ISOMUR® PLUS

The wall base element for providing efficient insulation for the base of buildings
OUR CONVICTION:
FORWARD CONSTRUCTING.

Not just to reflect the current state of building technology, but always to be a decisive step ahead – this is our promise. This is why we constantly achieve pioneering work in all product areas. Our employees consistently use their extensive practical experience and creativity to benefit our customers. Through regular collaborative dialogue with our target groups, we develop today the products which are needed tomorrow. With our dynamics we set consistently milestones in building technology – yesterday, today and tomorrow. This is what we mean by Forward Constructing.
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The wall base element for providing efficient insulation for the base of buildings

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We are at your service. Wherever you are, you can count on us.
**THERMAL INSULATION AND MOISTURE PROTECTION**

**SAVING ENERGY – A HEALTH RISK?**

**THE BETTER THE THERMAL INSULATION OF THE BUILDING ENVELOPE, THE TRICKIER THE ISSUE OF THERMAL BRIDGING BECOMES.**

Thermal bridges are becoming increasingly problematic due to continuous improvements to the thermal insulation of building envelopes. This situation is borne out by the fact that fungal growth is an issue that must be taken seriously even in new buildings, and that building developers and construction specialists are increasingly being confronted by this problem. The risk of mould growth is increased unless measures to tackle thermal bridging are introduced alongside the actual energy saving measures. This means that energy-saving measures that only concentrate on a single aspect of the problem can become a health risk.

**THE BASE OF THE BUILDING – A WEAK POINT**

**UNINSULATED BASE OF THE BUILDING**

If the base of the building is uninsulated, the walls built on top of it will create a gap in the thermal envelope of the building between the exterior wall insulation and the thermal insulation over the cellar roof.

This means:
- Increased risk of mould growth because of a local increase in relative humidity due to the lower surface temperature at the base of the wall
- Loss of heat

**INSULATED BASE OF THE BUILDING**

ISOMUR® Plus closes the gap in the thermal insulation between the exterior wall insulation and the insulation over the cellar roof.

This means:
- Healthy indoor climate
- The risk of mould growth is mitigated
- Loss of heat is minimised

**NOTE:**

Our ISOMUR® Plus elements are approved in accordance with the national technical approval no. Z-17.1-811
THERMAL INSULATION AND MOISTURE PROTECTION

EFFICIENT INSULATION FOR THE BASE OF BUILDINGS
ISOMUR® Plus elements are designed for use with all brick residential structures and correspond to brick compressive strength class 20.
The risk of moisture damage within rooms in the form of discoloursations and mould growth can be mitigated by using ISOMUR® Plus. The elements fully meet all requirements for load-bearing capacity and suitability for use under practical conditions.

ISOMUR® PLUS SOLVES THE PROBLEM OF THERMAL BRIDGING AT THE BASE OF THE WALL
These elements do not absorb moisture, which means that thermal insulation is not compromised by the moisture that occurs in the construction phase. ISOMUR® Plus has thermal insulating properties that significantly mitigate thermal bridging.
These elements can be installed easily and without problems, meaning that perfect quality is not dependant on tricky measures during construction.
THERMAL INSULATION AND MOISTURE PROTECTION

COMPARISON OF INSULATING MEASURES

BASE OF THE BUILDING WITH NO SPECIAL MEASURES
If no special measures are employed at the base of the building, the walls built on top of it will create a gap in the thermal envelope of the building between the exterior wall insulation and the insulation over the cellar roof. In conjunction with the high vertical thermal conductivity of the building bricks ($k \approx 1.0 \text{ W/mK}$), this causes a massive thermal bridge to form at the base of the building.

This means:
- A reduction in the surface temperature within the room, resulting in a risk of discolouration, mould growth and condensation forming
- Increased heat loss, resulting in higher heating costs

CONSTRUCTIONAL INSULATION MEASURES
The exterior wall insulation often continues into the earth in the form of perimeter insulation in order to mitigate thermal bridging at the base of the building. The costs of this measure are not insignificant and the thermal insulation that it provides is limited. Notably, continuing to extend the perimeter insulation downwards provides no further increase in insulation effectiveness beyond a depth of approx. 0.5 m.

INSULATION WITH ISOMUR® PLUS
ISOMUR® Plus load-bearing thermal insulation elements close the gap in the thermal insulation between the exterior wall insulation and the insulation over the cellar roof. This provides continuous and highly efficient thermal insulation.

This means:
- An increase in the surface temperature in the room to significantly above the critical dew point
- Mitigation of the risk of mould growth and condensation forming and a healthy indoor climate
- Loss of heat is minimised, providing a reduction in heating costs

THEORETICALLY IDEAL INSULATION FOR THE BASE OF THE BUILDING
The theoretically ideal scenario of a fully enclosed thermal insulation layer is defined as a reference point for the purpose of comparing the thermal insulation effectiveness of the constructions described above. However, for structural reasons, it is not possible to implement this measure in practice.
THERMAL INSULATION AND MOISTURE PROTECTION

MATERIALS AND THERMAL INSULATION EFFECTIVENESS

THERMAL INSULATION EFFECTIVENESS AND MOISTURE
Thermal conductivity is a material parameter that is significantly affected by the moisture content of the material. The greater the absorbency of a material, the greater the negative effect on its thermal insulation effectiveness. This means that the choice of material is of vital importance for applications in damp environments.

DECLARED VALUES AND ACTUAL CONDITIONS
Absorbent building bricks have a significantly higher thermal conductivity than the λ values declared in data sheets when they are saturated with moisture. Thermal conductivity increases by approx. 0.28 W/mK for every 10 vol% of moisture content. Autoclaved aerated concrete, for example, can absorb water up to 45 vol%. Consequently, it has a thermal conductivity of approx. 0.9 W/mK at a construction moisture level of 25 vol%. It should always be assumed that there will be moisture at the base of a wall, whether in the form of standing water on the ceiling in the shell or as a result of applying floating screed, to name just two of the possible factors.

PROGRESSION OF THE DRYING OUT OF BUILDINGS OVER TIME
The moisture absorbed during the construction phase can only be drained away again very slowly at the base of the wall due to the "packing" of the first layer of bricks on all sides. The Fraunhofer Institute for Building Physics used FEM simulations to ascertain that the actual thermal conductivity of absorbent bricks is significantly higher than the declared λ value, not only during the construction phase but over the entire drying period of a new building, which lasts for several years.

THE SOLUTION: MOISTURE-RESISTANT COMPONENTS
ISOMUR® Plus elements feature such a low level of water absorption that they practically act as a barrier layer when laid as the first layer of bricks. This ensures that thermal insulation is guaranteed from the beginning without the need for costly measures during construction.

FIRE PROTECTION AND SOUND INSULATION

FIRE PROTECTION

FIRE PROTECTION REQUIREMENTS
The fire protection requirements for building walls in Germany are determined by the state building regulations (Landesbauordnungen) specific to each federal state. In accordance with the fire protection requirements of the standard building regulations (Musterbauordnung), load-bearing walls in buildings that have a low height (meaning that the uppermost floor level is no higher than 7 m above ground level at any point) and are not free-standing require a fire resistance class of at least F30-B. The provisions in the valid state building regulations must be complied with in each specific case.

FIRE RESISTANCE CLASSES F30 AND F90*
The installation of ISOMUR® elements does not cause the loss of F30 - F90 classification for enclosing walls in accordance with DIN 4102-2:1977-09 – Fire Behaviour of Building Materials and Building Components; Building Components; Definitions, Requirements and Tests – or DIN 4102-4 as long as the following fire protection measures have been carried out:

- Installation of the elements within the ceiling structure so that the upper edge of the element ≤ the upper edge of the screed (fire behaviour class A), or
- Elements plastered on both sides with a minimum plaster thickness of 15 mm in accordance with DIN 4102-4, section 4.5.2.10 Alternatively, the plaster on the outside of exterior walls can be replaced with mineral wool with a melting point of ≥ 1000 °C as thermal insulation or with faced brickwork.

F90 classification in accordance with DIN 4102:1977-09 for enclosing exterior walls with a thickness of at least 175 mm will likewise not be lost as long as the ISOMUR® Plus elements are only installed at the base of the wall and within the ceiling structure in such a way that the upper edge of the element < the upper edge of the screed (fire behaviour class A) and as long as a thermal insulation composite system with insulating material that is at least flame resistant is applied on the outside.

Installation of the thermal insulation elements does not cause the loss of F30 - F90 classification for non-enclosing walls in accordance with DIN 4102-2:1977-09 or DIN 4102-4. Additional fire protection measures are not necessary.

The designation of the walls during installation of ISOMUR® Plus is as follows:

F30-AB, F60-AB or F90-AB in accordance with DIN 4102-2

The fire resistance class for load-bearing columns and load-bearing, non-enclosing wall sections (length < 1 m) has not been established.

FIREWALLS*

SOUND INSULATION
Installing ISOMUR® Plus does not compromise the sound insulation characteristics of the wall.
ENERGY SAVING REGULATION (EnEV)

The German Energy Saving Regulation came into force on 01.02.2002 and provides a binding specification for the energy standard for new buildings. The calculation methods in accordance with the EnEV numerically factor in the effects of thermal bridging when calculating heat loss due to transmission. The effects of thermal bridging play a particularly significant role in buildings that have a high thermal standard.

THREE OPTIONS FOR QUANTITATIVELY RECORDING THE EFFECTS OF THERMAL BRIDGING:

1. No verification of thermal bridging: The thermal transmittance is increased by an increment of ΔU_{WB} = 0.10 W/(m²K) for the entire thermal transmission surface area.

2. Verification of thermal bridging in accordance with DIN 4108, supplementary sheet 2: For construction details in accordance with the planning examples as per DIN 4108, supplementary sheet 2, an increase in the heat transmittance by ΔU_{WB} = 0.05 W/(m²K) must be expected for the entire thermal transmission surface area.

3. Accurate verification of thermal bridging: With verification of thermal bridging in accordance with DIN 4108-6 in conjunction with DIN EN ISO 10211-1 and DIN EN ISO 12211-2, the effective Ψa heat loss coefficients of the thermal bridges can be taken into account.

| Description | No verification of thermal bridging | Verification of thermal bridging in accordance with DIN 4108, supplementary sheet 2 | Accurate verification of thermal bridging*
|-------------|-----------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------|
| No verification | Materials and geometry correspond to the planning examples | Thermal bridge details in accordance with thermal bridge catalogue or calculation | Cannot be universally specified/individual thermal bridges have been recorded
| Thermal bridge correction factor | 0.10 | 0.05 | Cannot be universally specified/individual thermal bridges have been recorded
| Heat loss due to transmission H_{t} (W/K) | \( \sum F \cdot U_{t} \cdot A_{t} + 0.10 \cdot A_{\text{total}} \) | \( \sum F \cdot U_{t} \cdot A_{t} + 0.05 \cdot A_{\text{total}} \) | \( \sum F \cdot U_{t} \cdot A_{t} + \sum F \cdot \Psi_{a} \)
| Moisture protection | Risk of mould due to condensation | Moisture protection implemented in accordance with standard | Precise analysis of the moisture quality

Example calculation of a detached house

- **Thermal bridge correction factor** \( \Delta U_{WB} \) (W/m²K) resp. \( \Psi_{a} \) (W/mK)
  - 0.10
  - 0.05
  - -0.01

- **Deterioration of the U value**
  - ≥ 31%
  - ≥ 15%
  - ~ 0%

- **Surface temperature in the inside corner of the exterior wall**
  - No information – risk of mould growth
  - No information – non-critical in accordance with DIN 4108, supplementary sheet 2
  - 15.9 °C, moisture protection resolved optimally

**COMMENT REGARDING HEAT LOSS COEFFICIENTS Ψa**

In accordance with the EnEV, the heat lost through the heat-exchanging external components is calculated using the exterior dimensions. However, in the case of outside corners, for example, this causes the product of the heat-exchanging surfaces and their U value to be too high, as these calculation values are significantly too large compared to using the actual heat-exchanging surfaces based on the interior dimensions and additionally taking the thermal bridges into account. For this reason, it is possible to arrive at negative values when calculating the Ψa values, which causes the overall losses calculated using the exterior dimensions to be reduced.

*The calculated Ψ values for common exterior wall and interior wall constructions are listed on page 10 in this brochure. These values can be used to provide accurate verification of the thermal bridging (variant 3).
THERMAL PARAMETERS

The thermal parameters of ISOMUR® Plus and sand-lime brickwork result in the following thermal bridge heat loss coefficients, temperature factors and minimum surface temperatures.

### ISOMUR® Plus

<table>
<thead>
<tr>
<th>Type</th>
<th>$\Psi_a^{(1)}$ [W/mK]</th>
<th>$f_{RSi}$</th>
<th>$\theta_{min}^{(3)}$ [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-11.5</td>
<td>0.245</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-17.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-20.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### THERMAL INSULATION COMPOSITE SYSTEM

<table>
<thead>
<tr>
<th>Insulation</th>
<th>ISOMUR® Plus type</th>
<th>$\Psi_a^{(1)}$ [W/mK]</th>
<th>$f_{RSi}$</th>
<th>$\theta_{min}^{(3)}$ [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>20-15.0</td>
<td>-0.01</td>
<td>0.867</td>
<td>16.0</td>
</tr>
<tr>
<td>14</td>
<td>20-17.5</td>
<td>-0.01</td>
<td>0.860</td>
<td>15.8</td>
</tr>
<tr>
<td>12</td>
<td>20-20.0</td>
<td>-0.01</td>
<td>0.853</td>
<td>15.6</td>
</tr>
<tr>
<td>10</td>
<td>20-24.0</td>
<td>-0.03</td>
<td>0.844</td>
<td>15.3</td>
</tr>
</tbody>
</table>

### EXTERIOR CAVITY WALL

<table>
<thead>
<tr>
<th>Insulation</th>
<th>ISOMUR® Plus type</th>
<th>$\Psi_a^{(1)}$ [W/mK]</th>
<th>$f_{RSi}$</th>
<th>$\theta_{min}^{(3)}$ [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>20-15.0</td>
<td>-0.02</td>
<td>0.863</td>
<td>15.9</td>
</tr>
<tr>
<td>14</td>
<td>20-17.5</td>
<td>-0.03</td>
<td>0.846</td>
<td>15.4</td>
</tr>
<tr>
<td>12</td>
<td>20-20.0</td>
<td>-0.03</td>
<td>0.836</td>
<td>15.1</td>
</tr>
<tr>
<td>10</td>
<td>20-24.0</td>
<td>-0.04</td>
<td>0.825</td>
<td>14.8</td>
</tr>
</tbody>
</table>

### INTERIOR WALL

<table>
<thead>
<tr>
<th>ISOMUR® Plus Type</th>
<th>$\Psi_a^{(1)}$ [W/mK]</th>
<th>$f_{RSi}$</th>
<th>$\theta_{min}^{(3)}$ [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-15.0</td>
<td>0.14</td>
<td>0.857</td>
<td>18.6</td>
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<tr>
<td>20-17.5</td>
<td>0.17</td>
<td>0.843</td>
<td>18.4</td>
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<tr>
<td>20-20.0</td>
<td>0.19</td>
<td>0.834</td>
<td>18.3</td>
</tr>
<tr>
<td>20-24.0</td>
<td>0.21</td>
<td>0.827</td>
<td>18.3</td>
</tr>
</tbody>
</table>

1) Exterior thermal bridge heat loss coefficient
2) Temperature factor $f_{RSi} = (\theta_{i} - \theta_{min})/(\theta_{a} - \theta_{i})$ at $R_{se} = 0.04$ and $R_{si} = 0.25$ (m²K/W)
3) Minimum surface temperature $\theta_{min}$
4) Design value for thermal conductivity in accordance with approval, equivalent λ value on a homogeneous body

Isotherms with thermal composite system

Isotherms with exterior cavity wall

Isotherms with interior wall above unheated cellar
STRUCTURAL DIMENSIONING

BRICK COMpressive STRENGTH CLASS 20

<table>
<thead>
<tr>
<th>ISOMUR® Plus elements perspective</th>
<th>ISOMUR® Plus type</th>
<th>Width W [mm]</th>
<th>Height H [mm]</th>
<th>Length L [mm]</th>
<th>Load-bearing capacity kN/m</th>
<th>Thermal conductivity(^1) [W/mK]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>113</td>
<td></td>
<td>600</td>
<td>In accordance with approval</td>
</tr>
<tr>
<td>High-strength lightweight concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.245</td>
</tr>
<tr>
<td>Rigid polystyrene foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20-11.5 115
20-15.0 150
20-17.5 175
20-20.0 200
20-24.0 240
20-30.0* 300

Dimensioning of brick walls using ISOMUR® Plus is carried out in accordance with DIN 1053, part 1. All regulations that deviate from this standard are listed in the approval Z-17.1-811. These concern:

- **Lateral earth pressure**: ISOMUR® Plus is only used in walls that are not subject to long-term lateral earth pressure loads
- **Spatial rigidity**: Brick walls with ISOMUR® Plus do not require mathematical verification for multi-storey buildings up to two full stories plus loft conversion if the conditions stated in DIN 1053 part 1, section 6.4 have been met
- **Earthquake zones 3 and 4**: Verification that buildings are sufficiently braced is performed on the basis of interior walls, as walls with ISOMUR® Plus are not taken into account for calculations in the stated zones

BASIC VALUES \(\sigma_0\) FOR THE PERMITTED COMPRESSIVE STRENGTH IN ACCORDANCE WITH APPROVAL \(^2\)

<table>
<thead>
<tr>
<th>ISOMUR® Plus type</th>
<th>Compressive strength class of sand-lime bricks</th>
<th>Basic values (\sigma_0) for the permitted compressive stresses in N[mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard mortar from mortar group lia</td>
</tr>
<tr>
<td>20-11.5</td>
<td></td>
<td>12 ≥ 20</td>
</tr>
<tr>
<td>20-15.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-17.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-20.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Design value for thermal conductivity, equivalent \(\lambda\) value on a homogeneous body
\(^2\) Brickwork: Sand-lime bricks or sand-lime blocks in accordance with DIN 106, part 1; solid brick in accordance with DIN 105, part 1 or 2 (proportion of holes ≤ 15%)
WALL BASE DESIGN

THERMAL INSULATION COMPOSITE SYSTEM
Thermal insulation element on the ceiling

Thermal insulation element under the ceiling

CAVITY WALLS
Thermal insulation element on the ceiling

Thermal insulation element under the ceiling
INSTALLATION INSTRUCTIONS

INSTALLATION ABOVE THE CELLAR ROOF
- Use ISOMUR® Plus bricks to lay the first row of brickwork, laying them in the mortar layer directly next to each other without applying mortar in the connection joints across the entire surface.
- The position of the elements is determined by the marking.
- The position of the elements must be carefully adjusted, taking particular care to ensure that an even, horizontal surface is provided for laying blocks.
- Bricks are laid on top of the ISOMUR® Plus elements once the mortar has dried and stability is ensured.
- If thin bed mortar is used for sand-lime block walls, it must be applied to ensure that a joint with a thickness of at least 1 mm and at most 3 mm is formed on the rigid polystyrene foam and any negative tolerances in the lightweight concrete load-bearing structure are compensated for.

INSTALLATION UNDERNEATH THE CELLAR ROOF
- Use ISOMUR® Plus bricks to lay the last row of brickwork, laying them in the mortar layer directly next to each other without applying mortar in the connection joints across the entire surface. The position of the elements is determined by the marking.

GENERAL INFORMATION
- Protect rigid polystyrene foam against solvents and high temperatures.
- ISOMUR® Plus elements can be shortened using standard construction tools. All shortened sections used must be at least 20 cm long. Shortened sections must not be laid next to each other.
- ISOMUR® Plus elements must not be laid on top of each other.
- Slots and recesses that weaken the load-bearing cross-section are not permitted.
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