water (MJ)	17 357,28
Primary energy consumption hot domestic water (MJ)	17 357,28

Primary energy consumption auxiliary energy

Compartments	Annual total
Fans (kWh)	2 014,80
Circulation pumps (kWh)	389,54
Generators (kWh)	182,74
Pre-cooling (kWh)	0,00
Primary energy consumption auxiliary energy (MJ)	23 283,75

Primary energy savings by solar panels

Compartments	Annual total
Total power generation (kWh)	3 109,55
Primary energy savings by solar panels (MJ)	-27 985,91

Primary energy savings by cogeneration

Compartments	Annual total
Total power generation (kWh)	0,00
Primary energy savings by cogeneration (MJ)	-0,00

Total CO2 emission

Compartments	Annual total
Emission from heating (kg)	888,44
Emission from hot domestic water (kg)	874,81
Emission from cooling (kg)	0,00
Emission from auxiliary energy (kg)	1 667,12
Avoided emission from solar panels (kg)	-2 003,79
Avoided emission from cogeneration (kg)	-0,00
Total CO2 emission (kg)	1 426,57

sheet 4: Eisen ventilatie

Building "Gebouw17" (naam van het gebouw)

Nature of works: Newly build (or equivalent)

K-volume: K-Volume_vrijstaandeWoning

EPB-unit: Gebouw17

Destination of the EPB unit: Living (EPW)

Requirements respected: ✓

Ventilation system: Ventilatiezone_woning17

Type system: D - Mechanical inlet, mechanical extraction

With heat recovery: ☑

	Rooms	area [m²]	inlet [m³/h]	Flow [m³/h]	Extraction [m³/h]	Openings	Req.
D	Bureau_beneden (Slaap-, studeer-, speelkamer (of analoge ruimte))	25.766	72,00	28,80	0,00	1 MTO, 1 DO	✓
D	Bureau_eethoek (Slaap-, studeer-, speelkamer (of analoge ruimte))	8.692	32,00	32,00	0,00	1 MTO, 1 DO	✓
D	eethoek+ salon (Woonkamer (of analoge ruimten))	49.68	150,00	110,80	0,00	1 MTO, 3 DO	✓
D	slaapkamer ouders (Slaap-, studeer-, speelkamer (of analoge ruimte))	12.43	45,00	28,80	0,00	1 MTO, 1 DO	✓
D	kinderslaapkamer1 (Slaap-, studeer-, speelkamer (of analoge ruimte))	9.77	36,00	28,80	0,00	1 MTO, 1 DO	✓
D	kinderslaapkamer 2 (Slaap-, studeer-, speelkamer (of analoge ruimte))	12.95	47,00	28,80	0,00	1 MTO, 1 DO	✓
D	Verdiep_2_Cinemaruimte (Slaap-, studeer-, speelkamer (of analoge ruimte))	49.04	72,00	72,00	0,00	1 MTO, 1 DO	✓
C	Inkom (Gang, trapzaal, hal (of analoge ruimte))	6.868	0,00	57,60	0,00	2 DO	
C	nachthall (Gang, trapzaal, hal (of analoge ruimte))		0,00	216,00	0,00	6 DO	
V	Open_keuken (Open keuken)		0,00	78,80	132,00	2 DO, 1 MAO	✓
V	WC_beneden (WC)		0,00	28,80	25,00	1 DO, 1 MAO	✓
V	WC_boven (WC)		0,00	28,80	25,00	1 DO, 1 MAO	✓
V	badkamer (Badkamer, was-, droogplaats)	11.54	0,00	28,80	136,00	1 DO, 1 MAO	✓
V	Douchecel (Badkamer, was-, droogplaats)	4.4	0,00	28,80	136,00	1 DO, 1 MAO	✓
	Totaal		454,00		454,00		

MTO = mechanical inlet
DO = Flow
MAO = mechanical extraction

Sheet 5: Requirements renewable energy

Building "Gebouw17"

Nature of works: Newly build (or equivalent)

K-volume: K-Volume_vrijstaandeWoning

EPB-unit: Gebouw17

Requirements met: ✓

System	Present?	Req. Met?	Quantity renewable energy For building		Quantity renewable energy For offices, schools, apartments	
			Reached amount	required amount	(kWh)	(kWh/m²)
Solar boiler	✗	-	-	-	-	-
Solar panels	✓	✓	26,13 kWh/m²	10,00 kWh/m²	7.773,86	26,13
Biomass	✗	-	-	-	-	-
Heat pump	✗	-	-	-	-	-
Distict heating or cooling	✗	-	-	-	-	-
Participation	✗	-	-	-	-	-
Review	✓	✓	✓		7.773,86	26,13

Annex 1: Detailed calculations for each month

Building "Gebouw17"

EPB-unit: Gebouw17

Destination of the EPB unit: Living (EPW)

Summary of the results if the EPB-unit

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Primary energy consumption heating (and humidification for EPU) (MJ)	4 891,1	3 465,0	1 318,3	55,7	0,0	0,0	0,0	0,0	0,0	111,1	2 938,4	4 848,1	**17 627,7**
Primary energy consumption cooling (MJ)	0,0	0,0	0,0	14,4	127,8	367,4	616,8	504,9	136,0	5,4	0,0	0,0	**1 772,6**
Primary energy consumption hot domestic water (MJ)	1 474,2	1 331,5	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	**17 357,3**
Primary energy savings by solar panels (MJ)	-836,3	-1 326,5	-2 193,0	-2 907,7	-3 625,5	-3 618,1	-3 575,5	-3 406,6	-2 820,3	-1 961,6	-1 049,5	-665,2	**-27 985,9**
Primary energy consumption auxiliary systems (MJ)	1 986,4	1 791,7	1 977,1	1 910,1	1 973,6	1 909,9	1 973,6	1 973,6	1 909,9	1 973,9	1 917,6	1 986,3	**23 283,8**
Primary energy savings by cogeneration (MJ)	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	**-0,0**
Characteristic primary energy consumption (MJ)	7 515,4	5 261,7	2 576,5	499,1	-49,9	85,8	489,0	546,0	652,2	1 603,0	5 233,2	7 643,4	**32 055,5**

Primary energy consumption heating (and humidification as EPU)

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Transmission losses (MJ)	6 198,1	5 333,5	5 067,4	3 566,5	1 968,3	729,5	167,5	167,5	1 134,8	2 847,8	4 741,8	6 072,5	**37 995,1**
Ventilation losses (MJ)	1 143,3	983,8	934,7	657,9	363,1	134,6	30,9	30,9	209,3	525,3	874,6	1 120,1	**7 008,4**
Intern gains (MJ)	-2 489,2	-2 248,3	-2 489,2	-2 408,9	-2 489,2	-2 408,9	-2 489,2	-2 489,2	-2 408,9	-2 489,2	-2 408,9	-2 489,2	**-29 308,8**
Solar gains(MJ)	-497,6	-990,3	-2 601,4	-4 017,4	-4 748,6	-4 854,6	-4 827,2	-4 583,5	-3 719,7	-1 923,3	-599,7	-387,0	**-33 750,4**
Net energy need heating (MJ)	4 355,7	3 085,7	1 174,0	49,6	0,0	0,0	0,0	0,0	0,0	99,0	2 616,7	4 317,4	**15 698,1**
Gross energy need heating (MJ)	5 124,4	3 630,2	1 381,2	58,4	0,0	0,0	0,0	0,0	0,0	116,4	3 078,5	5 079,3	**18 468,4**
Energy for heating produced by thermal solar energy (MJ)	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	**-0,0**
Gross energy demand covered by heating system (MJ)	5 124,4	3 630,2	1 381,2	58,4	0,0	0,0	0,0	0,0	0,0	116,4	3 078,5	5 079,3	**18 468,4**
End energy consumption heating - preferred (MJ)	4 891,1	3 465,0	1 318,3	55,7	0,0	0,0	0,0	0,0	0,0	111,1	2 938,4	4 848,1	**17 627,7**
End energy consumption heating - not preferable (MJ)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,0**
Final energy consumption heating (MJ)	4 891,1	3 465,0	1 318,3	55,7	0,0	0,0	0,0	0,0	0,0	111,1	2 938,4	4 848,1	**17 627,7**
Primary energy consumption heating (and humidification as EPU) (MJ)	4 891,1	3 465,0	1 318,3	55,7	0,0	0,0	0,0	0,0	0,0	111,1	2 938,4	4 848,1	**17 627,7**

Primary energy consumption cooling

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Transmission losses cooling (MJ)												
7 873,3	6 846,6	6 742,5	5 187,6	3 643,5	2 350,6	1 842,7	1 842,7	2 755,9	4 522,9	6 362,9	7 747,6	**57 718,8**
Ventilation losses cooling (MJ)												
4 806,4	4 179,6	4 116,1	3 166,9	2 224,2	1 435,0	1 124,9	1 124,9	1 682,4	2 761,1	3 884,4	4 729,7	**35 235,7**
Intern gains cooling (MJ)												
-2 489,2	-2 248,3	-2 489,2	-2 408,9	-2 489,2	-2 408,9	-2 489,2	-2 489,2	-2 408,9	-2 489,2	-2 408,9	-2 489,2	**-29 308,8**
Solar gains cooling (MJ)												
-594,7	-1 041,3	-1 700,8	-2 434,9	-3 019,2	-3 033,8	-3 459,2	-2 901,5	-2 109,4	-1 194,3	-869,9	-428,9	**-22 787,9**
Net energy need cooling (MJ)												
0,0	0,0	0,0	13,0	115,0	330,6	555,1	454,4	122,4	4,9	0,0	0,0	**1 595,4**
Final energy consumption cooling (kWh)												
0,0	0,0	0,0	1,6	14,2	40,8	68,5	56,1	15,1	0,6	0,0	0,0	**197,0**
Primary energy consumption cooling (MJ)												
0,0	0,0	0,0	14,4	127,8	367,4	616,8	504,9	136,0	5,4	0,0	0,0	**1 772,6**

Primary energy consumption domestic hot water

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Net energy need domestic hot water (MJ)												
637,8	576,1	637,8	617,2	637,8	617,2	637,8	637,8	617,2	637,8	617,2	637,8	**7 509,7**
Gross energy need hot domestic water (MJ)												
737,1	665,8	737,1	713,3	737,1	713,3	737,1	737,1	713,3	737,1	713,3	737,1	**8 678,6**
Energy for hot domestic water produced by thermal solar energy (MJ)												
-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	**-0,0**
Gross energy demand covered by hot domestic water system (MJ)												
737,1	665,8	737,1	713,3	737,1	713,3	737,1	737,1	713,3	737,1	713,3	737,1	**8 678,6**
End energy consumption HDW - preferred (MJ)												
1 474,2	1 331,5	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	**17 357,3**
End energy consumption HDW - not preferable (MJ)												
0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,0**
Final energy consumption HDW(MJ)												
1 474,2	1 331,5	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	**17 357,3**
Primary energy consumption HDW (MJ)												
1 474,2	1 331,5	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	1 474,2	1 426,6	1 474,2	1 426,6	1 474,2	**17 357,3**

Primary energy consumption auxiliary energy

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Fans(kWh)												
171,1	154,6	171,1	165,6	171,1	165,6	171,1	171,1	165,6	171,1	165,6	171,1	**2 014,8**
Circulation pumps (kWh)												
33,1	29,9	33,1	32,0	33,1	32,0	33,1	33,1	32,0	33,1	32,0	33,1	**389,5**
Generators (kWh)												
16,5	14,6	15,5	14,6	15,1	14,6	15,1	15,1	14,6	15,1	15,5	16,5	**182,7**
Pre-cooling (kWh)												
0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,0**
Primary energy consumption auxiliary energy (MJ)												
1 986,4	1 791,7	1 977,1	1 910,1	1 973,6	1 909,9	1 973,6	1 973,6	1 909,9	1 973,9	1 917,6	1 986,3	**23 283,8**

Primary energy savings by solar panels

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Final electrician generation (kWh)	92,9	147,4	243,7	323,1	402,8	402,0	397,3	378,5	313,4	218,0	116,6	73,9	**3 109,5**
Primary energy savings by solar panels(MJ)	-836,3	-1 326,5	-2 193,0	-2 907,7	-3 625,5	-3 618,1	-3 575,5	-3 406,6	-2 820,3	-1 961,6	-1 049,5	-665,2	**-27 985,9**

Primary energy savings by cogeneration

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Final electrician generation (kWh)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,0**
Primary energy savings by cogeneration (MJ)	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	**-0,0**

CO2-emission

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Emission from heating (kg)	246,5	174,6	66,4	2,8	0,0	0,0	0,0	0,0	0,0	5,6	148,1	244,3	**888,4**
Emission from domestic hot water (kg)	74,3	67,1	74,3	71,9	74,3	71,9	74,3	74,3	71,9	74,3	71,9	74,3	**874,8**
Emission from cooling (kg)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,0**
Emission by auxiliary energy (kg)	142,2	128,3	141,6	136,8	141,3	136,8	141,3	141,3	136,8	141,3	137,3	142,2	**1 667,1**
Avoided emission from solar panels (kg)	-59,9	-95,0	-157,0	-208,2	-259,6	-259,1	-256,0	-243,9	-201,9	-140,5	-75,1	-47,6	**-2 003,8**
Avoided emission from cogeneration (kg)	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	-0,0	**-0,0**
Total CO2 emission (kg)	403,2	275,1	125,3	3,3	-44,0	-50,4	-40,4	-28,3	6,7	80,8	282,2	413,2	**1 426,6**

Annex 2: Composition of the separation constructions

Note: The U value in the walls and floors tables represents:

- aUeq: if the environment is the ground
- bUeq: if the environment is a basement or a crawl space
- bUi: if the environment is an adjacent unheated space

Type scheidingsconstructie: Muur

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Metselwerk	Stenen van gebakken aarde (Elementen van metselwerk) - λU: 0.56 Verbinding: Cementmortel (Gipsen, mortels en bepleisteringen) - λU: 1.5	0,088	0,117
2	Laag	Matig geventileerde luchtlaag (Luchtlaag)	0,040	N.V.T.
3	Laag	Kingspan Insulation / Kooltherm K8 45-120 - λU: 0.02	0,100	5,000
4	Laag	Kingspan Insulation / Kooltherm K8 45-120 - λU: 0.02	0,100	5,000
5	Metselwerk	Ploegsteert / Lambdabloc 14 - λU: 0.16 Verbinding: Ander (Ander)	0,138	0,863
6	Laag	Gipsbepleistering (Gipsen, mortels en bepleisteringen) - λU: 0.52	0,015	0,029

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Buitenmuur	351,99	Buitenomgeving	0,09		✓

Type scheidingsconstructie: Muur

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Metselwerk	Ploegsteert / Lambdabloc 10 - λU: 0.16 Verbinding: Ander (Ander)	0,088	0,550
2	Laag	Recticel Insultation / Eurothane G - λU: 0.022	0,100	4,545
3	Laag	Gipsbepleistering (Gipsen, mortels en bepleisteringen) - λU: 0.52	0,012	0,023

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Keldermuur	9,24	Kelder	0,17	5,12	

Type scheidingsconstructie: Muur

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Laag	Timmerhout van hard-,loof- en naaldhout (Hout en houtderivaten) - λU: 0.15	0,050	0,333
2	Laag	Matig geventileerde luchtlaag (Luchtlaag)	0,005	N.V.T.
3	Laag	Kingspan Insulation / Kooltherm K8 45-120 - λU: 0.02	0,090	4,500
4	Laag	Kingspan Insulation / Kooltherm K8 45-120 - λU: 0.02	0,090	4,500
5	Laag	Zwaar normaal gewapend beton (Steenachtige bouwdelen zonder voegen) - λU: 1.7	0,138	0,081

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Hoekpannel_ramen	1,84	Buitenomgeving	0,11		

Type scheidingsconstructie: Venster

Type venster : Enkelvoudig venster

U-waarde beglazing: 0,50 W/m²k

g-waarde 0,54

Groep: Kunststof

Uf-waarde raamprofiel: 0,80 W/m²k (Directe invoer)

U-waarde ventilatierooster: Geen ventilatierooster

U-waarde vulpaneel: Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_Oost	2,20	Buitenomgeving	-90,00	0,72	0,50	✔

Type scheidingsconstructie:	Venster	
Type venster :	Enkelvoudig venster	
U-waarde beglazing:	0,50	W/m²k
g-waarde	0,54	
Groep:	Kunststof	
Uf-waarde raamprofiel:	0,80	W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster	
U-waarde vulpaneel:	Geen vulpaneel	

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_naast_voordeur	0,99	Buitenomgeving	180,00	0,87	0,50	✓

Type scheidingsconstructie:	Venster	
Type venster :	Enkelvoudig venster	
U-waarde beglazing:	0,50	W/m²k
g-waarde	0,54	
Groep:	Kunststof	
Uf-waarde raamprofiel:	0,80	W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster	
U-waarde vulpaneel:	Geen vulpaneel	

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_schuifraam_Zuid_keuk	5,17	Buitenomgeving	0,00	0,69	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_Zuid_zithoek_Va	5,06	Buitenomgeving	0,00	0,63	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_Zuid_zithoek_ka	2,64	Buitenomgeving	0,00	0,70	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_schuifraam_west	5,17	Buitenomgeving	90,00	0,69	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	1,90 W/m²k

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_West_eethoek_v	8,80	Buitenomgeving	90,00	0,68	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_Noord_bureau_V	6,60	Buitenomgeving	180,00	0,62	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
GLVL_raam_West_bureau	4,18	Buitenomgeving	90,00	0,72	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Oost	1,20	Buitenomgeving	-90,00	0,82	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Zuid_Slaapkamer	2,40	Buitenomgeving	0,00	0,69	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Zuid_Slaapkamer	1,20	Buitenomgeving	0,00	0,71	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Zuid_Nachthall_K	1,18	Buitenomgeving	0,00	0,76	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Zuid_Kinderkame	1,20	Buitenomgeving	0,00	0,76	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_Zuid_Kinderkame	1,74	Buitenomgeving	0,00	0,71	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR2_Raam_Zuid_Zolder_Bur	4,12	Buitenomgeving	0,00	0,67	0,50	✓

Type scheidingsconstructie:	Venster
Type venster :	Enkelvoudig venster
U-waarde beglazing:	0,50 W/m²k
g-waarde	0,54
Groep:	Kunststof
Uf-waarde raamprofiel:	0,80 W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster
U-waarde vulpaneel:	Geen vulpaneel

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_West_Slaapkame	1,80	Buitenomgeving	90,00	0,71	0,50	✓

Type scheidingsconstructie:	Venster	
Type venster :	Enkelvoudig venster	
U-waarde beglazing:	0,50	W/m²k
g-waarde	0,54	
Groep:	Kunststof	
Uf-waarde raamprofiel:	0,80	W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster	
U-waarde vulpaneel:	Geen vulpaneel	

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_West_Slaapkame	1,20	Buitenomgeving	90,00	0,76	0,50	✓

Type scheidingsconstructie:	Venster	
Type venster :	Enkelvoudig venster	
U-waarde beglazing:	0,50	W/m²k
g-waarde	0,54	
Groep:	Kunststof	
Uf-waarde raamprofiel:	0,80	W/m²k (Directe invoer)
U-waarde ventilatierooster:	Geen ventilatierooster	
U-waarde vulpaneel:	Geen vulpaneel	

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Ug [m²K/W]	Eis
VR1_Raam_West_Kinderkam	2,82	Buitenomgeving	90,00	0,74	0,50	✓

Type scheidingsconstructie: Vloer/plafond

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Laag	Zwaar normaal gewapend beton (Steenachtige bouwdelen zonder voegen) - λU: 2.2	0,200	0,091
2	Laag	Kingspan Insulation / Kooltherm K3 45-120 - λU: 0.02	0,100	5,000
3	Laag	Kingspan Insulation / Kooltherm K3 45-120 - λU: 0.02	0,100	5,000
4	Laag	Zwaar normaal ongewapend beton (Steenachtige bouwdelen zonder voegen) - λU: 1.3	0,080	0,062
5	Laag	Zware steen (graniet, gneis, basalt, porfier) (Natuursteen) - λU: 3.5	0,020	0,006

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Vloer_Gelijksvloer	136,19	Grond	0,09	10,16	✔

Type scheidingsconstructie: Dak

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Laag	Rubber (Verscheidene materialen) - λU: 0.17	0,005	0,029
2	Laag	Recticel Insultation / Powerroof - λU: 0.022	0,100	4,545
3	Laag	Recticel Insultation / Powerroof Maxx - λU: 0.022	0,100	4,545
4	Laag	OSB-plaat (oriented strand board) (Hout en houtderivaten) - λU: 0.13	0,012	0,092
5	Samengest	8% van Timmerhout van hard-,loof- en naaldhout (Hout en houtderivaten) - λU: 0.13 92% van Recticel Insultation / Powerroof - λU: 0.022	0,150	4,934

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Zadeldak	114,70	Buitenomgeving	0,07		✔

Type scheidingsconstructie: Dak

Lagen

#	Type laag	Type materiaal	Dikte [m]	R [m²K/W]
1	Laag	Bitumenmembraan (Verscheidene materialen) - λU: 0.23	0,015	0,065
2	Laag	Kingspan Insulation / Therma™ TR26 30-160 - λU: 0.023	0,100	4,348
3	Laag	Kingspan Insulation / Therma™ TR26 30-160 - λU: 0.023	0,100	4,348
4	Laag	OSB-plaat (oriented strand board) (Hout en houtderivaten) - λU: 0.13	0,012	0,092
5	Samengest	8% van Timmerhout van hard-,loof- en naaldhout (Hout en houtderivaten) - λU: 0.13 92% van Kingspan Insulation / Therma™ TR26 30-160 - λU: 0.023	0,150	4,789
6	Laag	OSB-plaat (oriented strand board) (Hout en houtderivaten) - λU: 0.13	0,012	0,092
7	Laag	Gipsbepleistering (Gipsen, mortels en bepleisteringen) - λU: 0.52	0,015	0,029

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	U [W/m²K]	R [m²K/W]	Eis
Platdak	54,19	Buitenomgeving	0,07		

Type scheidingsconstructie: Deur

Groep: Kunststof

Uf-waarde raamprofiel: U- 0,80 W/m²k (Directe invoer) Geen

waarde ventilatierooster: ventilatierooster

U-waarde vulpaneel: 1,40 W/m²k

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Eis
GLVL_VoorDeur	2,20	Buitenomgeving	-	1,27	✓

Type scheidingsconstructie: Deur

Groep: Kunststof

Uf-waarde raamprofiel: U- 0,80 W/m²k (Directe invoer) Geen

waarde ventilatierooster: ventilatierooster

U-waarde vulpaneel: 1,40 W/m²k

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Eis
GLVL_Deur_Oost	2,31	Buitenomgeving	-	1,27	✓

Type scheidingsconstructie: Deur

Groep: Hout

Uf-waarde raamprofiel: 0,80 W/m²k (Directe invoer)

U-waarde ventilatierooster: Geen ventilatierooster

U-waarde vulpaneel: 1,40 W/m²k

Lijst met scheidingsconstructies

Naam	Oppervlakte [m²]	Omgeving	Oriëntatie [°]	U [W/m²K]	Eis
Kelder_deur	2,31	Buitenomgeving	-	1,27	✓

Annex 3: Presence of systems

Systems of EPB-unit : Gebouw17

Heating <verwarming1>

Sort of heating	Central heating (1 ES)
Direct input of storage efficiency	no
Heat storage in buffer tank	No buffer vessel present
System efficiency heating	85,00 %

Heat generating device <Warmtesysteem1>

Brand	Viessmann
Product-ID	Vitodens-200W
Kind of device	Condensing water boiler
Energy carrier	Neutral gas
efficiency	104,77 %

Ventilation system <Ventilatiesyst1>

Ventilation system	D - Mechanical inlet, mechanical extraction
There is demand-driven ventilation	yes
Reduction factor	1,00

Air density (value V50)

The measured value of the leak rate is known	yes
Leak flow at 50 Pa per unit area	0,18 m³/(h.m²)

Domestic hot water <InstSWW1>

Kind of domestic hot water system	Local DHW (in 1 ES)
Circulation line present	No

Heat generating device <-->

brand	Viessmann
Product-ID	Vitodens-200W
Kind of device	Incinerator for DHW

Efficiency	50,00 %

Thermal solar system

Non-existent

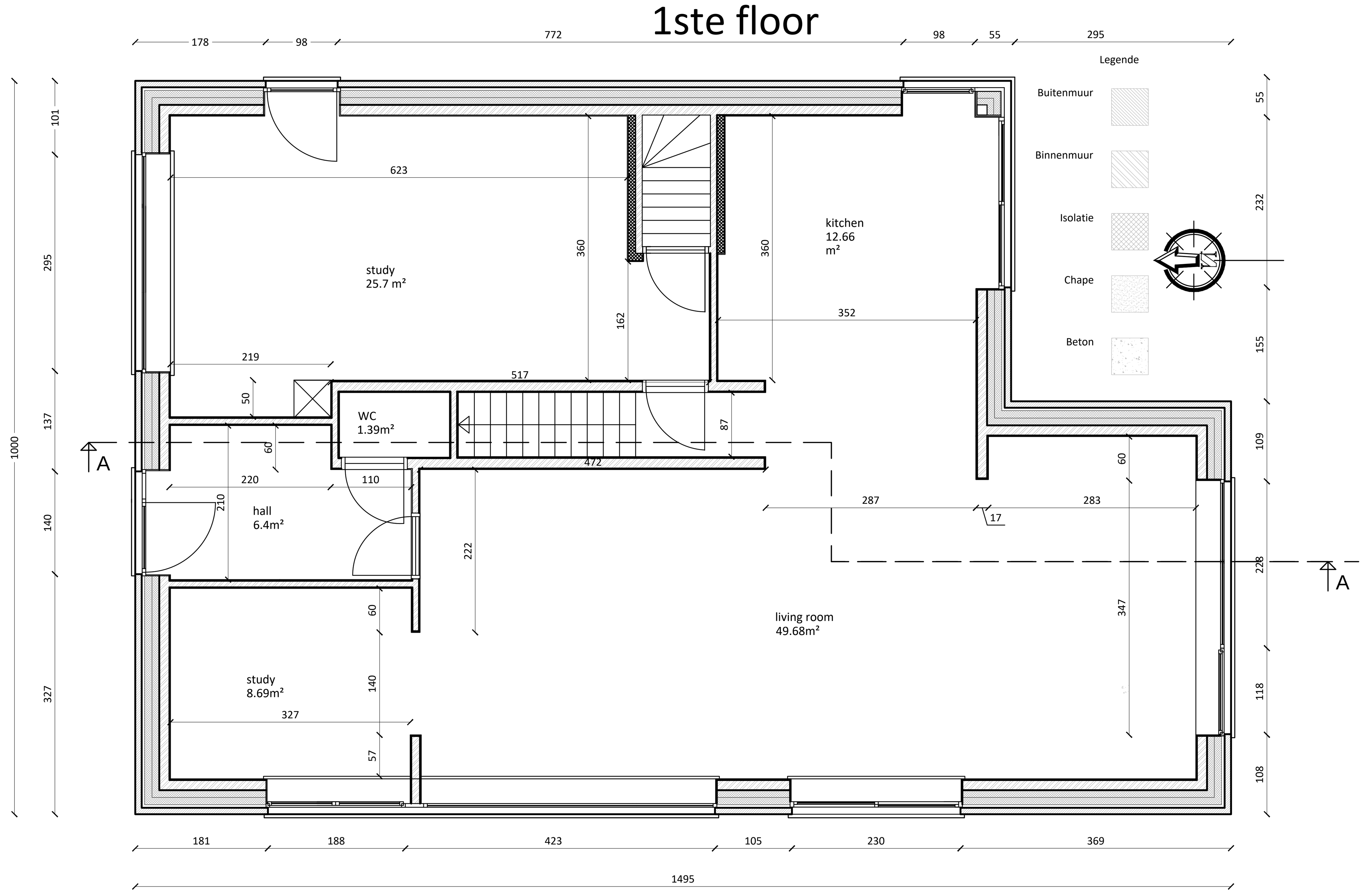
Solar panels <Zonnepanelen_Bisol>

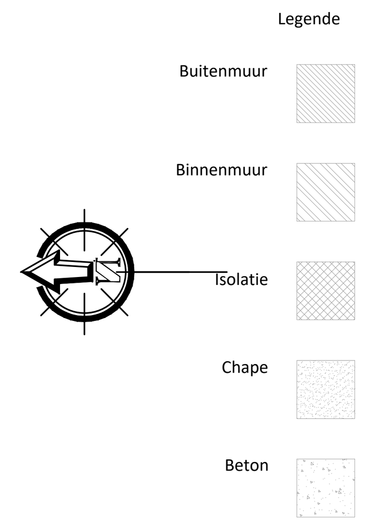
Peak power	3900,00

Innovative techniques

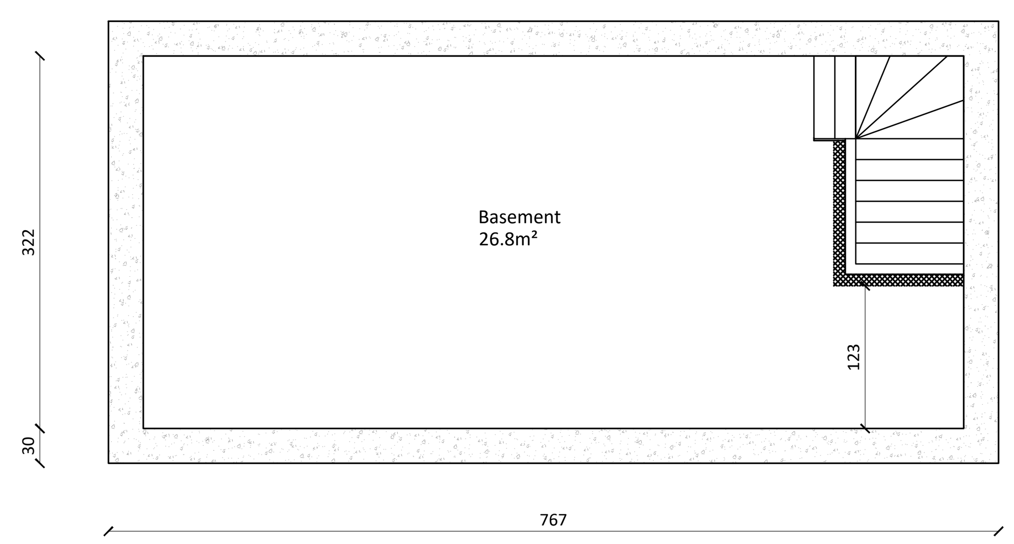
Non-existent

1ste floor

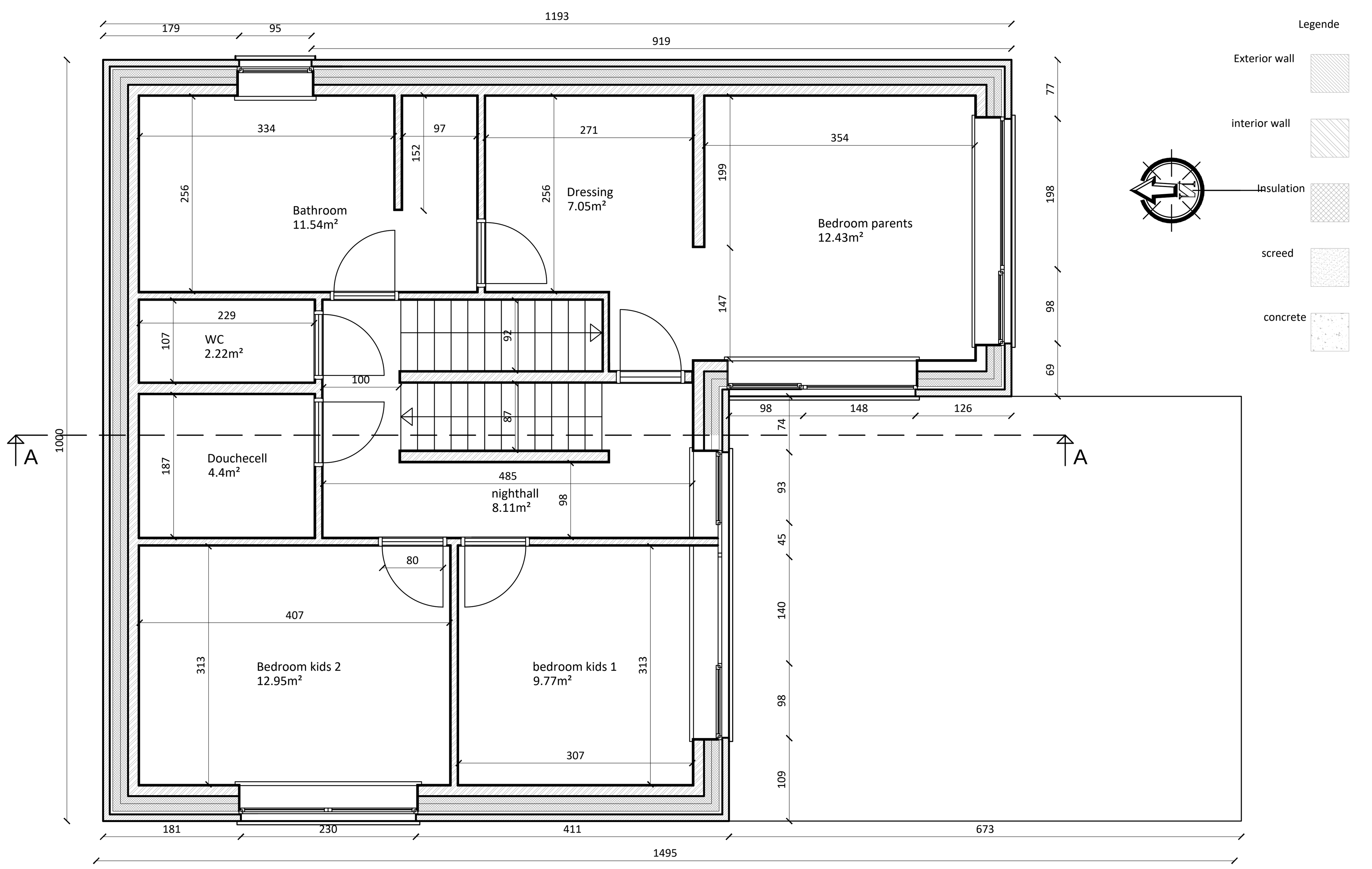




Basement



2nd floor



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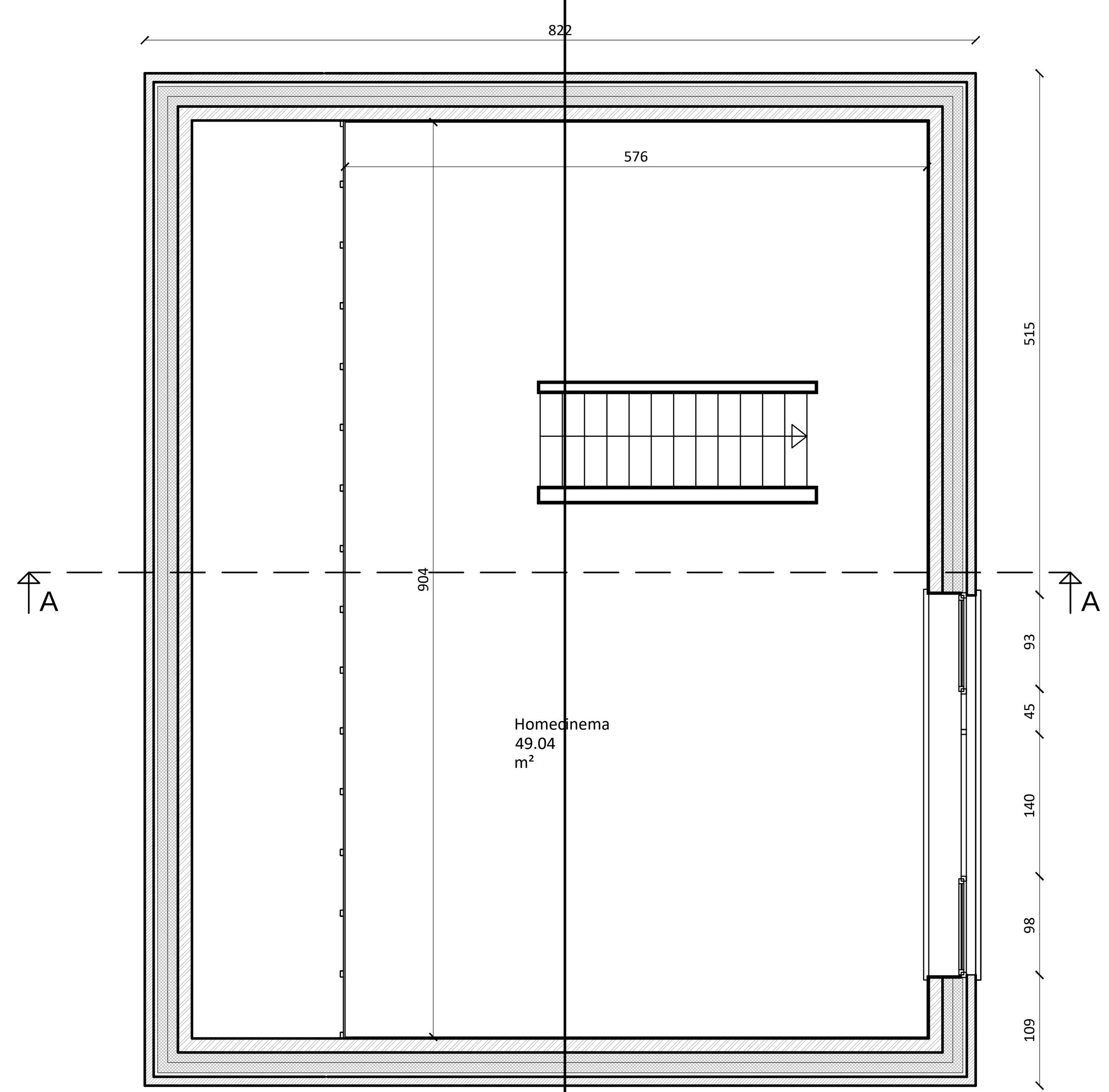
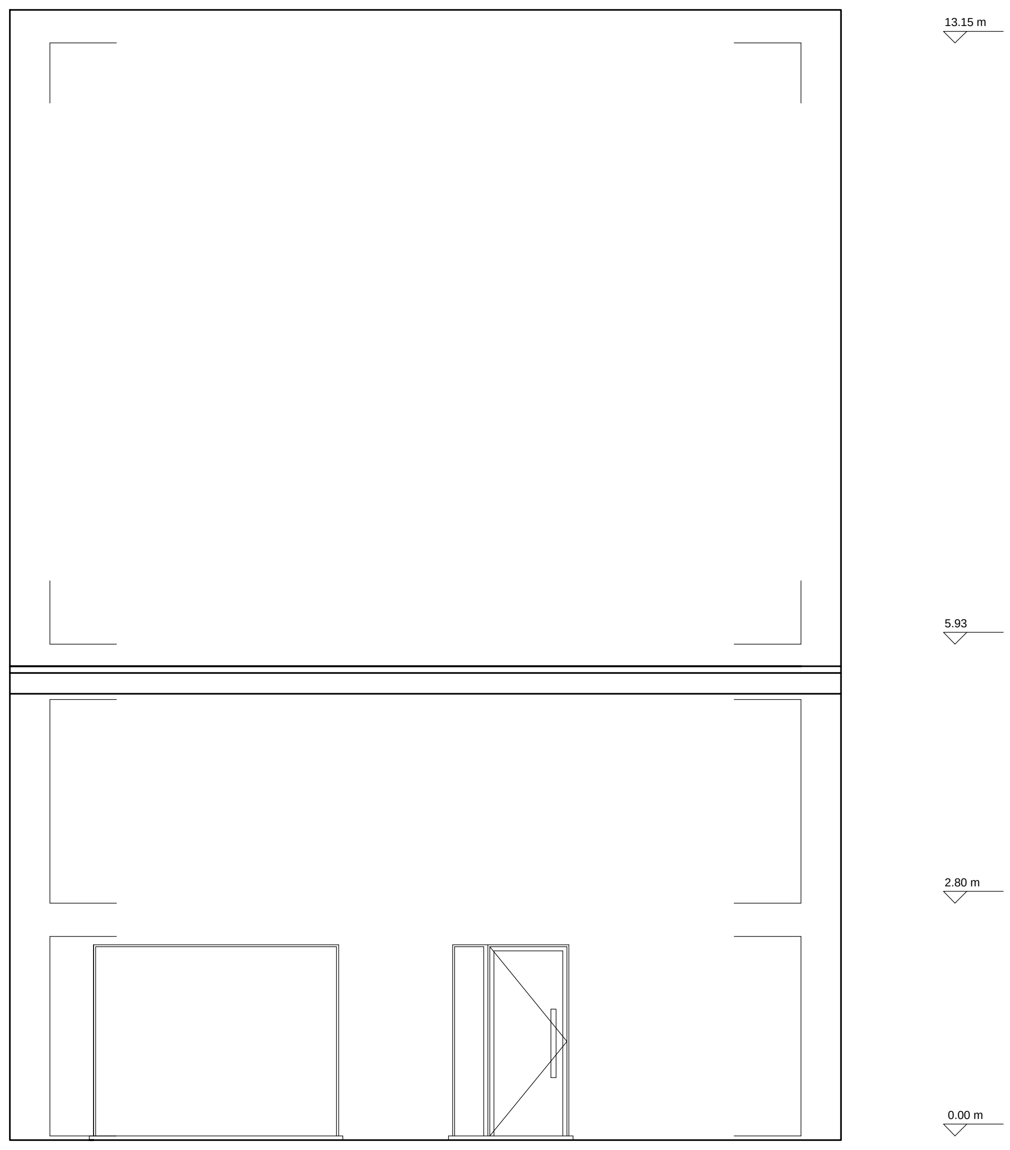
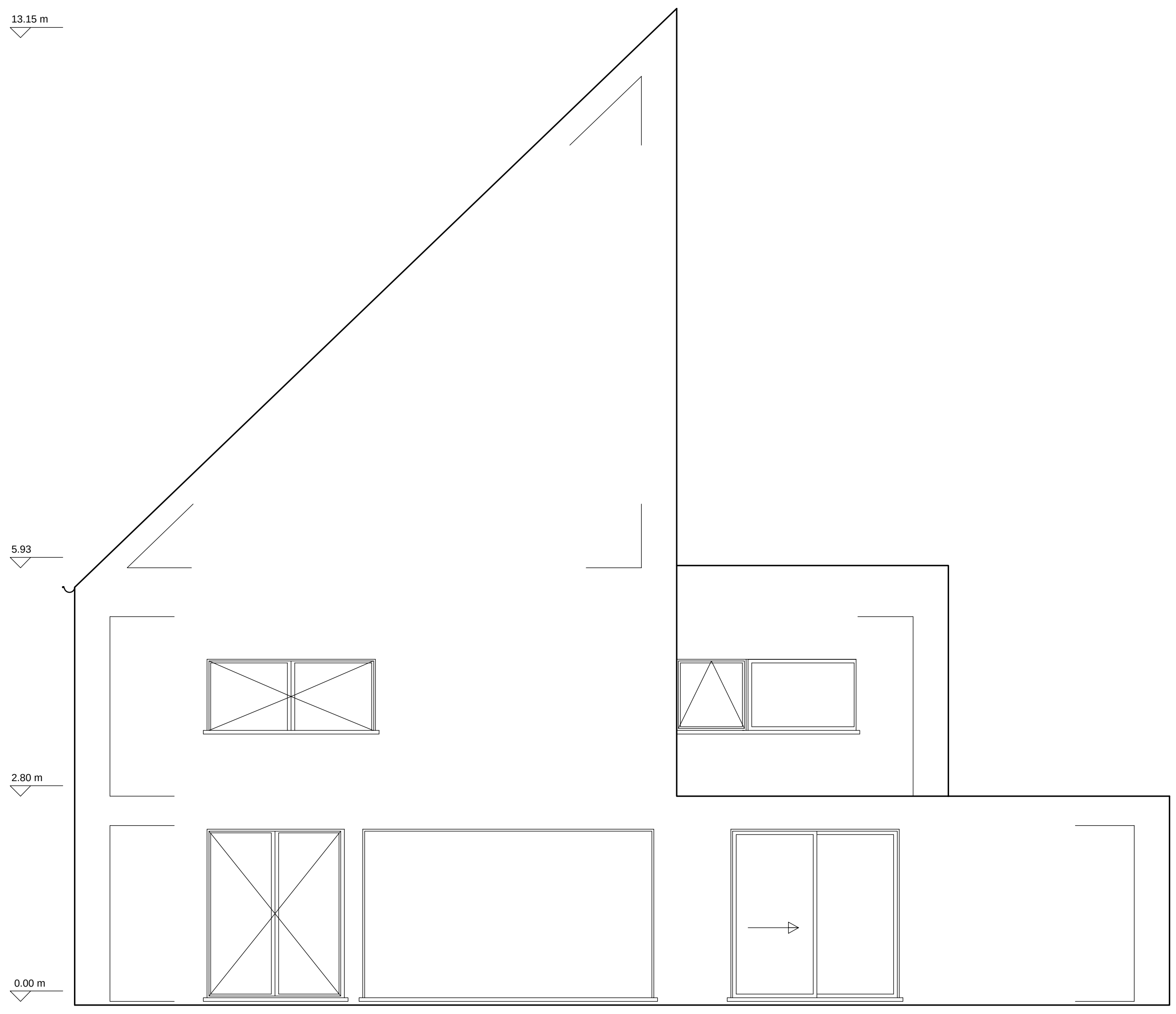


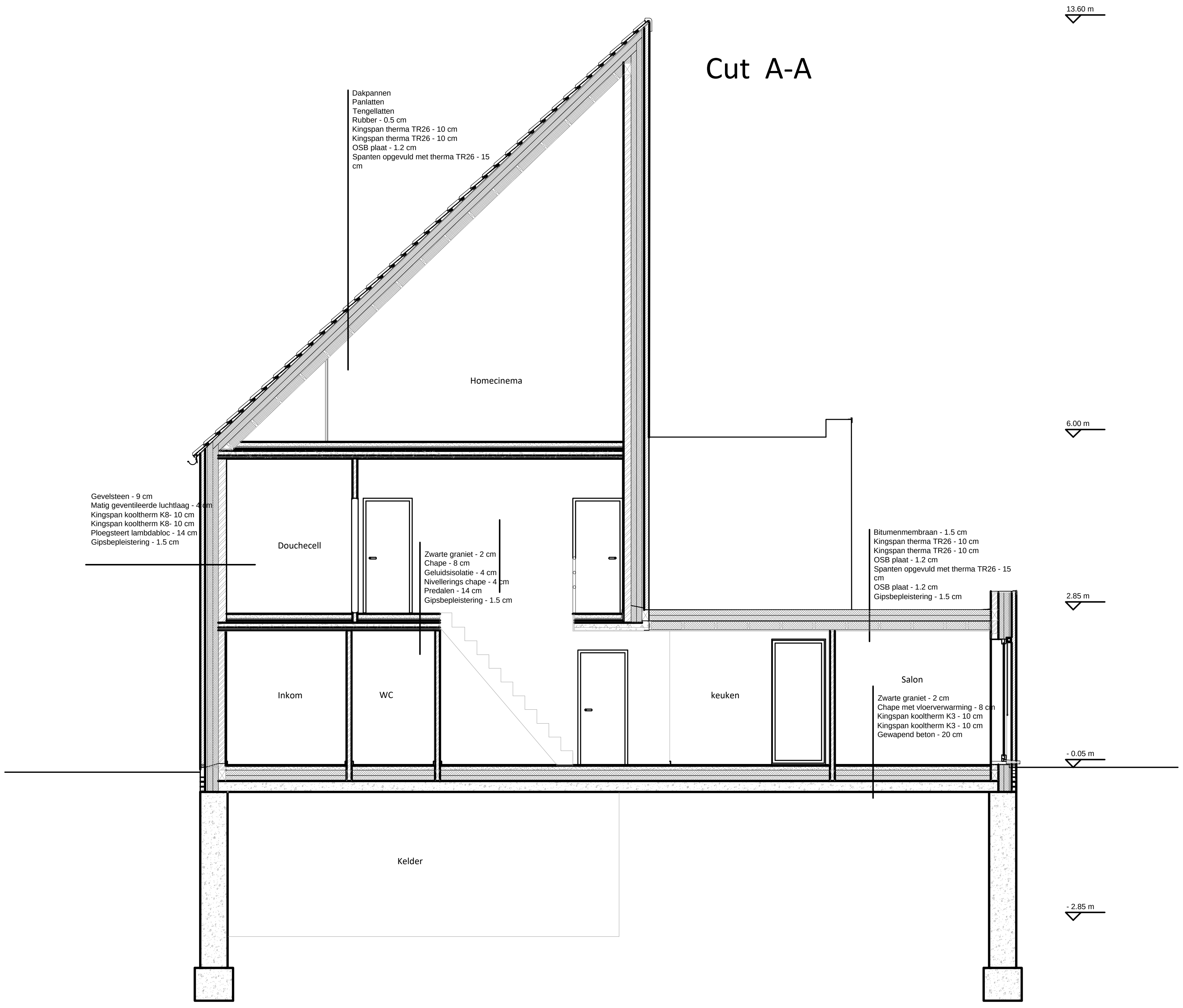
Frontview

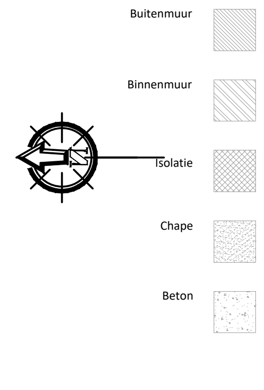


Sideview
West



Cut A-A





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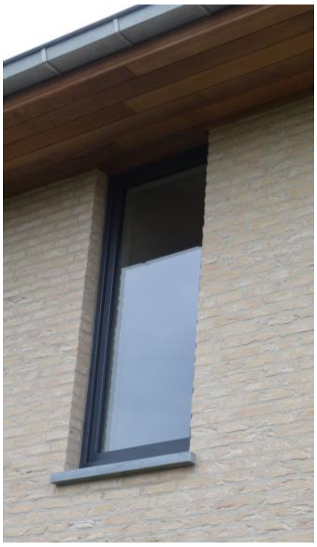
Appendix 2

Voor bouwprojecten met stedenbouwkundige vergunningsaanvraag of melding vanaf 1 maart 2017 tot en met 31 december 2017

EPB-eisen (eisen op het vlak van ENERGIEPRESTATIE en BINNENKLIMAAT)		BESTEMMING		
AARD VAN HET WERK		**wonen**	**niet-residentieel**	**industrie**
nieuwbouw (of gelijkwaardig)	thermische isolatie	maximaal K 40 (gebouw) en maximale U-waarden	maximaal K 40 (gebouw) en maximale U-waarden	maximaal K 40 (gebouw) en maximale U-waarden
	energieprestatie	maximaal E 50 (wooneenheid)	maximaal E-peil* (in functie van de bestemmingen)	-
	netto-energiebehoefte	maximaal 100-25 x c of 70 kWh/m² (waarbij c = compactheid)	-	-
	binnenklimaat	minimale ventilatievoorzieningen en beperken van risico op oververhitting (wooneenheid)	minimale ventilatievoorzieningen	minimale ventilatievoorzieningen
	hernieuwbare energie	≥ 15 kwh/m².jaar	≥ 10 kwh/m².jaar	-
*: *voor kantoorgebouwen van publieke organisaties gelden strengere E-peilen*	installaties	-	-	minimale installatie-eisen
ingrijpende energetische renovatie	thermische isolatie	maximale U-waarden (voor nieuwe en na-geïsoleerde delen)		volg de eisen bij renovatie
	energieprestatie	maximaal E 90 (wooneenheid)	maximaal E-peil (in functie van de bestemmingen)	
	installaties	-	-	
	binnenklimaat	minimale ventilatievoorzieningen		
	hernieuwbare energie	≥ 10 kwh/m².jaar	≥ 10 kwh/m².jaar	-
renovatie	thermische isolatie	maximale U-waarden (voor nieuwe en na-geïsoleerde delen)		
	energieprestatie	-		
	installaties	minimale eisen (voor nieuwe, vernieuwde of vervangen installaties)		
	binnenklimaat	minimale ventilatievoorzieningen (voor bestaande ruimten bij vervanging van vensters en voor nieuwe ruimten)		ventilatie-eisen (voor het nieuw gebouwde toegevoegde deel)

Appendix 3



Definitie van 'inbraakrisico'

Inhoudstafel

Inleiding

In §7.8.6 van bijlage V bij het Energiebesluit van 19 november 2010 wordt de warmteoverdrachtscoëfficiënt door het manueel openen van opengaande delen berekend. Hiervoor wordt het gecorrigeerd ventilatiedebiet voor het manueel openen van opengaande delen bepaald. Dat hangt af van de totale netto oppervlakte van de opengaande delen die deel uitmaken van de uitwendige schil in contact met de buitenomgeving.

Bij het bepalen van de totale netto oppervlakte van de opengaande delen wordt per venster een factor ingerekend die rekening houdt met het inbraakrisico. Deze factor $r_{win,overh,j}$ is afhankelijk van het type opening en het inbraakrisico. Zie onderstaande tabel.

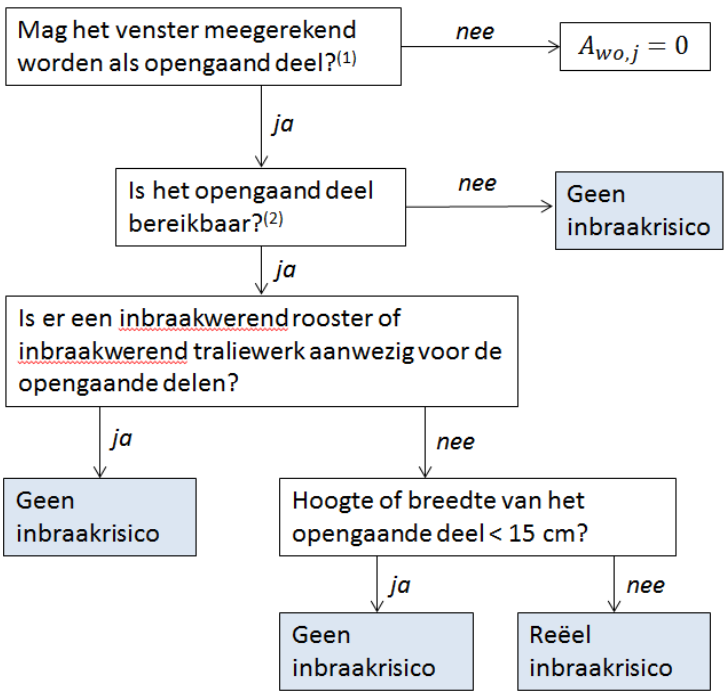
Type opening	reëel inbraakrisico	gering inbraakrisico	geen inbraakrisico
element met enkel kipstand	0	1/3	1/3
element met draai-kipstand	0	1/3	1
element met enkel draaistand	0	0	1

Het type opening is een eigenschap van het venster dat kan worden vastgesteld door de verslaggever. Nadere specificaties voor het bepalen van het inbraakrisico (reëel, gering of geen) moeten nog door de minister worden vastgelegd.

In afwachting van het ministerieel besluit omtrent de specificaties voor het bepalen van het inbraakrisico, heeft het Vlaams Energieagentschap dit document uitgewerkt als leidraad voor de verslaggever voor het bepalen van het inbraakrisico van de opengaande delen.

1. Stroomschema voor het bepalen van het inbraakrisico

Bepaal het inbraakrisico volgens het volgende stroomschema:



(1) Volgende vensters mogen niet meegerekend worden als opengaand deel:

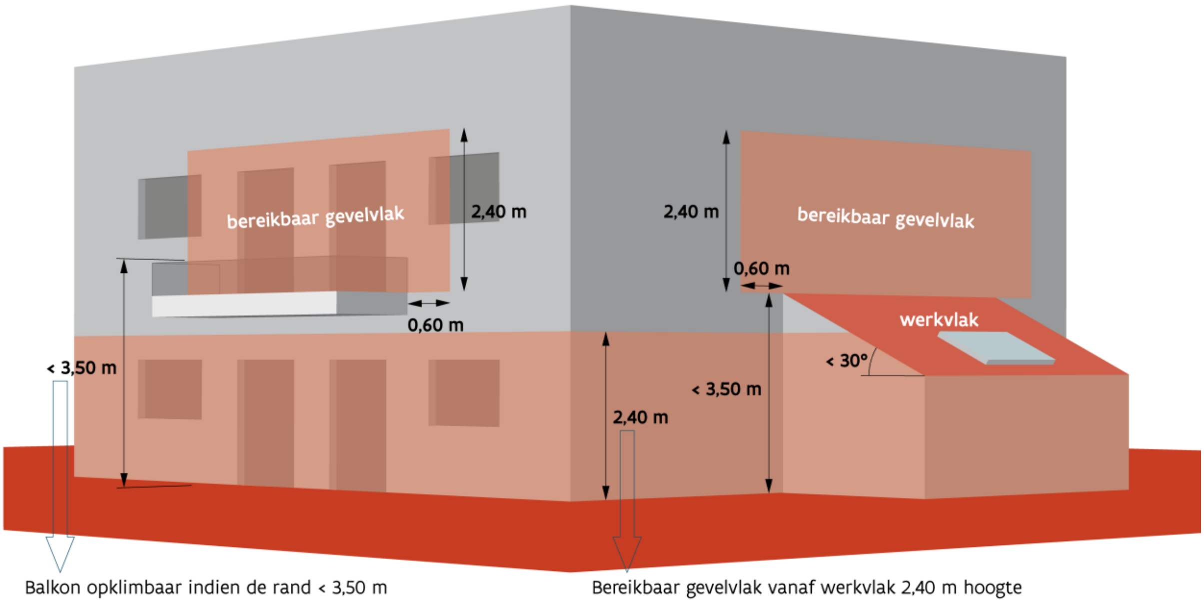
- schuifvensters/schuifdeuren;
- deuren;
- opendraaiende vensters zonder kipstand, die tot aan het grondniveau/vloerniveau reiken, geplaatst ter hoogte van het maaiveld (meestal op het gelijkvloers).

(2) Opengaande delen zijn bereikbaar als ze in een bereikbaar gevelvlak of een werkvlak liggen, zoals hieronder gedefinieerd:

Het bereikbare gevelvlak is een vlak van 2,40 meter hoog vanaf het horizontale werkvlak waarop de inbreker staat. Dat horizontale werkvlak is de begane grond of een oppervlakte van minstens 60 cm X 60 cm, maximaal 3,50 m boven de grond of vloer of boven een ander bereikbaar werkvlak met een hellingshoek van maximaal 30° (het werkvlak kan dus ook een hellend dak zijn). De breedte van het bereikbare verticale gevelvlak is de breedte van het horizontale werkvlak met aan weerszijden 60 cm extra, wat overeenstemt met de gemiddelde armlengte.

De figuur hieronder toont welke gevelvlakken en werkvlakken als bereikbaar worden beschouwd (de werkvlakken zijn in een donkere tint weergegeven).

Elk horizontaal (met maximale hellingshoek van 30°) vlak met een oppervlakte van minstens 60 cm X 60 cm, dat bereikbaar is via een vaste ladder (bv. brandladder) wordt eveneens als werkvlak beschouwd, ongeacht de hoogte van het vlak ten opzichte van de grond of vloer of een ander werkvlak.



Figuur 1 Bereikbare gevelvlakken en werkvlakken

2. Standpunten omtrent het bepalen van het type opening voor dakvlakvensters

- dakvlakvensters die volledig kunnen opendraaien (venstervlak loodrecht op het raamkader), worden beschouwd als draairamen;
- dakvlakvensters die (in volledig open stand) niet volledig kunnen opendraaien, worden beschouwd als kipramen;
- dakvlakvensters die volledig kunnen opendraaien, maar die ook het raam in een kleinere opening kunnen positioneren in een vaste stand, worden beschouwd als draai-kipramen.

3. Versiebeheer

Hieronder vindt u een overzicht van de verschillende versies van dit document.

- Versie 1.0 – oktober 2014