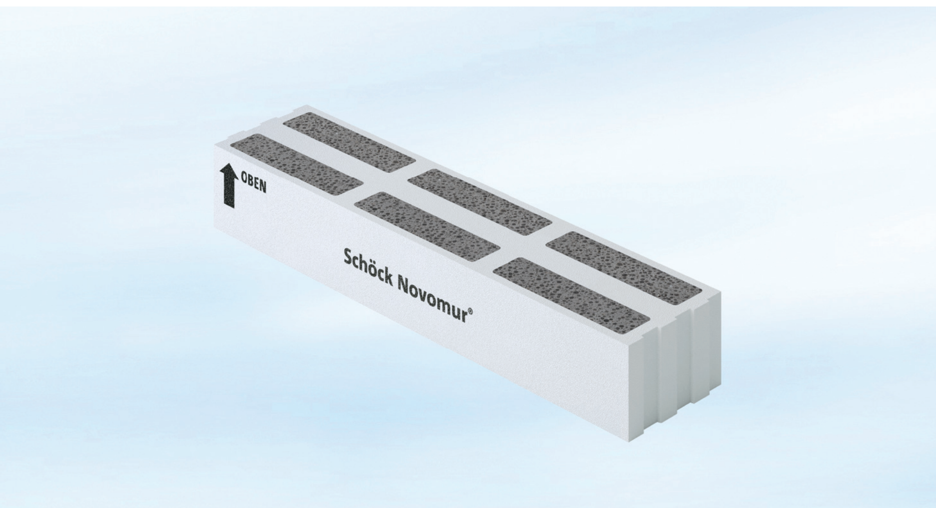
Schöck Novomur®



Technical information
Schöck Novomur®

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Design support
Hotline and
technical project support
Tel.: +49 (0) 7223 967 567
Fax: +49 (0) 7223 967 251
awt.technik@schoeck.de

Planning aids
Requests and downloads
Tel.: +49 (0) 7223 967 435
Fax: +49 (0) 7223 967 454
schoeck@schoeck.de
www.schoeck.de

Seminar programme and
on-site assistance
Tel.: +49 (0) 7223 967 435
Fax: +49 (0) 7223 967 454
schoeck@schoeck.de
www.schoeck.de

Schöck Novomur®
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General information

Thermal bridges are component areas where material or construction factors cause a greater thermal outflow than in surrounding areas. Because of the greater thermal outflow, the surface temperatures on the side facing inwards decrease in the thermal bridge area.

A distinction is made, e.g. between **geometric** and **material-caused** thermal bridges, although a combination of both usually occurs in most cases. Corners and edges of walls are typical examples of a purely geometric thermal bridge. A purely material thermal bridge occurs, for example, when a homogeneous wall structure is interspersed with a local inhomogeneous material with good thermal conductivity. Balcony slab connections constitute a combination of geometric (cooling fin effect) and material thermal bridges (brickwork/reinforced concrete). Equally, thermal bridges at the base of a building are produced by a combination of geometric and material effects.

The loss of heat through the thermal bridge increases in direct proportion to the difference between indoor and outdoor air temperature.

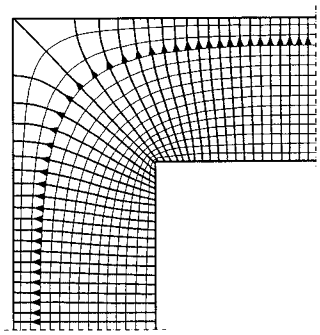
Fig. 1

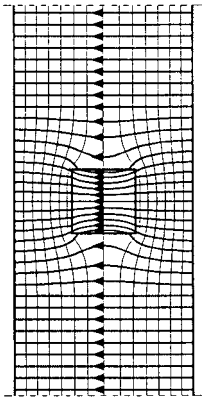
Fig. 2

Heat flow lines (arrow) and isotherms at a protruding corner of a building (fig. 1: purely geometric thermal bridge) and where a wall structure features a an inhomogeneous material with good thermal conductivity (fig.2: purely material thermal bridge). Heat flow lines and isotherms are always perpendicular on top of each other.

The following thermal insulation effects occur when increased heat is lost through a thermal bridge:

- **Increased demand for heating energy**
  Since additional heating energy is necessary to maintain constant indoor temperatures, the cost of heating energy can be expected to increase.

- **Risk of mould growth and condensation**
  When indoor surface temperatures fall, the relative humidity on surfaces surrounding thermal bridges rises. This increases the risk of mould growth (see fig. 4, page 5). If the minimum surface temperature falls below the dew point, condensation forms (see fig. 3, page 5), which can cause severe construction damage.

Building physics
Thermal insulation

Dew point temperature
The dew point temperature θ_τ of a room is the temperature at which the ambient air can no longer hold moisture and condenses it into drops of water. In such cases, the relative air humidity in the room is 100%.

Contact with colder component surfaces causes the layers of ambient air in the vicinity to fall to the same temperature as the cold surfaces. If the minimum surface temperature of a thermal bridge is lower than the dew point temperature, the temperature of the air at exactly this point will also be below the dew point. As a result, the moisture in that layer of ambient air will condense on the cold surface and condensation will form.
The dew point temperature is dependent on the ambient air temperature and the humidity in the room (see fig. 3). The higher the humidity and air temperature in a room, the more the dew point temperature rises, and the sooner condensation begins to form on colder surfaces.

An average indoor air climate is typically approx. 20°C and 50% relative humidity. This puts the dew point temperature at 9.3°C. Rooms frequently exposed to moisture, such as bathrooms, can easily reach higher humidity levels of 60% or more. Consequently, the dew point temperature is higher, and there is an increased risk of condensation forming. At a humidity level of 60% in a room, the dew point temperature is already 12.0°C (see fig. 3). The slope of the curve in Figure 1 clearly shows this sensitive dependency of the dew point temperature on the humidity level in the room: even minor increases in humidity lead to a significant increase in the dew point temperature. As a result, the risk of condensation accumulating on the cold component surfaces also increases significantly.

Mould temperature
Mould growth on building component surfaces can occur with moisture levels as low as 80% humidity in the room. This means that mould begins to grow on cold component surfaces if the surface is at least cold enough that a moisture level of 80% can be reached in the directly adjacent air layer. The temperature at which this occurs is known as the mould temperature θ_S.

Accordingly, mould starts growing at temperatures that are still above the dew point temperature. For an indoor climate of 20°C/50%, the mould temperature is 12.6°C (see fig. 4), which means it is 3.3°C higher than the dew point temperature (see fig. 10). This is why the mould temperature is more important than the dew point temperature when it comes to avoiding construction damage (mould formation). It is not enough for the indoor surfaces merely to be warmer than the dew point temperature of the ambient air: Surface temperatures must also be higher than the mould temperature!

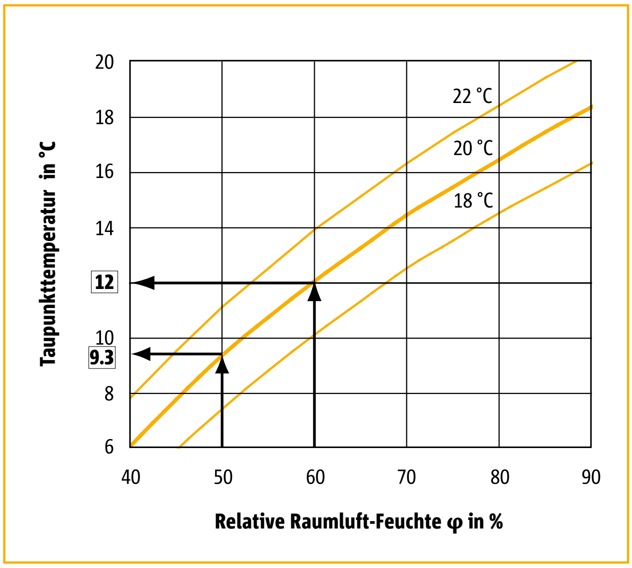

Fig. 3: Dependency of dew point temperature on humidity and temperature in the room

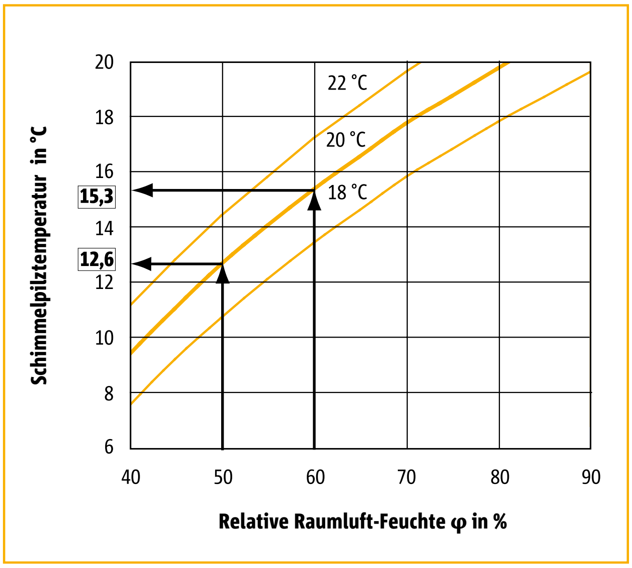

Fig. 4: Dependency of mould temperature on humidity and temperature in the room

Construction damage caused by increased dampness in living areas

- **Moisture patches on inside walls**
  cause damage to wallpaper, plaster and wood cladding, and encourage dust accumulation. Dust deposits provide an ideal breeding ground for mould.

- **Mould infestation**
  Moisture levels of 80% or more on component surfaces harbour the risk of mould growth. Mould is a hygiene risk in living areas with spores in the ambient air posing a health hazard for occupants. These spores can cause allergy-related illnesses, such as asthma.

- **Progressive damage to the thermal insulation**
  Because water conducts heat relatively well, moisture in brickwork causes the surface temperature to drop further, leading to progressive deterioration in thermal and moisture performance.

- **Impaired quality of living**
  If the brickwork is very damp, a cosy home is difficult to achieve, even with constant heating.

Fig. 5: Example of mould infestation in a corner

Fig. 6: Example of construction damage caused by mould infestation

Building physics
Moisture proofing

The actual degree of thermal conductivity and, as such, the insulation performance of a construction material is substantially dictated by its moisture content: the damper the material, the higher is its thermal conductivity and thus the lower its insulation performance.
This is due to the pores filling with water as humidity increases. As water conducts more heat than air, the thermal conductivity of the material increases as humidity rises. The thermal conductivity of a porous insulation block for example, rises by about 8% for every 1 vol. % increase in moisture content.

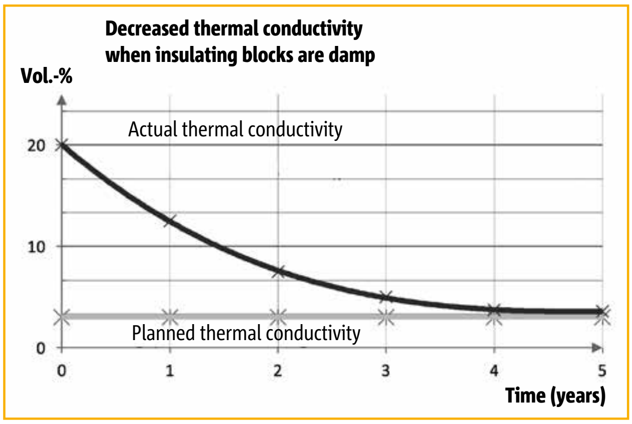

Fig. 7: Decreased thermal conductivity of damp insulating blocks

A look at the details of a basement slab shows this interaction very clearly: because thermal bridges are an issue, a load bearing thermal insulation element is needed at this point. These insulation elements – which are laid as the first row of blocks – can have capillary absorption properties, which becomes an issue when a large volume of water is used for building the shell during construction. The layer of blocks above the cellar slab, in particular, is exposed to severe moisture loads and can absorb moisture up to full saturation. The increased moisture content severely detracts from the insulation performance.

As long as the insulating blocks demonstrate this increased moisture content, thermal insulation performance at the basement slab is compromised. This creates problems such as accumulation of condensation and mould growth, and leads to increased thermal losses.

Because the blocks are covered from all sides, the moisture absorbed during the construction phase can only be released very slowly. The levelling layer is enclosed – by an external thermal insulation composite system and perimeter insulation on the outside wall, and by the upper floor and impact sound insulation and floor structure on the inside wall.
In these geometric conditions, it is difficult for the first row of blocks to release the moisture they have stored. As a result, the levelling layer demonstrates increased thermal conductivity for a very long time, thus increasing the risk of mould growth and construction damage. In some cases, it can take years to achieve the calculated thermal insulation performance.

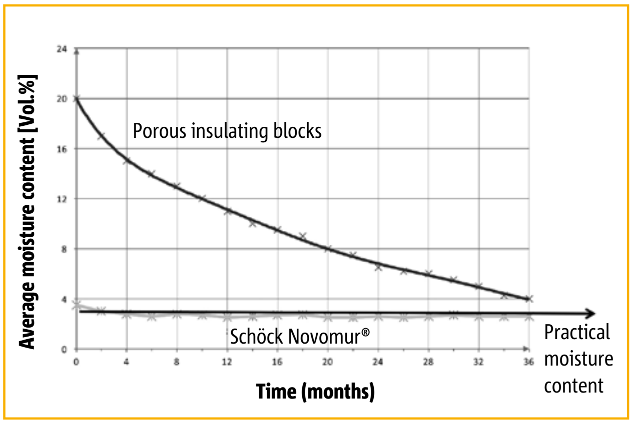

Fig. 8: Drying time of damp insulating blocks

FEM simulations[1] conducted by Fraunhofer Institute for Building Physics show that the actual thermal conductivity of porous insulating blocks over the period of about 5 years that it takes for the blocks to dry out is very much higher than the calculated value. By comparison, the thermal conductivity of Schöck Novomur® and Novomur® light in this same phase is only marginally higher.

Schöck Novomur® and Schöck Novomur® light are load bearing thermal insulation elements that demonstrate virtually no capillary absorption, are classified as water repellent according to DIN 4108 Part 3, and therefore only absorb a negligible amount of water during the construction phase. The danger of moisture penetrating the basement slab during the construction phase is therefore eliminated. Schöck Novomur® and Schöck Novomur® light ensure thermal insulation performance right from the start and reduce the risk of construction damage and mould growth.

[1] Fraunhofer Institute for Building Physics IBP Holzkirchen – Report no. HTB-5/2000

Building physics
Thermal bridges at the base of a building

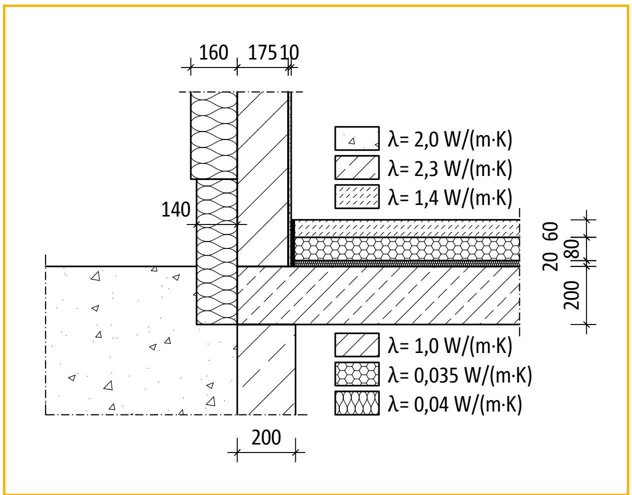

Fig. 9: Cross section of the base of a building without insulation

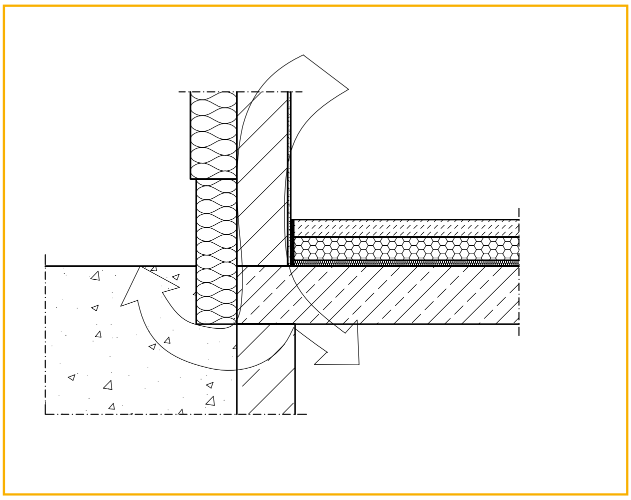

Fig. 9: Cross section of the base of a building without insulation

With energy efficiency requirements in buildings becoming increasingly stricter, the importance of minimising thermal bridges is growing. At present, about 17% of the total thermal transmission loss in buildings with good heat insulation (KfW 40 standard, passive house standard) is attributable to thermal bridges, with window reveals (approx. 6%), balcony connections (approx. 3% in the case of cantilever balconies) and external and internal wall connections (approx. 8%) accounting for most of this share.
This demonstrates how severe the thermal bridge at the base of a building is, given its length and geometric configuration.
The highly problematic combination of external and internal walls that are exposed to severe stress (λ ≈ 1.0- 2.3 W/(m . K)) and which have to be positioned on the cellar slab and therefore pierce the building's insulation jacket (λ ≈ 0.04 (W/(m . K)) (thermal insulation on the external walls and thermal insulation on the cellar or underground garage slab) constitutes an enormous challenge when designing an efficient insulation jacket.

Variables that influence the loss of energy at the base of a building

Thermal transmission through flat components is largely minimised by insulating the external walls and providing surface insulation above and/or beneath the ground floor slab.

As flat insulation is becoming more widespread, the importance of thermal bridges is growing. Attempts to mitigate this critical issue include supplementary measures to insulate the thermal bridges caused by the design (by pulling the perimeter insulation down 50-100 cm from slab underside over the joint between wall and slab, see fig. 13).

The success of this approach is, however, less than satisfactory. Supplementary insulation is not able to assure compliance with the critical surface temperature of >12.6°C, see fig. 14.

The problem is further exacerbated by the affinity of wall building materials to absorb moisture. They are exposed to moisture from the outside during the construction phase, in particular. The exceptional capillary absorption properties of these porous components result in damp materials and, consequently, in reduced insulation performance.
The result is a significant deterioration in insulation performance, as the wall materials take several years to dry out due to the first layer of blocks being encased from all sides by insulating materials, floor structures, plaster, etc. During this time, the insulation performance of the wall materials is drastically impaired to a level far below the calculated effect.

Building physics
Comparison of insulation procedures

Base of a building without insulation

If the base is not insulated, the brick walls interrupt the insulation jacket between the insulation of the external wall and the insulation above the cellar slab (see fig. 11). Coupled with the high thermal conductivity of the bricks (λ ≈ 1.0 W/(m . K)), this results in formation of a massive thermal bridge at the base of the building (see fig. 12).
Which means:

- Increased thermal loss resulting in increased heating costs
- Reduced surface temperature in the room
- Risk of condensation and mould growth

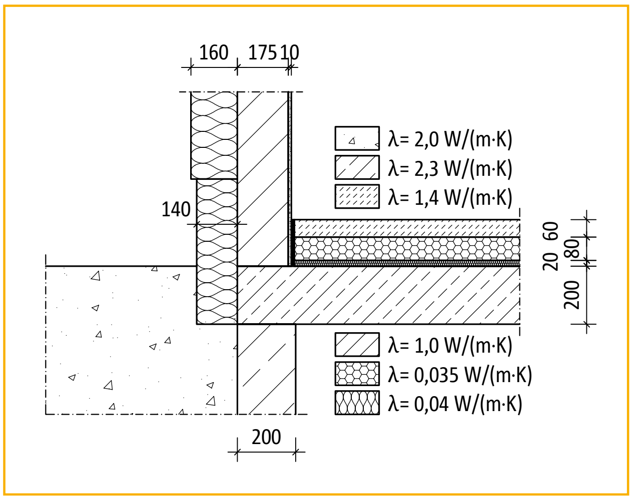

Fig. 11: Base of a building without insulation

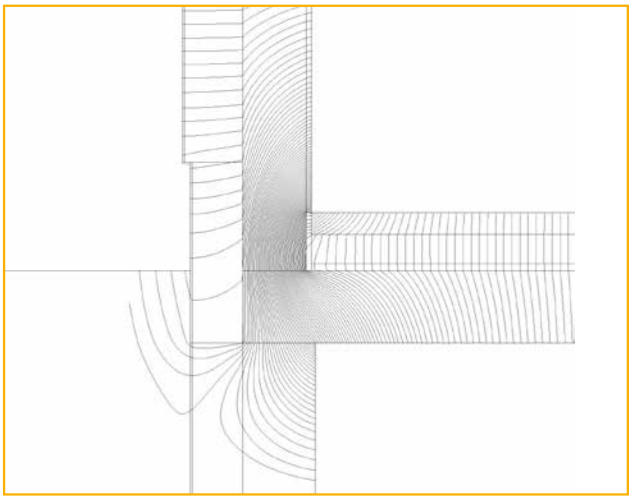

Fig. 12: Heat flows in a base without insulation

Constructional insulation measures

In order to mitigate thermal bridges at the base of a building, the insulation of the external wall is often extended down into the ground to provide perimeter insulation (see fig. 13). Apart from the fact that this solution incurs not inconsiderable costs, the resulting insulating effect is unsatisfactory (see fig. 14). Specifically, below a depth h of about 0.5 m, there is no evidence of increased insulation performance by pulling the perimeter insulation down (see fig. 15).

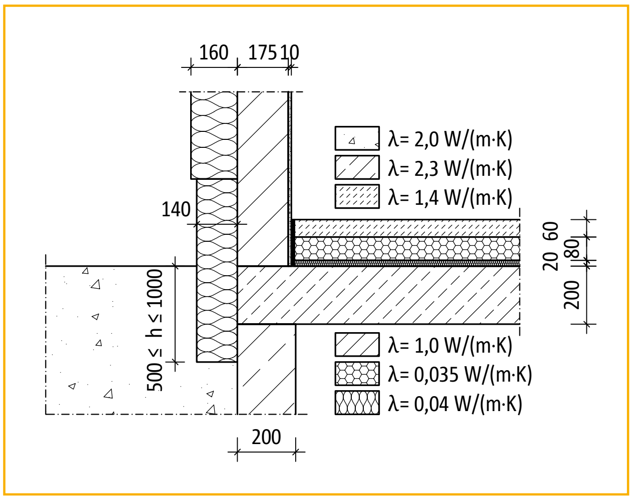

Fig. 13: Constructional insulation measures

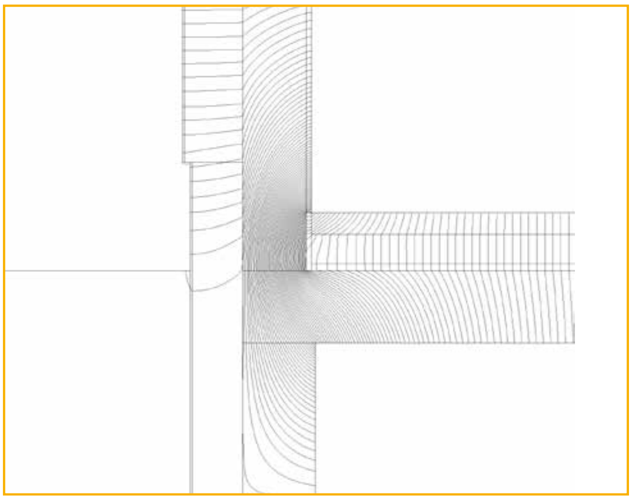

Fig. 14: Heat flows of constructional insulation measures

Building physics
Comparison of insulation procedures

As already mentioned, applying perimeter insulation only makes sense down to a certain depth in the ground. The following chart illustrates that insulation performance is only marginally improved by further extending the depth of insulation beyond about 0.5 m.

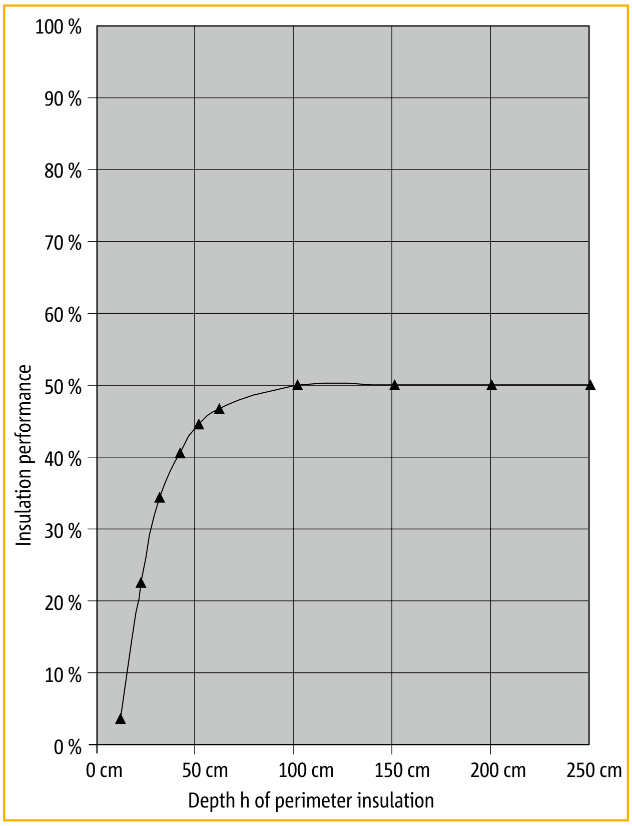

Fig. 15: Insulation performance of constructional insulation measure

This constructional insulation measure produces a total improvement of only about 50%, regardless of the depth.

Building physics
Comparison of insulation procedures

Insulating with Schöck Novomur® and Novomur® light

Schöck Novomur® and Schöck Novomur® light are load bearing thermal insulation elements that close the gap between the insulation of the external wall and the insulation above the cellar slab (see fig. 16). The resulting thermal insulation is continuous and very efficient (see fig. 17).
Which means:

- Minimised thermal loss resulting in lower heating costs
- Increased surface temperature in the room to well above the critical mould temperature
- No risk of mould formation and condensation
- Healthy room climate

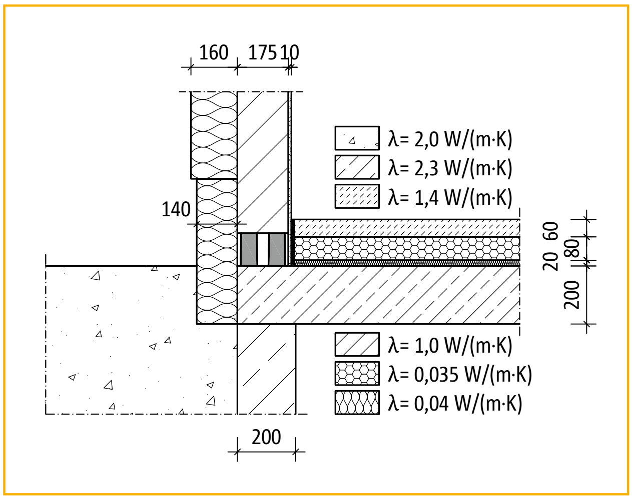

Fig. 16: Efficient thermal insulation with Schöck Novomur®

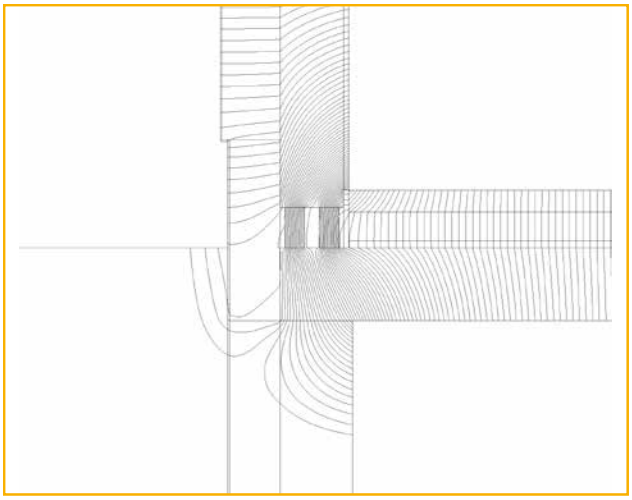

Fig. 17: Heat flows with Schöck Novomur®

Base of a building with theoretically ideal insulation

To enable comparison of the insulation performance of the constructional measures described above, the theoretically ideal case of a completely enclosed insulation layer is shown (see figs. 18 and 19). Implementation of this solution is, however, virtually impossible in practice.

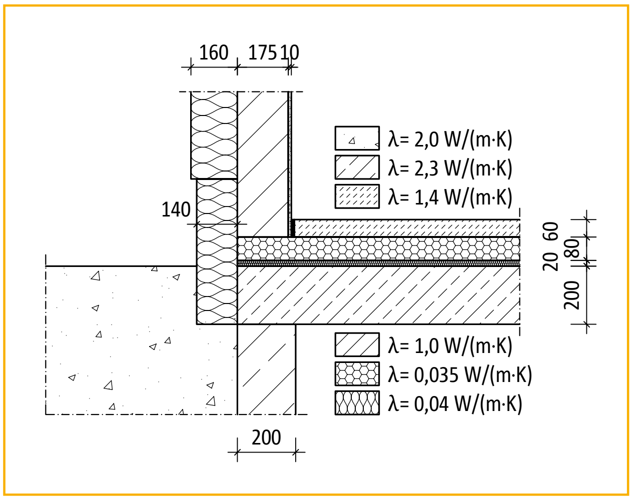

Fig. 18: Base of a building with theoretically ideal insulation

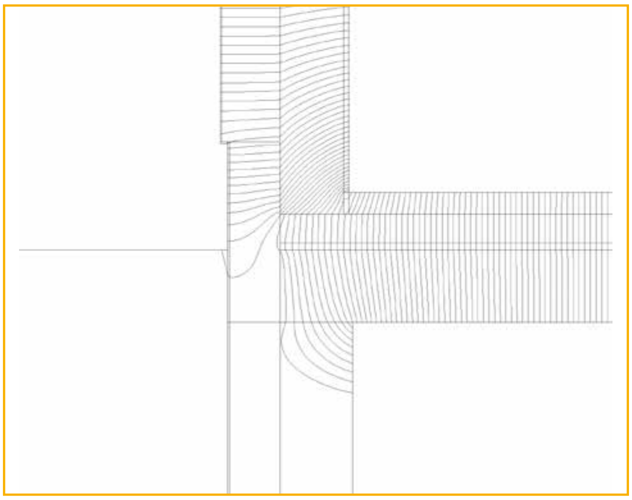

Fig. 19: Heat flows around the base of a building with theoretically ideal insulation

Building physics
Comparison of insulation procedures

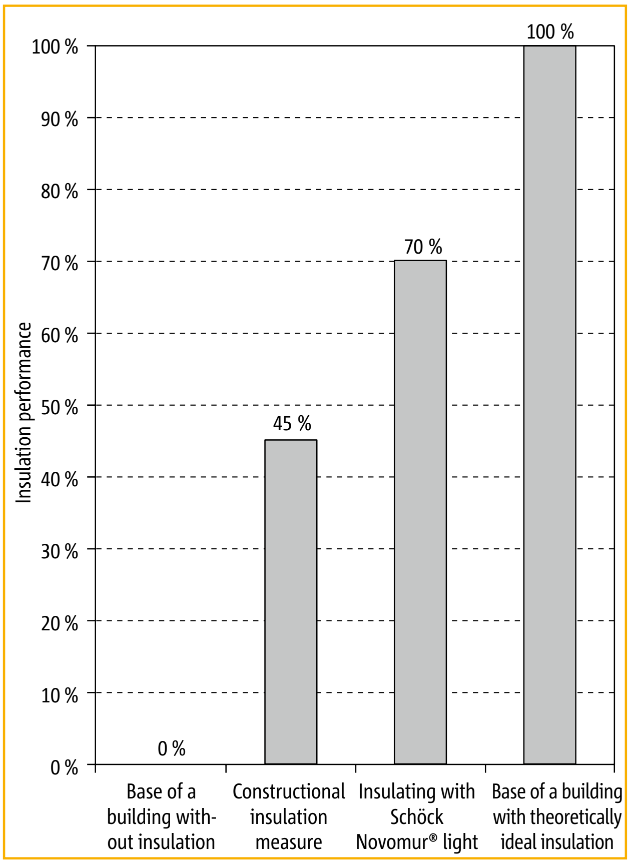

Fig. 20: Comparison of insulation performance of the constructional measures described above

Compared with the base of a building with theoretically ideal insulation, Schöck Novomur® clearly offers the best insulation performance of the alternatives listed here. A constructional insulation measure can only achieve less than half the performance of the base of a building with theoretically ideal insulation, whereas Schöck Novomur® achieves 70%.

Added to which, the water repellent properties of Schöck Novomur® materials ensure that the amount of water absorbed during the construction phase is negligible. And, as a result, that insulation performance is highly effective, right from the start.

Building physics
Deriving λ_{eq}

What makes thermal bridges at the base of a building so significant is that both heat and loads are transferred in the same direction. As explained earlier, there are numerous factors relating to the design of a base that can influence heat transfer. Of particular relevance here is the fact that heat flows from the ground floor both vertically to the areas below it (into a cellar/underground garage that is possibly not heated and into the surrounding ground) and horizontally through the wall and, possibly, the adjoining ground. The same holds true for Novomur®: heat flows both horizontally and vertically through these insulation elements as well, see fig. 21.

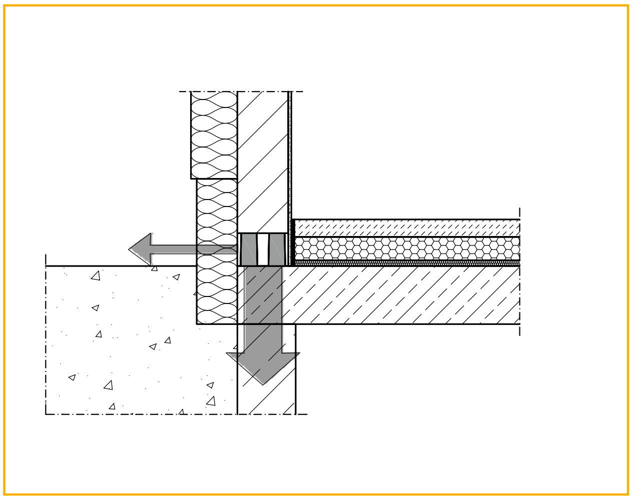

Fig. 21: Heat flows through Schöck Novomur®

How do these thermal bridges differ from purely horizontal bridges?
A look at purely horizontal thermal bridges, such as balcony connections, shows that heat only flows horizontally from inside out as there is only one cold area: the outside. By contrast, unheated cellars or underground garages – and the adjoining ground – cause heat to flow both vertically and horizontally at the base of a building.

Thermal conductivity of inhomogeneous products
The structure of Novomur® insulation elements is inhomogeneous. They consist of a supporting and an insulating structure arranged unevenly in the cross section, see fig. 34. As a result, heat transfer through the material differs in horizontal and vertical direction. Because of the interior structure of Schöck Novomur®, horizontal thermal conductivity is much lower than vertical.

Building physics
Deriving λ_{eq}

λ of the product is needed to calculate the flow of heat through the thermal bridge. Appropriate building physics software programs can be used to calculate the heat flow through the thermal bridge, which is expressed as a ψ value (please refer to the section "Thermal insulation analysis" for further details). However, since only one λ per material can be entered in this software, we have compiled recommendations for calculating the heat flow in the base of your building.

Calculating λ_{eq} to reflect the inhomogeneity

The simplest method is to take the vertical λ of the product as it is the poorer value and thus produces a conservative result. Analysing the influence of the horizontal and vertical heat flows produces a more accurate result. An analysis of the possible configurations reveals a regular pattern of influence for the horizontal and vertical heat flows. Put simply, 90% of the heat flows vertically and 10% horizontally. (An extensive study of the parameters has validated this result.) A very accurate value for calculating λ_{eq} can then be derived from this ratio:

$$\lambda_{eq} = 0,9 \cdot \lambda_v + 0,1 \cdot \lambda_h$$

$$\lambda_{eq,Novomur} = 0,248 \; \frac{W}{m \cdot K}$$

$$\lambda_{eq,Novomur\ light} = 0,182 \; \frac{W}{m \cdot K}$$

This value can then be entered in a suitable software program to calculate the thermal transmission resistance, expressed as ψ, for a structure. The table below lists the average thermal conductivity in vertical and horizontal direction for purposes of more detailed analysis.

Schöck Novomur® element width [cm]	Average thermal conductivity [W/ (m . K)]	
	Vertical direction	Horizontal direction
11.5 - 24.0	$\lambda_v = 0.266$	$\lambda_h = 0.088$

Fig. 22: Thermal conductivity of Novomur®

Schöck Novomur® light element width [cm]	Average thermal conductivity [W/ (m . K)]	
	Vertical direction	Horizontal direction
11.5 - 24.0	$\lambda_v = 0.193$	$\lambda_h = 0.083$

Fig. 23: Thermal conductivity of Novomur® light

Building physics
Thermal insulation analysis

Energy conservation regulations and thermal bridges

When the energy conservation regulations (EnEV) came into force on 1 February 2002, the low energy standard for new buildings became binding. This good level of thermal insulation necessitates paying particular attention to thermal bridges as very good insulation of a building exterior can only be achieved if thermal bridges are avoided/insulated at the same time. The inclusion of thermal bridges when calculating the energy demand for heating is explicitly specified for the first time in the energy conservation regulations.

According to EnEV, the specific transmission heat loss H_T must be calculated as follows:

$$H_T = \sum F_i \cdot U_i \cdot A_i + H_{WB}$$

$\sum F_i \cdot U_i \cdot A_i$ describes the thermal loss through the flat components (walls, floor slabs, etc.) with U_i as the thermal transmission coefficient (formerly: “k”) of wall i with external surface area A_i and temperature reduction factors F_i • H_{WB} indicates the share of thermal transmission loss caused by thermal bridges.

Case 1: Without thermal bridge analysis

Assuming no further analysis of the thermal bridges is supplied, the following applies:

$$H_{WB} = \Delta U_{WB} \cdot A_{ges} \text{ where: } \Delta U_{WB} = 0.1\ W/(m^2 \cdot K),\ A_{ges} = \sum A_i \text{ (total area of the building exterior).}$$

i. e. a flat rate value ΔU_{WB} is added to the average U value of the building envelope (penalty for non-consideration of the thermal bridges). This addition to the U value is approximately equivalent to an increase in the average U value of a quite substantial 30%.

Case 2: Thermal bridge analysis as per Supplement 2 DIN 4108

Supplement 2 to DIN 4108 lists application examples of minimum insulation measures for thermal bridges. If the connection details correspond to these application examples, the flat rate value ΔU_{WB} is reduced to 0.05 $W/(m^2 \cdot K)$ equivalent to a 15% increase in the average U value.

Case 3: Exact calculation of thermal bridges

If effective measures for insulating thermal bridges are used (e.g. Schöck Novomur® and Schöck Isokorb®), the values for H_{WB} are much lower. In such cases, it makes sense to calculate the thermal bridges exactly using the thermal bridge loss coefficient ψ as per EN 10211. In which case, the following applies:

$$H_{WB} = \sum F_j \cdot \psi_j \cdot l_j + \sum F_k \cdot \chi_k$$

Variable ψ_j represents the (outer) value of the linear thermal transmittance ψ_j (also known as the thermal bridge loss coefficient) of linear thermal bridge j which is l_j long. χ_k is the thermal bridge loss coefficient of punctiform thermal bridge k. Since thermal insulation analysis as per EnEV must be based on outer areas, the applied ψ values must also be outer based.

Building physics
Thermal insulation analysis

Analysis levels	1. Without thermal bridge analysis	2. General consideration of thermal bridges as per Supplement 2 DIN 4108	3. Exact thermal bridge analysis method
Description	The thermal bridges on a building are not individually analysed or do not correspond to the application examples listed in Supplement 2 DIN 4108.	The thermal bridge insulation measures correspond to the application examples listed in Supplement 2 DIN 4108.	The thermal bridge details are contained in acknowledged thermal bridge registers or calculated with the aid of FE software.
Proof by analysis	$H_{WB} = 0{,}1\ W/(m^2 \cdot K)\ A_{ges}$	$H_{WB} = 0{,}05\ W/(m^2 \cdot K)\ A_{ges}$	$H_{WB} = \sum F_j \cdot \psi_j \cdot l_j + \sum F_k \cdot \chi_k$
Deterioration in the average U value of the building envelope by	approx. 30%	approx. 15 %	approx. 5% (if the thermal bridges are well insulated)

Fig. 24: Analysis levels of thermal bridges as per EnEV

According to fig. 24, the insulation factor of a building deteriorates from approx. 95% to approx. 85% or 70% if exact calculation of efficiently insulated thermal bridge details is omitted. This then has to be compensated through countermeasures that cost time and money (e.g. thicker insulation of the outer wall).
Level 3 thermal bridge analysis is very easy to perform using the Novomur® λ_{eq} values, and thermal transmission losses can be minimised.

Contribution of transmission and ventilation thermal losses to annual primary energy demand [kWh/(m² • a)]

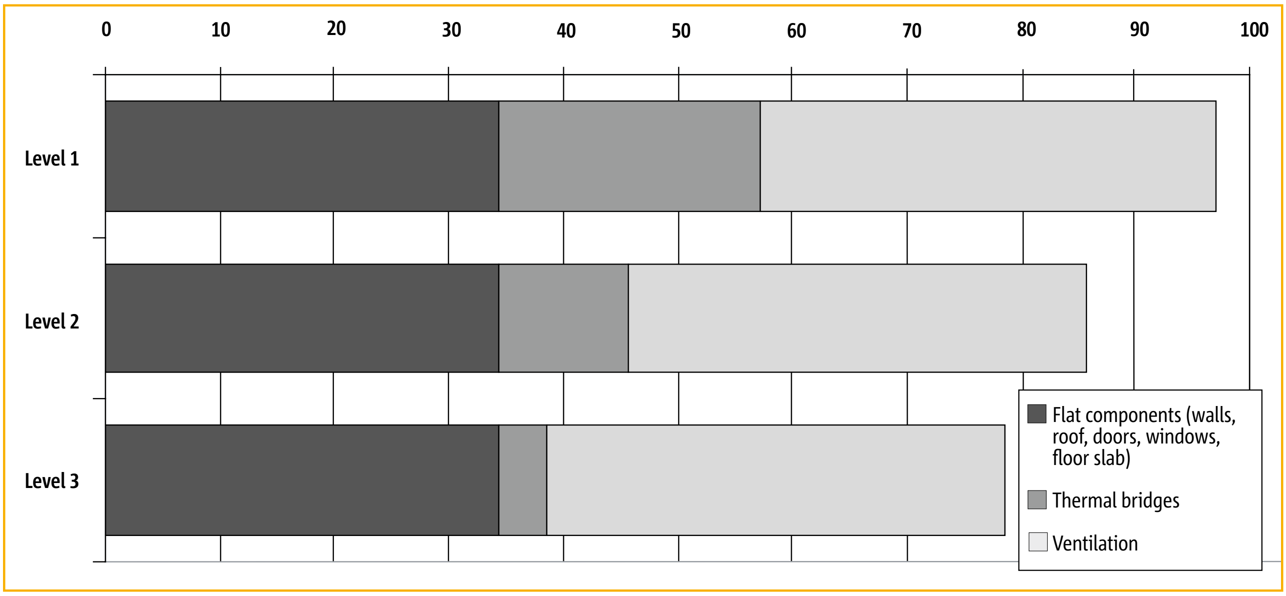

Fig. 25: Impacts of thermal bridge influence on the heating energy balance as per EnEV, using a typical apartment building as an example and broken down by analysis level (source: "Bauphysik", issue 1, 02/2002)

Technical fire protection demands for apartment buildings

The state building codes in force in each federal state determine the technical fire protection demands for building walls.

Section 28 (1) MBO (Model Building Code) specifies the limitation of fire spread as a general requirement for outer walls. This containment must be assured for a sufficient length of time.
The technical fire protection demands in the MBO specify fireproofing – i.e. minimum R90 classification – for load bearing walls in residential buildings of not insignificant height (i.e. the uppermost floor level is more than 7 m above ground surface level in one place, at least). Notwithstanding this, the provisions of the applicable state building code must be observed in specific buildings.

Fire resistance classes REI30 and REI90

The classification of separating walls in fire resistance classes REI30 and REI90 as per EN 13501-2 or EN 1996-1-2 in conjunction with EN 1996-1-2/NA remains valid when using Schöck Novomur® / Novomur® light, providing installation is performed as follows:

- Install elements within the slab structure such that the upper edge (UE) of the load bearing thermal insulation element is below the upper edge of the screed.
- Alternatively, cover both sides of the elements with a layer of plaster at least 15 mm thick as per EN 1996-1-2, Section 4.2 (1) or
- Attach strips of gypsum fireboard (at least 12.5 mm thick and at least as tall as the element) to both sides as per DIN 18180
- Alternatively, the plaster or strips of gypsum fireboard on one side can be replaced with facing brickwork.

The classification of non-separating walls in fire resistance classes R30 and R90 as per EN 13501-2 or EN 1996-1-2 in conjunction with EN 1996-1-2/NA remains valid when using Schöck Novomur® / Novomur® light. Additional fire protection measures are not necessary.

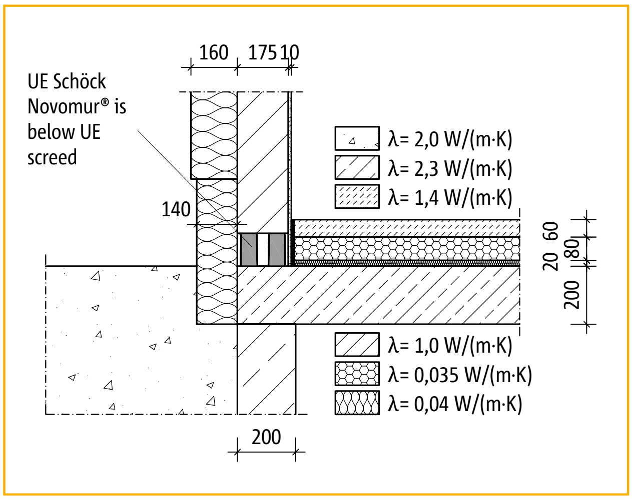

Fig. 26: REI30 / REI90 classification of firewalls

Building physics
Fire protection/Soundproofing

Firewalls
As a general rule, Schöck Novomur® may not be used for firewalls.

If Schöck Novomur® is encased on both sides with a suitable screed construction, an appropriate fire protection survey may confirm suitability for use on firewalls in individual instances.

Soundproofing
According to the results of acoustic measurements on a test bench, the airborne sound insulation performance of a wall incorporating Schöck Novomur® is not impaired (see test report no. L 97.94 – P 18 and supplement P 225/02 dated 29.07.2002, ITA – Ingenieurgesellschaft für Technische Akustik, Wiesbaden).

Care must be taken to prevent occurrence of airborne acoustic bridges caused by lack of seal integrity in the wall (e.g. butt joints) by covering the wall entirely with plaster (on at least one side).

Schöck Novomur®/Novomur® light

Load bearing, water repellent thermal insulation element for preventing thermal bridges at the base of a building

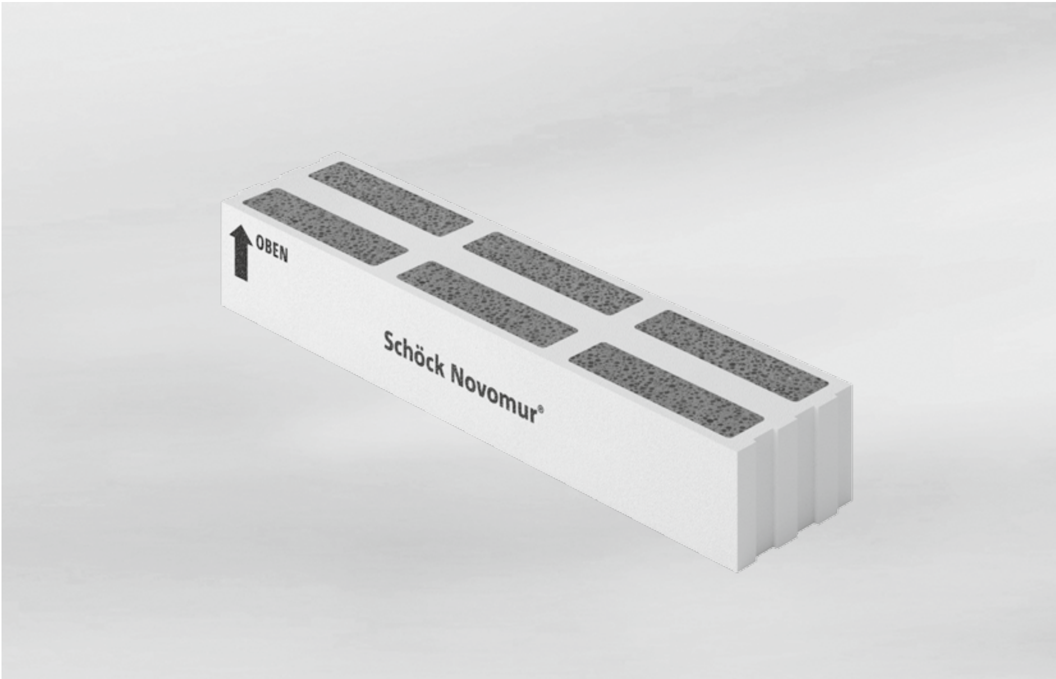

Fig. 27: Schöck Novomur® type 20 - 17.5

Applications: First or last layer in brickwork walls
▸ Novomur®: Compressive strength class 20 ▸ Novomur® light: Compressive strength class 6 ▸ Simple design as per EN 1996-3/NA for building heights ≤ 20 m ▸ Use with thin bed and normal mortar ▸ Good planning reliability, building code approved, thermal performance tested, fire protection performance tested, moisture performance tested ▸ Classified as water repellent according to DIN 4108 Part 3

Contents **Page**

Schöck Novomur®/Novomur® light
Installation situation

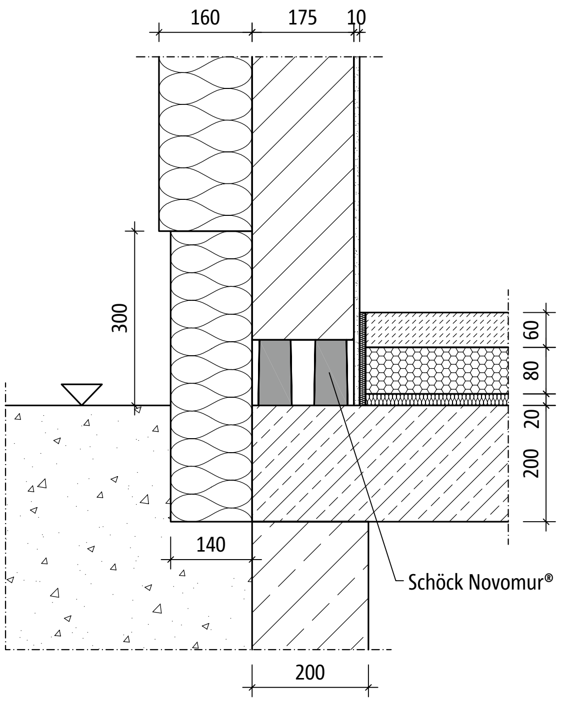

Fig. 28: Schöck Novomur® installed in external thermal insulation composite system

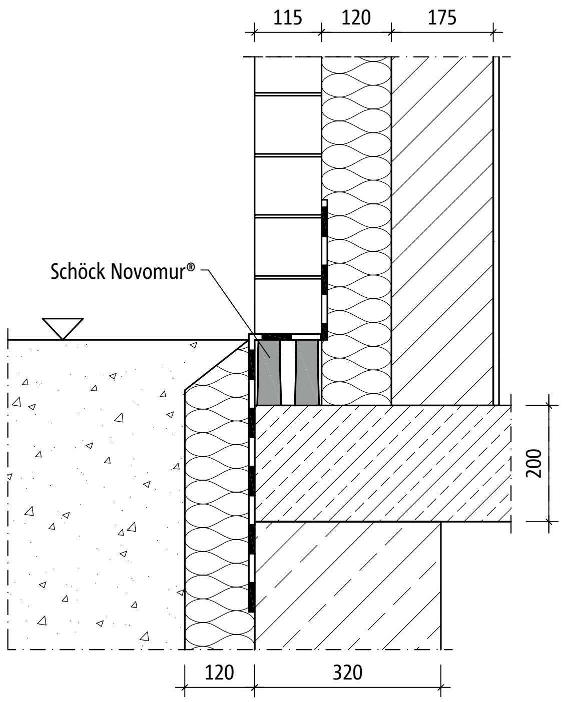

Fig. 29: Schöck Novomur® installed in filled cavity wall system

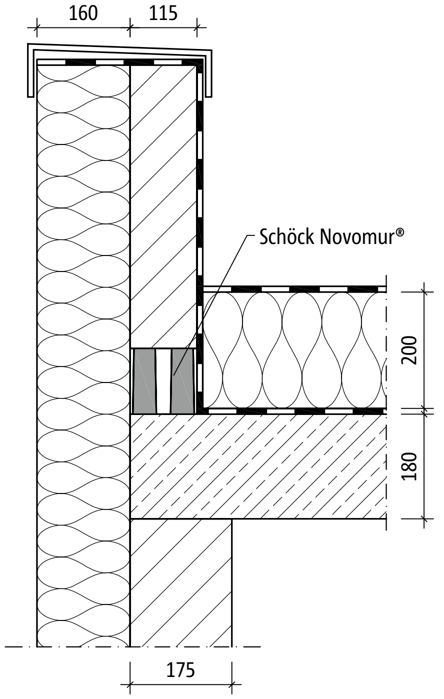

Fig. 30: Schöck Novomur® installed in the parapet

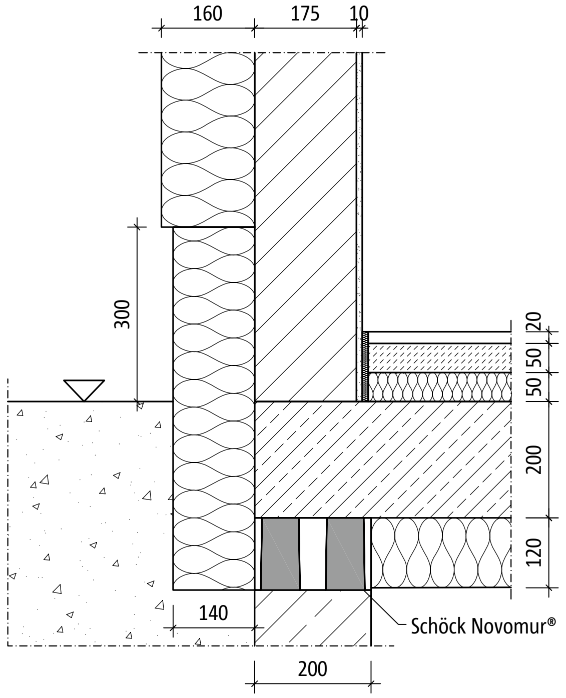

Fig. 31: Schöck Novomur® installed beneath the cellar slab

Schöck Novomur®/Novomur® light
Dimensions/Weights/Materials

Schöck Novomur® type	Compressive strength class	Element width [mm]	Height [mm]	Length [mm]	Weight [kg]
20 - 11.5	20	115	113	750	9.3
20 - 15		150			12.1
20 - 17.5		175			14.1
20 - 20		200			16.1
20 - 24		240			19.3

Fig. 32: Overview of Novomur® types

Schöck Novomur® type	Compressive strength class	Element width [mm]	Height [mm]	Length [mm]	Weight [kg]
6 - 11.5	6	115	113	750	6.8
6 - 15		150			8.9
6 - 17.5		175			10.4
6 - 20		200			11.9
6 - 24		240			14.2

Fig. 33: Overview of Novomur® light types

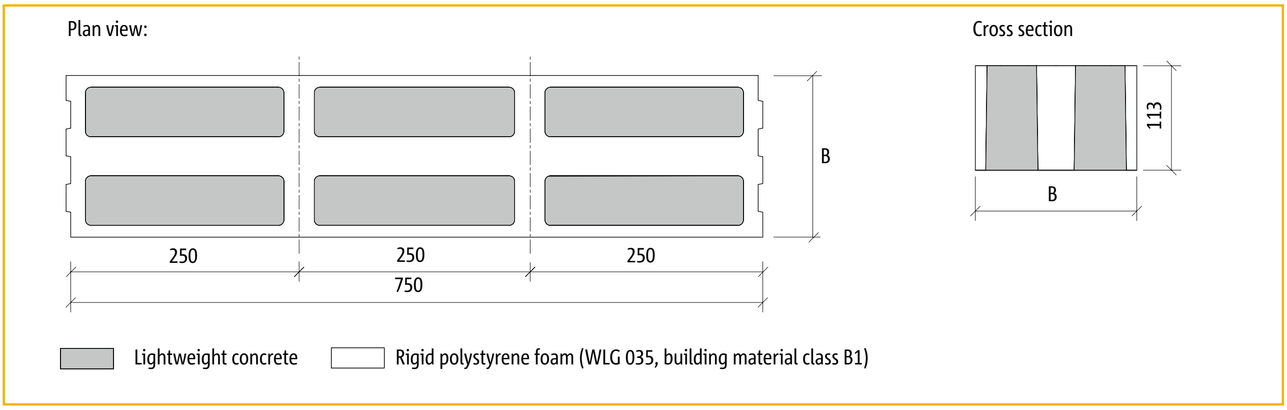

Fig. 34: Schöck Novomur®/Novomur® light dimensions

Novomur® / Novomur® light

Novomur®/Novomur® light
Design

Novomur® compression strength f_k			
Compression strength classification of sand-lime / solid bricks	Characteristic value f_k of compression strength in N/mm² for brickwork with		
	Normal masonry mortar from group		Thin bed mortar
	II a	III	
12	4.2	4.2	4.7
16	4.4	4.4	5.5
20	5.0	5.0	6.3
28	5.0	5.0	6.3

Fig. 35: Compression strength f_k of Novomur®

Novomur® light compression strength f_k			
Compression strength classification of sand-lime / solid bricks	Characteristic value f_k of compression strength in N/mm² for brickwork with		
	Normal masonry mortar from group		Thin bed mortar
	II a	III	
≥ 12	2.6	2.6	3.1

Fig. 36: Compression strength f_k of Novomur® light

<table>
<tr><th colspan="8">Absorbable normal force of brickwork in conjunction with Novomur®/ Novomur® light n_{Rd} [kN/m] = T[1] * f_k [N/mm²]</th></tr>
<tr><th rowspan="5">Clear wall height h [m]</th><th rowspan="5">Wall thickness t [cm]</th><th rowspan="4">Intermediate supports</th><th colspan="5">End supports</th></tr>
<tr><th colspan="4">Ceiling slab</th><th>Roof slab</th></tr>
<tr><th colspan="4">Fully supported slab a/t = 1.0</th><th>a/t = 1.0</th></tr>
<tr><th colspan="5">Span length lf [m]</th></tr>
<tr><th>≤ 6.0</th><th>≤ 4.5</th><th>5.0</th><th>5.5</th><th>6.0</th><th>≤ 6.0</th></tr>
<tr><td rowspan="5">2.50</td><td>11.5</td><td>36</td><td colspan="4">36</td><td>21</td></tr>
<tr><td>15.0</td><td>57</td><td colspan="3">57</td><td>51</td><td>28</td></tr>
<tr><td>17.5</td><td>71</td><td colspan="2">71</td><td>67</td><td>59</td><td>33</td></tr>
<tr><td>20.0</td><td>80</td><td colspan="2">80</td><td>77</td><td>68</td><td>37</td></tr>
<tr><td>24.0</td><td>102</td><td colspan="2">102</td><td>92</td><td>81</td><td>45</td></tr>
<tr><td rowspan="5">2.75</td><td>11.5</td><td>32</td><td colspan="4">32</td><td>21</td></tr>
<tr><td>15.0</td><td>54</td><td colspan="3">54</td><td>51</td><td>28</td></tr>
<tr><td>17.5</td><td>69</td><td colspan="2">69</td><td>67</td><td>59</td><td>33</td></tr>
<tr><td>20.0</td><td>77</td><td colspan="2">77</td><td>77</td><td>68</td><td>37</td></tr>
<tr><td>24.0</td><td>99</td><td colspan="2">99</td><td>92</td><td>81</td><td>45</td></tr>
<tr><td>3.00</td><td>24.0</td><td>96</td><td>-</td><td>-</td><td>-</td><td>-</td><td>45</td></tr>
<tr><td colspan="8">Intermediate values may not be interpolated. [1] T = table value</td></tr>
</table>

Fig. 37: Measurement table for brickwork combined with Novomur®/Novomur® light

Notes on using the table of measurements

- Schöck Novomur® is measured using the simplified verification procedure as per EN 1996-3/NA.
- Schöck Novomur® may only be used in the bottommost or topmost layer of brickwork.

Novomur®/Novomur® light
Design

- According to the simplified calculation methods specified in EN 1996-3/NA, NDP for 4.1 (1)P, verification of the overall stability of a building may be omitted if the ceilings in the building are designed as rigid slabs / ring beams of demonstrably sufficient rigidity, and enough bracing walls exist in both longitudinal and transverse direction. Otherwise, the lesser shear strength described below must be included in the calculation.

- If wall shear is verified as per EN 1996-1-1, A. 6.2 in conjunction with EN 1996-1-/NA, NCI for 6.2, calculation of VR_{dlt} must be based on only 50% of the value produced by the NA.19 / NA.24 equation, albeit no more than the value produced when f_{vk} / f_{vlt} is 0.2 N/mm². The lower figure must be taken.

- Walls containing Schöck Novomur®/Novomur ® light may not be included when considering the stiffening of buildings located in zone 2 and 3 earthquake regions as per DIN 4149-1:2005-04.

- Calculation of buckling lengths must be based on walls that are braced on just two sides.

- Flexural stresses of brickwork exposed to loads at right angles to its plane may not be included in the calculation. If proof by analysis of the absorption of these loads is required, a load bearing effect may only be assumed perpendicular to the horizontal joints, with flexural stress excluded.

Outer wall measurement example

Novomur® 20 - 17.5
Sand-lime bricks, compression strength class 20
Thin bed mortar

Wall thickness	17.5 cm
Clear height	2.75 m
Span length	5.5 m

Table value from fig. 37: 67
f_k from fig. 35: f_k = 6.3 N/mm²

n_{Rd} = 67 * 6.3 = 422 kN/m

Novomur®/Novomur® light
Installation advice

General notes

- Brickwork must always be composite.
- Schöck Novomur® must always be positioned with the correspondingly marked top facing upwards.
- Schöck Novomur® can be cut to length using standard construction tools. Partial blocks must be at least one grid length, i.e. at least 250 mm, long. Partial blocks may not be arranged next to each other.
- Slits and recesses that weaken the load bearing section are not permitted.
- Schöck Novomur® must not be built on top of each other.
- A seal (membrane) is required as per DIN 18195 Part 4.
- Contrary to EN 1996-2/NA, NCI annex NA D, section NA.D1 (4), any overhang of the brick outer skin of a filled cavity outer wall that is not load bearing must not protrude more than 10 mm over the thermal insulation element.
- Schöck Novomur must be protected against moisture ingress when installing it in the outer skin of filled cavity brickwork.

Installation above the cellar slab

- Schöck Novomur® blocks must be offset closely together in a bed of MG IIa / III normal mortar.
- Once the elements are in place, wait until the mortar has hardened sufficiently to permit work to be resumed without endangering the fixed positioning of the elements.
- When building walls out of sand-lime bricks in thin bed mortar, the elements must be carefully aligned to ensure they are flat and horizontal.

Installation beneath the cellar slab

- The slab must be fully supported by Schöck Novomur®.
- Comply with building waterproofing regulations as per DIN 18195.

Credits

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Schöck Bauteile GmbH
Vimbucher Strasse 2
76534 Baden-Baden, Germany
Tel.: +49 7223 967 567
Fax: +49 7223 967 251
awt.technik@schoeck.de
www.schoeck.de

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